



Leveraging single-use plastics to foster a sustainable community:

Empowering Toronto communities to reduce and reuse plastics through the co-creation of pro-environmental initiatives

By Jenny Hwang & Jaime Rivera

A major research project submitted to OCAD University in partial fulfillment of the requirements for the degree of Master of Design in Strategic Foresight & Innovation.

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Abstract

While many people in Toronto believe it is important to support sustainability initiatives, they are not always sure how to make a true difference as an individual. Recycling is one act that Torontonians do participate in, but most are unaware of the fact that until recently, the majority of their recycled materials were being exported to be dealt with by China. In December 2017, China stopped importing most of those recycling materials, which are now ending up in Canadian landfills instead. Some of the most problematic materials are plastics, with 86% of them ending up in landfills in Canada. This MRP set out to find alternative solutions for the Toronto community beyond recycling by answering the following HMW statement: How might we ignite a community to reduce and reuse household plastic containers by designing processes that can be easily adopted and acted upon by the Toronto communities and its members? To explore this, a prototype in the form of a co-creation community workshop was developed to encourage and foster pro-environmental behaviour changes using the Design Thinking framework. In addition, the workshop was leveraged as a method to conduct further Research through Design (RtD) in order to uncover further insights to help iterate on the solution. After the series of workshops, there was a positive increase in attitude and behaviour changes toward reducing and reusing plastic containers, at least in the short-term. In order to foster long-term, permanent behaviour changes among community members, a Theory of Change (ToC) for plastic consumption in Toronto was created. This ToC is meant to be utilized by Toronto communities as a guide and starting point to help iterate upon the workshop series and to generate new scalable solutions to ignite behaviour changes. This MRP acknowledges that individuals of small communities alone cannot change the system of plastic waste management. However, testing and co-creating with communities is an effective way of prototyping before investing in a scaled-up solution. More importantly, local grassroots movements from communities do have the power to influence and impact larger key stakeholders and areas of the waste management system. The ToC that was created can help empower both individuals and communities to care about and demand systemic changes, both directly and indirectly.

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1

Introduction

Introduction

For decades, the Canadian government stressed the importance of recycling for individuals and tried to socially normalize recycling behaviour. Today, Canadians see recycling as an integral part of environmental sustainability, and it is considered the forefront approach to tackling waste management.

Despite the societal awareness of what one “ought to do” when it comes to recycling, many Canadians are still confused about the exact rules (Bianchini, 2019). The signages for recycling are not always clear and can change from province to province, which often puts people in decision paralysis.

Therefore, the initial objective of this research was to explore how one might better design the recycling system to make it clear and actionable for individuals to correctly recycle their household items.

However, as more research was conducted, more limitations of recycling in Canada on a systemic level were revealed. The tipping point for recycling was in 2018 when China declared its “National Sword” policy, which banned the import of most plastic and other recycling materials into the country. This dramatically increased the standard of quality material considered acceptable for recycling vendors, as materials could no longer be recycled unless they contained almost zero contamination. Until then, almost all of the G7 countries relied on China to process and manage the waste they were producing. With China no longer serving as a dumping ground for Canada and other countries, there was a great deal of shock and frenzy for the waste management system on a global scale (Reed, Blood, Faunce & Hook, 2018).

Many Canadians are still unaware of the limited effectiveness of the recycling system. In fact, prioritizing recycling as the preferred method for waste management can actually increase consumption among consumers, creating more waste in the first place. Consumers can relieve any guilt they might otherwise possess about their mass consumption of disposable goods, if they are tossing the items in blue bins (Westervelt, 2012). Even for those who are now aware of the limitations, suddenly realizing that their effort to recycle made little to no difference for the environment can be dejecting and discourage them from exerting more of that effort into pro-environmental behaviour.

Hence, the purpose of this research paper is to empower individual members of Toronto communities to believe in their ability to make a meaningful impact in preserving the environment. This research comes from a place of genuine interest and concern about how to address the different challenges of waste management at a community level.

Specifically, this MRP will explore how to:

1. Encourage and foster pro-environmental behaviours through community co-design sessions.
2. Gain a better understanding of behaviour change theory in the context of waste management so that the new learnings can be incorporated into the next iterations

Subsequently, as an outcome of the exploration, the MRP will:

3. Provide a tangible solution prototype that is accessible and actionable for communities and their members in Toronto.
4. Create a framework using the Theory of Change to help generate further comprehensive and scalable solutions that could be implemented in Toronto and subsequently in other cities.

To maximize the scalability and durability of the research findings and also to help others iterate on the solution, there was a need to create an artifact that was tangible and easily actionable. All the different insights uncovered through the MRP helped shape a Theory of Change for waste management within the communities of Toronto.

This research acknowledges that waste management is a complex system that cannot be solved solely by a few communities. However, igniting members of the community to change their attitude and behaviour is a starting point that can trigger an interplay with the larger waste management system.



2

Methodology

*Design Thinking framework
Research through Design
Theory of Change*

Methodology

1. Structuring the MRP through the Design Thinking framework

The structure of this Major Research Project (MRP) follows the Design Thinking framework. Design Thinking is an iterative process that seeks to understand the user through a user-centric approach, challenge assumptions, and constantly redefine the problem in order to identify alternative strategies and solutions that might not be evident in the initial stages of the research (Dam & Siang Teo, 2020). This framework typically comprises six different phases that are not strictly linear but rather cyclical and iterative: empathize, define/frame, ideate, prototype, test, and implement.

The design thinking framework was selected as the ideal framework for this research for the following reasons:

Learning through iteration: This research is based on the idea of a never-ending cycle of understanding, exploring, and materializing as proposed in the Design Thinking approach. As the nature of the problem is highly complex, the iterative approach allows researchers to define and redefine the problem through several research methods to ultimately create the boundaries and scope for this research.

Systemic approach: Design thinking is inherently holistic. It undertakes the problem and solutions as a whole and sets the foundation for utilizing a systemic approach throughout the process. This systemic approach also facilitates understanding and enables the creation of boundaries in highly complex problems that encompass multiple subsystems, complex relationships, and multi-stakeholder participation (Jones, 2014).

Opportunities for ideation: This part of the exploration in the Design Thinking process is crucial for encouraging researchers to diverge by ideating and exploring multiple avenues in search of the solution. Design Thinking acknowledges that there are multiple ways of addressing the problem and that they can always be iterated.

Prototype as an output: The key component of the Design Thinking framework for this MRP is the development of a prototype. For this research, a solution prototype, in the form of a co-creation workshop, was developed and then evaluated based on its effectiveness in solving the problem.

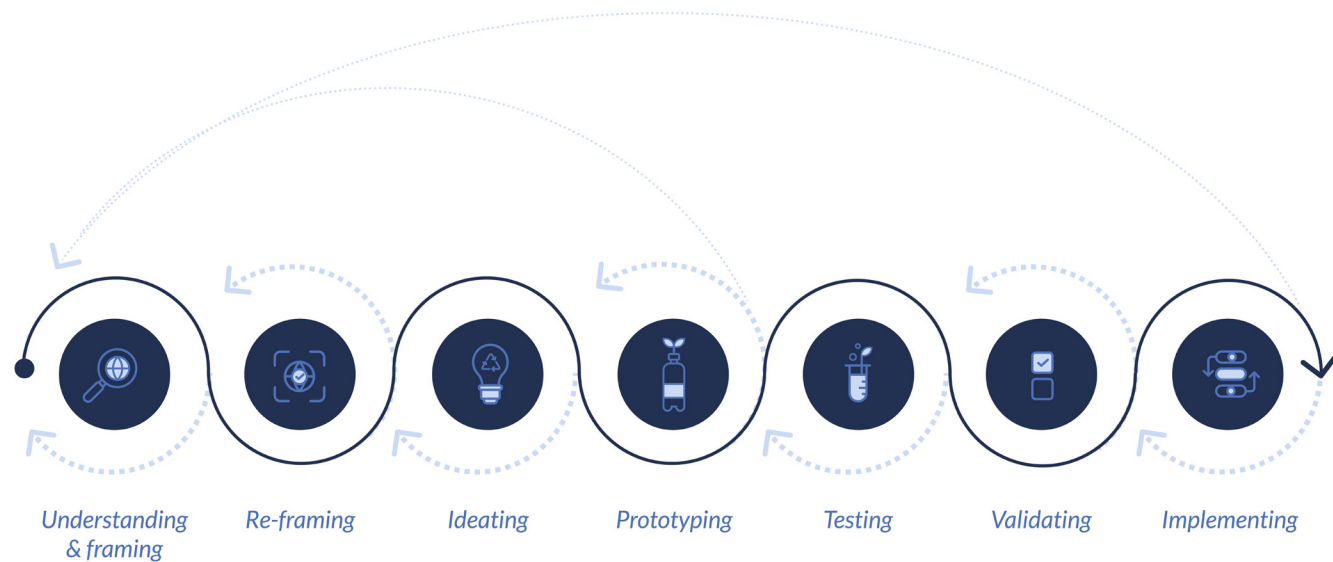


Figure 1. The Design Thinking Framework (Gibbon, 2016)

2. Conducting further generative research leveraging Research through Design

The prototype, the co-creation workshop, was not only designed as a solution prototype to the problem, but it was also leveraged as a method to conduct further Research through Design (RtD).

RtD is an approach to conducting scholarly research that employs the methods, practices, and processes of design practice with the intention of generating new knowledge. The approach “draws on design’s strength as a reflective practice of continually reinterpreting and reframing a problematic situation through a process of making and critiquing artifacts that function as proposed solutions (Rittel & Webber, 1973; Schön, 1983).” For this MRP, the workshop prototype served as an artifact to continue researching and generating new findings to iterate toward a new solution.



Figure 2. Research through Design

3. Incorporating a wide variety of research methods

The following diagram depicts the different research methods that were leveraged throughout the MRP research process:

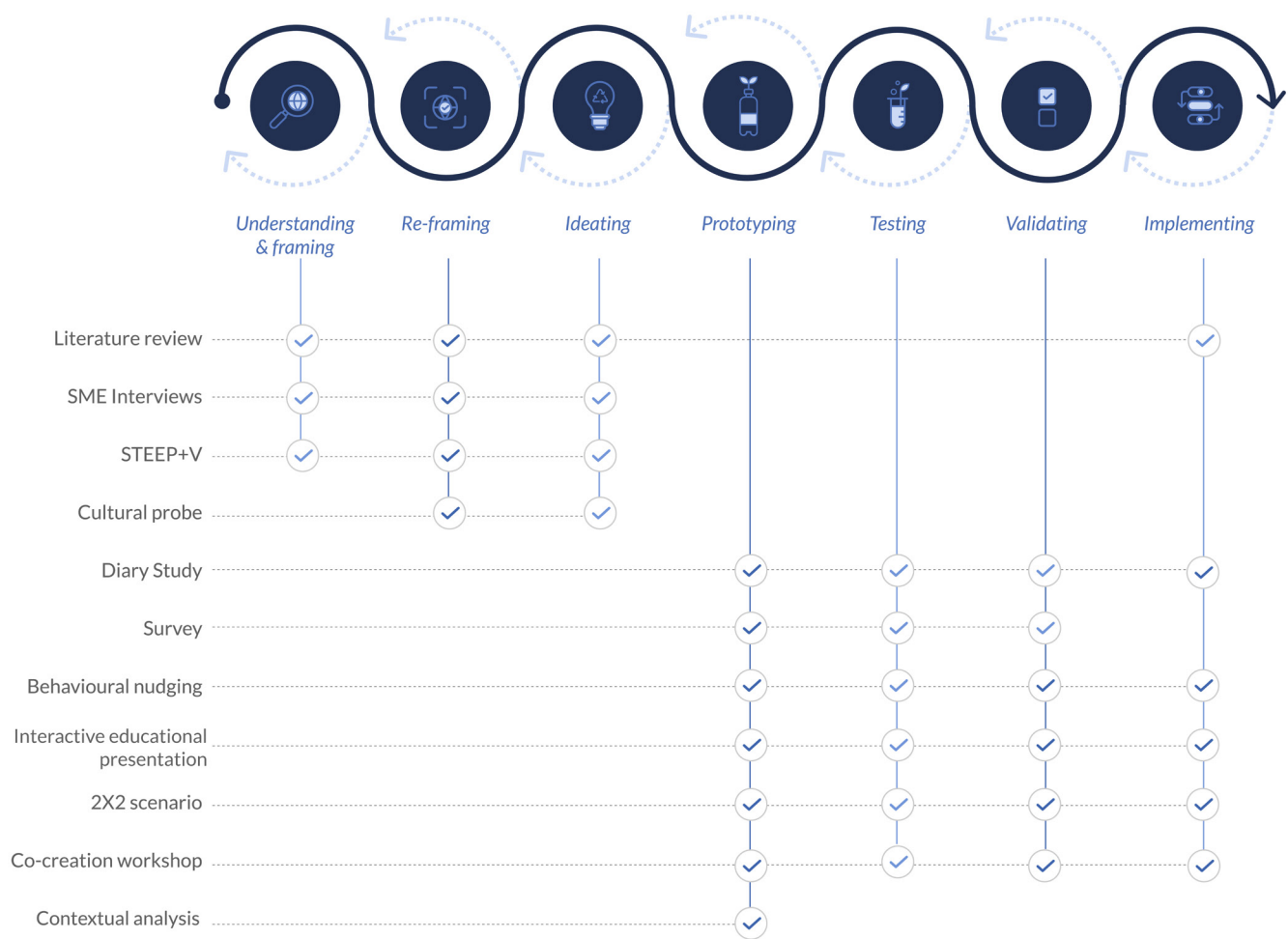


Figure 3. Methodologies throughout the design process

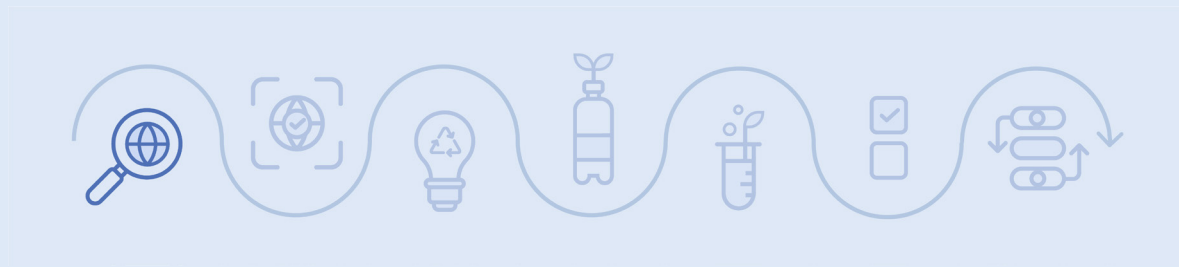
The top icons indicate the different stages of the Design Thinking process as it pertains to this MRP. The checkmarks indicate which specific research methods were leveraged for each step of the design process. For instance, interviews with subject matter experts (SMEs) were relied on heavily in the beginning (Understand, Framing, Ideation), but not so much during the second half of the MRP.

1. **Literature review:** An extensive review of diverse literature was conducted throughout the process to gain an understanding of waste management and the impact on the environment, wildlife, and human health.
2. **SME interviews:** Semi-structured interviews, which ranged from 30-45 minutes, took place with experts on waste management, intersectionality, and community engagement.
3. **STEEP+V:** This analysis tool was used to identify and evaluate emerging trends around waste management, sustainable initiatives, and the impact of pollution on the environment from six different dimensions: social, technological, economic, ecological, political, and values.
4. **Co-creation workshop:** The workshop was designed to be highly interactive and generative so that new insights could be uncovered organically by the participants. These participants were active designers who produced both artifacts and new research findings.
5. **Cultural probe:** a technique used to inspire new ideas in the design process and capture data about people's lives, behaviours, and thoughts. The probe helped validate insights from the literature review and define the boundaries for the research.

6. **Diary study:** a longitudinal research method that was used to collect qualitative data about user behaviour, activities, and experiences over time regarding pro-environmental initiatives.
7. **Survey:** Surveys were conducted at the beginning and end of the workshop to measure the changes in behaviour, knowledge, interest, and engagement of participants.
8. **Behavioural-nudging challenge:** leveraged "rewards" and "commitment" as nudging techniques to encourage pro-environmental behaviour change among participants. The effectiveness of the types of nudging on pro-environmental behaviour change was also measured and compared.
9. **Interactive educational presentation:** an interactive presentation that complemented other activities in the workshop. Participants were familiarized with a variety of topics related to plastic consumption and waste management.
10. **2x2 Scenarios:** A method used in Strategic Foresight to hypothesize not just one but four alternative futures. As part of 2X2 scenario planning, participants had the opportunity to create four different futures of plastic waste management for 30 years in the future based on two main driving forces of society.

4. Empowering communities through The Theory of Change

To increase the scalability and durability of the research findings and also to help others iterate on the proposed solution, there was a need to create an artifact that was tangible and easily actionable. All the different insights uncovered through the MRP helped shape a Theory of Change for waste management within the communities of Toronto. Theory of Change is a “comprehensive description and illustration of how and why the desired change is expected to happen in a particular context” (Centre for Theory of Change, n.d.). It is visually represented in a map, which is a graphic representation of the causal pathways between what a program or change initiative does (its activities or interventions) and how these lead to desired goals being achieved (Centre for Theory of Change, n.d.). In summary, it is a pragmatic framework that describes how the intervention affects change (De Silva et al. 2014). The objective of creating a Theory of Change as an output was to better guide community organizations in iterating on the solution beyond the suggested prototype presented in the MRP.



3

Understanding & framing the problem

STEEP+V
The Tipping Point of Recycling: China's National Sword Policy

Understanding and framing the problem

At this stage of the Design Thinking process, the main goal is to gather enough diverse information to develop a deep understanding of the problem space. The problem space needs to be explored from multiple perspectives in order to get to the root of the true problem. This is also crucial for identifying opportunities, defining boundaries, and tightening the scope of this research.

Based on the amount of confusion faced by the individuals when engaging in recycling, the research initially set out to solve the following problem statement: **How Might We design a way to make recycling simple and easy to follow for the average Torontonians?**

This problem statement guided the need to better understand the problem space of waste management and recycling in Canada and in Toronto. As a result, the STEEP+V model was leveraged to conduct an environmental scan based on literature review and SME interviews.

A STEEP+V analysis is a tool commonly used in environmental analysis to evaluate different macro environmental factors that encompass the problem space. It is about understanding the trends and events from a social, technological, economic, ecological, political and values perspective (CIPD, 2020). In diverging on the theme of waste management, a wide range of trends relevant to the topic of research were discovered. The table below highlights the key trends discovered from the analysis:

STEEP+V

Social

The emerging lifestyle trend of zero waste

Zero waste is a set of principles that encourage the conservation of resources by means of responsible production, consumption, reuse and recovery, and packaging of materials. The main goal of zero waste is to avoid sending waste to landfills, incinerators, or the ocean. (Zero waste international alliance, zwia.org, 2018). Zero waste is part of the circular economy where the whole system aims for a massive change in the way materials flow through society, resulting in no waste. (Davidson, 2011). Today, “zero waste” is commonly seen and used to describe a lifestyle trend or a choice among average Canadians. This movement of zero waste lifestyle encourages people to produce no or very little household waste. Thousands of social media channels, books, blogs, and organizations have emerged worldwide that advocate for this conscious consumer lifestyle. Furthermore, what became popular as a lifestyle trend is now becoming a movement that can push large corporations like Unilever and Procter & Gamble to consider developing reusable alternatives to avoid waste.

Simple living: choosing the simple life

Simple living refers to a variety of voluntary practices to simplify one’s lifestyle. These include the reduction of possessions, better known as minimalism or increasing self-sufficiency (Pierce & Breen, 2000). While the meaning of simple living can be drastically different between cultures and generations, for the mainstream Canadian culture, simple living is seen as a reaction to materialism and conspicuous consumption (nwtccc.org). It is also seen as a way of going back to the simpler time, before humans were mass producing goods and subsequently, waste and pollution.

One of the main practices for simple living is the reduction of consumption, work time, and possessions (Pierce, 2000). These practices have influenced the emergence of movements like the “100 things challenge” and “Tiny Homes”. Furthermore, an extension of simple living is called low-impact living, where the consumer’s lifestyle includes buying produce only locally or growing one’s own, leveraging bicycles and other environmentally friendly transportation, and overall, being conscious about the environmental impact that one is making on the planet (“Low-impact living, 2014”).

Technology

In search of the holy grail of materials

As a response to the negative impact plastic fuel-based waste is having on the environment and wildlife, manufacturers are looking for new alternatives to plastics. Bioplastics refer to plastics made from plants or other biological material instead of petroleum (Gibbens, 2018). While bioplastic is considered to be more eco-friendly than traditional plastic, bioplastics can actually create more pollution as fertilizers and land is required to grow the bioplastic materials. Furthermore, it is often the case that industrial composting and special conditions such as being exposed to high temperatures are necessary for this material to degrade. “Without the adequate composting infrastructure and consumer know-how, bioplastic products can end up an example of greenwashing, a phrase coined by environmentalists to indicate when consumers are misled about how sustainable a product truly is” (Gibbens, 2018).

There are also other innovations taking place hoping to replace plastics, especially in the food packaging industry. “Shrilk,” invented by Harvard University’s Wyss Institute, is a low-cost plastic that is completely compostable with its material derived from shrimp cells and silk protein from insects (National Geographic, 2018)

. In addition, there are now edible materials as an alternative to plastic that can reduce the need for packaging. For instance, in 2019, London marathon runners were given edible seaweed pouches filled with a sports drink. (Nace, 2019).

Economy

Building economies of scale

A circular economy is an industrial system that is restorative or regenerative by intention and design (Ellen McArthur foundation, 2013). Contrary to the traditional linear economy which has a “take, make, dispose” model of production approach, the circular economy focuses on renewable energy and aims for the elimination of waste through the superior design of materials that constantly flow around a closed-loop system. (Ellen McArthur foundation, 2013)

First, the circular economy is about reducing waste by designing and optimizing products to facilitate a cycle of reuse, as well as using the bare minimum amount of energy to bring back the product in a closed loop. Second, circular economy acknowledges that there is a clear differentiation between consumable and durable components of a product. Consumable components should be made from biological ingredients, which facilitate their safe return and degradation into the biosphere. Durable components, on the other hand, are materials that are designed from the beginning to be reused in a continuous product cycle. Last, it believes that the energy used to fuel this cycle should be renewable by nature, which decreases the depletion of resources and increases system resilience. (Ellen McArthur foundation, 2013)

It is also crucial to note that the essence of the circular economy, which comes down to understanding the interconnectedness of all things in nature and the creation of cycles and continual regeneration, is based on a model that has been practiced for a long time by several indigenous communities and is rooted in Indigenous knowledge systems (Iles, 2019).

Ecology

From a miracle material to a serious pollution culprit

Plastic pollution has become one of the most critical environmental issues especially as the production of single-use plastics has been increasing every year accounting for almost 40% of all the plastics produced (Parker a, 2019). Half of the plastic pollution in the world is produced by only five countries in Asia: China, Vietnam, Indonesia, Sri Lanka, and the Philippines (Parker b, 2019).

Millions of animals from birds to fish and even other land animals are impacted by the unstoppable consumption of plastics around the world. "Seals, whales, turtles, and other animals are strangled by abandoned fishing gear or discarded six-pack rings. Microplastics have been found in more than 100 aquatic species, including fish, shrimp, and mussels destined for our dinner plates." (Parker a, 2019). Moreover, the ecological impact goes beyond organisms as more than 90% of plastic materials are derived from petroleum. A recent report by CIEL estimates that the pollution from plastic production is equal to 189 coal-fired power plants (Greenpeace.org, learn about plastic pollution).

Such devastating ecological impact caused by plastic pollution eventually leads to consequences in not just ecology but also the economy, social structure, and health, as evidenced in various South Asian countries (McCormick, Fullerton, Gee, Simmonds & Murray, 2019).

Political

The producers of plastics need to take action

Extended product responsibility (EPR) is a policy approach in which the producer is responsible, physically or financially, for the environmental cost associated throughout the product life cycle (Waste to Wealth - Extended Producer Responsibility (EPR), 2012).

EPR supports waste reduction, re-usage, and recycling activities, which reduces the burden on municipalities for the financial and physical requirements for waste management. To date, the concept of EPR has been used to ensure the proper end-of-life management of a broad and growing range of post-consumer products such as batteries, electronic equipment, ozone-depleting substances, paints, pesticide containers, etc.

In Canada, each of the provinces has its own regulations and policies when it comes to waste management. In B.C., companies take on all the responsibility for recycling, funding, and operating the system (CBC News, 2019). However, despite having worked toward 100 percent EPR for almost 13 years, Ontario has not been successful in its implementation due to the struggles of coming to an alignment between the stakeholders over responsibilities and assignments (CBC News, 2019).

China's plastic ban: National Sword policy

"National Sword" policy announced by the government of China in December of 2017 set a new quality standard for recycled material imports, banning materials that were deemed too contaminated or hazardous. Exports of recyclable materials from the G7 countries to China dropped dramatically since the introduction of this policy. As a result, G7 countries like Canada, have taken a serious hit within their recycling system both financially and environmentally (CBC News, 2019).

Values

Generation Greta

Young people have been inspired by environmental activists like Greta Thunberg to raise their voices about environmental issues (Asmelash, 2019). Millions of young students in different countries are part of environmental initiatives, protests, talks, and innovation, all happening with unprecedented momentum on a global scale.

"Seeing Greta Thunberg leading school strikes in Sweden was really powerful – that's what inspired us. Twenty of us started striking for climate action outside our MP's office and it quickly escalated," (The Guardian, Turns, 2019)

UK Youth Climate Coalition's Jake Woodier believes that climate strikes are reconfiguring the political sphere. "We are seeing thousands of incredibly intelligent and articulate children who are grasping the severity of the climate crisis better than adults in power." (The Guardian, Turns, 2019)

Environmental justice

Environmental justice refers to the fair treatment and involvement of communities, regardless of their race, colour, national origin or economic status, with respect to development, implementation and enforcement of environmental laws regulations and policies (US EPA, 2014).

The movement was initiated by individuals and grass-root organizations, primarily people of colour in the U.S seeking to address environmental issues, including waste disposal and treatment of hazardous materials affecting their community. (US EPA, 2014).

In Canada, environmental justice is framed more toward the environmental inequality involving the Indigenous peoples. Indigenous peoples are faced with considerable environmental injustice in terms of the abrogation of treaties, land rights, resource management, and living conditions. These cases must be placed in the context of the history and social consequences of Canadian colonialism (Haluza-DeLay, 2007).

The tipping point for recycling: China's National Sword policy

One of the biggest trends revealed by the STEEP+V analysis was the impact of China's National Sword policy - its ban on importing most of the recycled materials. Before the ban, when developed nations collected recycled goods from well-meaning consumers, the majority of the goods were just ending up in China and it became someone else's problem to deal with.

People who engage in recycling activities do so because they believe in the positive impact that recycling has on the environment. It has been thought of as one of the key components of modern waste reduction and the third component of the waste hierarchy along with Reduce and Reuse. (Defra, 2011)

However, the concept of recycling as we know it today was quite different in the pre-industrial age. Recycling was a common practice (at a smaller scale) for those faced with scarcity of resources and the high cost associated with the production of new objects (Economist, 2007). By the early 1990s, many countries lacked the capacity to manage the amount of e-waste that was created or to handle their hazardous nature. They began to export e-waste to developing countries without enforced environmental legislation. This process of shipping away waste, from e-waste to plastics, as a form of "recycling" to developing nations, became the norm for developed nations. As a result, countries like Canada were not equipped or prepared to handle China shutting its doors on most recycled materials.

After China stopped accepting much of the world's recycling at the end of 2017, the recycling market became flooded with products. The dwindling number of buyers who were left demanded only the highest-quality material — and at a fraction of the cost. Toronto alone lost around \$8 million-\$9 million in recycling revenue in 2018 (Jarvis & Robinson, 2019). Furthermore, several recycling programs in North America have been forced to end the operations, scale down or divert most of their recycling material to landfills or incinerators. (Corkery, 2019)

Today, G7 countries, specifically, the United States, are still shipping more than 1 million tons of plastics each year overseas to other countries with poor plastic waste management systems. Malaysia, one of the biggest recipients of those plastics after China's ban, mismanaged 55% of its own plastic waste, while Indonesia and Vietnam improperly managed 81% and 86%, respectively (McCormick et al. 2019).

A months-long investigation from Global News revealed that with few exceptions, "more recycling is being sent to landfill, fewer items are being accepted in the blue bin, and the financial toll of running these programs has become a burden for some municipalities" (Jarvis & Robinson, 2019).

The initial literature review made it evident that the recycling system today was causing a greater negative impact environmentally, financially, and politically within Canada. With the current recycling system at a crossroads, it was clear that trying to redesign the recycling system for the communities in Toronto would not contribute to any meaningful outcome for sustainability. The bigger global system of recycling was broken and there was a need to look into other areas of waste management to find a solution.

4

Reframing the problem

*Pivoting to Reduce and Reuse
Focusing on plastic waste
Defining the target group
Understanding the causal relationship
The new How Might We statement*



Reframing the problem

In order to better frame and define the problem, it was necessary to look beyond recycling to find a more sustainable and effective waste management approach. Furthermore, it was important to set the boundaries of this MRP by clearly defining the target group and type of waste to prioritize in order to ground the research in something tangible and achievable within the given time frame. In order to do so, the research expanded to examine waste management from a systemic perspective, specifically, the relationships and loops between different stakeholders, dependencies, and levels of participation.

Pivoting to Reduce and Reuse

In the ecosphere of waste management, recycling is only one of the three essential components of a very complex system. What has been neglected and overshadowed by the push for recycling is the need to reduce and reuse the materials in the first place.

The waste management hierarchy is a framework used to protect the environment, reduce the use of resources, and to optimize energy consumption (Christopher, Hansen & Verbuecheln, 2002). The waste management hierarchy is usually depicted using an inverted pyramid where the most preferred option is at the top and then represents the progression of any material or product through different stages of waste management.

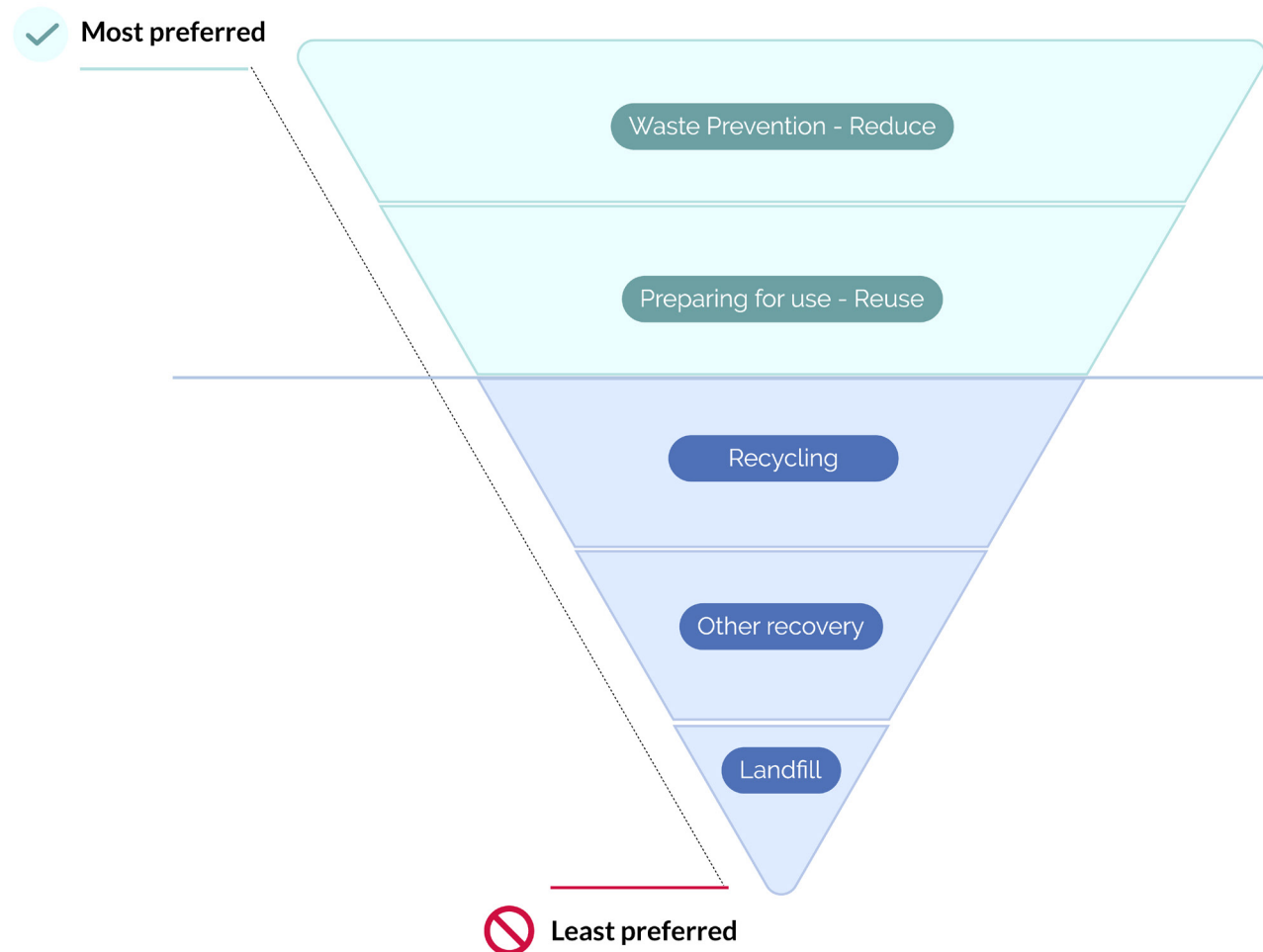


Figure 4. Waste management hierarchy (European Commission,2012)

According to the Environmental European Commission (2012), the EU waste hierarchy is composed of 5 stages of waste management. The first stage is **Waste prevention - Reduce**, which represents the most sustainable and efficient use of resources. Next is **Preparing for use-Reuse**, where the goal is to divert products and materials from the waste stream that could be repaired and cleaned for re-use. **Recycling** is the third stage and it is the most popular and in some cases, the only approach for waste management. The next stage is **Other recovery**, which in most cases include the incineration of waste to produce energy, a practice that is not recommended due to the possible emission of hazardous chemicals. Finally, at the bottom of the pyramid is **Landfill**, the most undesirable way of managing waste. This stage is responsible for producing and releasing methane into the atmosphere as well as polluting the soil and underground water sources. (European Commission,2012)

Taking a closer look at the two preferred stages of the hierarchy helps illuminate the importance of prioritizing reduce and reuse for waste management and also for this research project:

Reduce (Waste prevention): Prevention normally results in the least economical and environmental costs because it does not require the steps of collecting and processing the materials. Waste prevention shares a similar ideology as sustainable, eco-friendly design and product manufacturing. Today, as consumers are becoming more aware of the impact they have on the environment, they are demanding greener products with less packaging (Environmental European Commission, 2010).

Reuse: On the other hand, Reuse involves the repeated use of the product or materials for which they were conceived. The process of reuse can have a social, economic and environmental benefit by cre-

ating new job opportunities for repair and reform, providing used products at a lower price for those who cannot afford new, and diverting the products from entering the waste stream (Environmental European Commission, 2010).

Reduce and Reuse as part of the long-term waste management strategy for Toronto

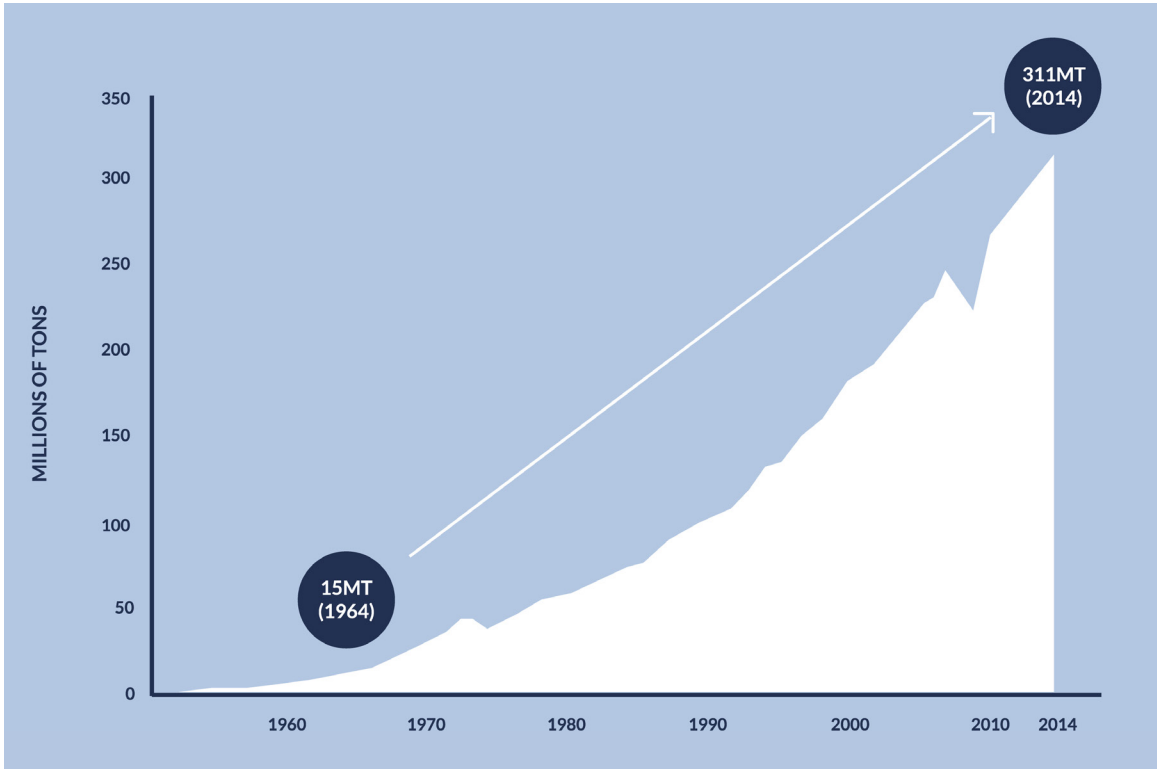
Reduce and Reuse are also the two key areas of focus for Ontario and Toronto's waste management strategy to achieve their shared goal of 70% diversion of waste by 2026 (City of Toronto, 2018). Ontario and Toronto's new vision is that waste should be seen as a resource that can be recovered, reused, and reintegrated to achieve a circular economy. (Environmental Commissioner of Ontario, 2017). The purpose of introducing resource recovery and circular economy act (RRCE) was to get to the root cause of the waste produced in the city.

Despite the upcoming efforts, the Canadian waste management system, especially those of Toronto and Ontario, still focuses a lot of its strategic efforts into recycling (Saxe, 2017). Not only has this been relatively ineffective as Toronto's recycling contamination rate is at 26%, the worst in Canada (Machildon,2018), it fails to invigorate and embed a new systemic approach that looks into other parts of the waste management cycle.

Focusing on plastic waste

Deciding on a specific waste material to prioritize for this research was another important part of the problem reframing process. The environmental scan performed using the STEEP+V helped identify plastic pollution as one of the main issues that required global attention, given the ubiquity of this material and the negative impact it has on the environment, wildlife, and human health.

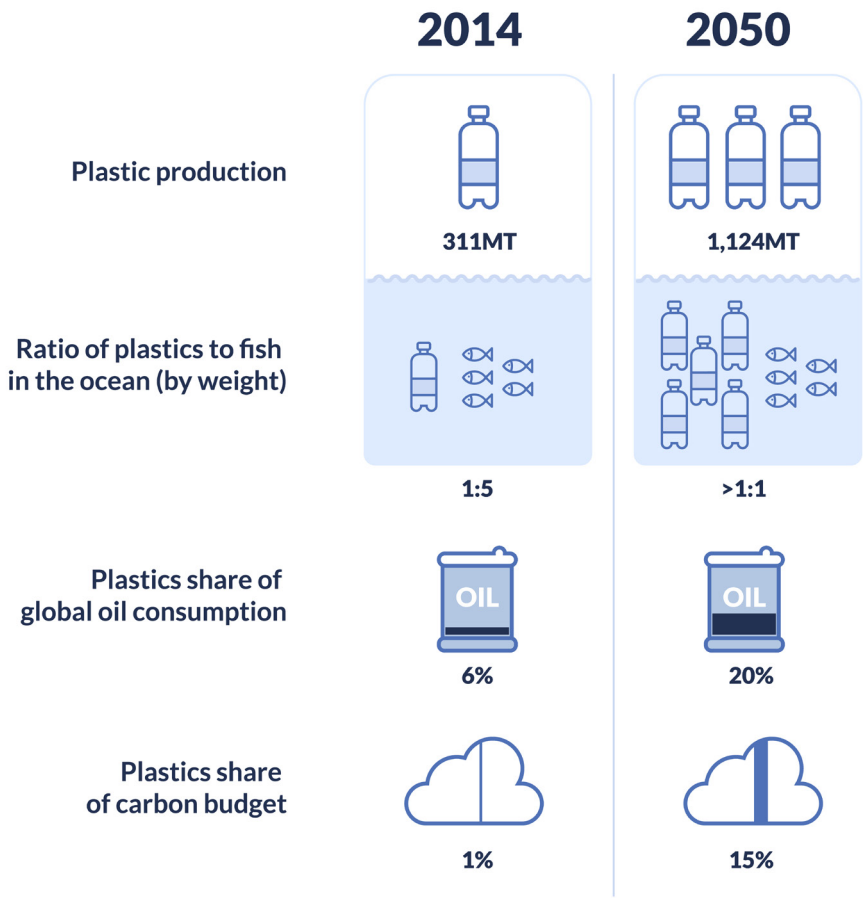
Plastics are part of everyday life for most of the people around the world. Thanks to its low production cost, versatility, durability, and high strength-to-weight ratio, plastics have cemented its place as a material of choice as reflected in the exponential growth in their production. Since 1964, global production has increased twenty folds and is expected to double again in 20 years and quadruple by 2050 (Ellen Macarthur foundation, 2016).



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Figure 5. Growth in global plastic production (Ellen Macarthur foundation, 2016)

Poor management of plastics across their life cycle and the improper disposal of plastic waste has resulted in large amounts of plastic pollution. In 2016, an estimated 9% of plastics were recycled, 86% landfilled, 4% incinerated for energy recovery, and 1% was released into the environment in Canada (Environment and climate change Canada, 2020). At a global scale, overconsumption and production of plastic packaging affect the environment in three main areas: degradation of natural resources as a result of leakage (especially in the ocean), greenhouse gas emissions as a result of production and energy recovery through incineration, and health and environmental impact from substances of concern (Ellen Macarthur foundation, 2016).



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Figure 6. Forecast of plastic volume growth (Ellen Macarthur foundation, 2016)

Household plastic containers PET (Category 1) and HDPE (Category 2)

Plastic packaging is the largest application of plastics, representing 26% of the total volume (Ellen Macarthur foundation, 2016). Individuals have a direct relationship with plastic packaging and most of the household containers are also made out of plastics. Out of the seven categories of plastic resins used for plastic applications [Figure 6. type of plastic resins], the two resins that are more commonly used for plastic containers are PET and HDPE category 1 and 2, respectively. Therefore, the scope of research will be contained to these two categories of plastics to ensure that the solution developed targets the materials that are most relevant for the average consumer.



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Figure 7. Main plastic resins, application in packaging and recyclability (Ellen Macarthur foundation, 2016), (CLF,2019)

Provenance study and the plastic bottle life cycle

Once the material was scoped out for this research, it was important to understand the full life cycle of plastic containers and its different stages including manufacturing, distribution, consumption, and recycling, from a systemic point of view. The provenance study was leveraged to understand the full life cycle of a Dasani Water bottle to comprehend the provenance of a bottle of water in Toronto. Learning about the amount of resources and environmental damage attributed to a Dasani bottle validated the research decision to prioritize the efforts into plastic containers. For more details on the provenance study see appendix A: Plastic bottle provenance study and life cycle.

Defining the target group: Toronto communities (and the community members)

The final element of problem framing consists of defining the target group that is suitable for the research objectives. As previously discussed, it is easy for individuals to feel a sense of hopelessness and disempowerment when trying to change a system that is overwhelming and vast such as the waste management.

However, according to Ledsham (2018), it is clear how the individual, the consumer, still plays a critical role in generating a circular economy as they have the opportunity to decide on the type of goods to purchase to ensure its return back into the circular supply chain. “Simply put, without the participation of consumers, there will not be enough materials to drive an effective circular economy for plastics (Ledsham, 2018)”.

However, it is also true that an individual alone cannot change the norm or the way people live. People belong in groups and often look to the social norms of the group that they identify with when deciding how they want to act (Cialdini, Reno, & Kallgren, 1990). Therefore, this research will look specifically into the communities around Toronto and its community members. By scoping the research to the communities and its members, it is possible to examine the problem from a systems design perspective, the system being the community, and also design a tangible solution that is actionable by the individual members of the community. Last, by scoping the research at this level, it will be possible to create and test design prototypes feasible at the Major Research Project level.

In defining the target group, it is also important to choose a specific community or communities that reflect the diversity of Toronto. Communities with diverse socio-economic classes were preferred when scoping the research target. It was crucial to also include low-income groups as the goal was to design a solution accessible by all, regardless of their income. In addition, the target community groups needed to reflect the cultural diversity of Toronto to ensure that the prototype developed for this research was scalable as an adoptable solution.

Finally, the research aimed to co-design and co-create with community groups and its members to reflect the diverse socio-economic and cultural differences of Toronto. Without co-design, the research is limited in its ability to properly empathize with the community and risk missing important cultural and social nuances and contexts of the group and as a result, jeopardize the success of the proposed solution.

Understanding the causal relationship between the plastic production and waste cycle, community members, and the waste management hierarchy

In summary, reframing the problem involved examining the pathways and loops between the 1) plastic containers production cycle 2), Toronto communities and their members, and 3) the waste management hierarchy, specifically Reduce and Reuse. By understanding the systemic relationship between the different elements, it was possible to identify the key points of intervention.

The following diagram depicts the three components described above in a set of loops, which highlights their relationships and potential points of intervention for improving the waste management system. It is loosely based on a causal loop model to depict the pathways between one another (Kirkwood, 1998).

The main loop is the **Production and waste cycle of plastic containers (1)** depicted in blue. It includes various phases like Retailing, Usage, Recycling, and Processing. Throughout the cycle, there are different inputs and outputs such as pollutants and waste that are generated between each phase of the life cycle. A key point of intervention that was identified through the research was the usage phase of this loop. Within this **Usage sub-cycle (2)**, the consumers (specifically the individual community members) are placed in the centre as they are the key piece of this phase. The usage sub-cycle begins with the premise that the individual has a need for a plastic container product. The individual decides to purchase and consume the product, then disposes of the plastic container as the final step before new needs surge again, triggering the cycle to repeat. Finally, within this sub-cycle, purchase decision and product consumption were identified as **Potential points of intervention to increase the behaviour of reducing and reusing plastics (3)**, the areas of priority for the waste management hierarchy.

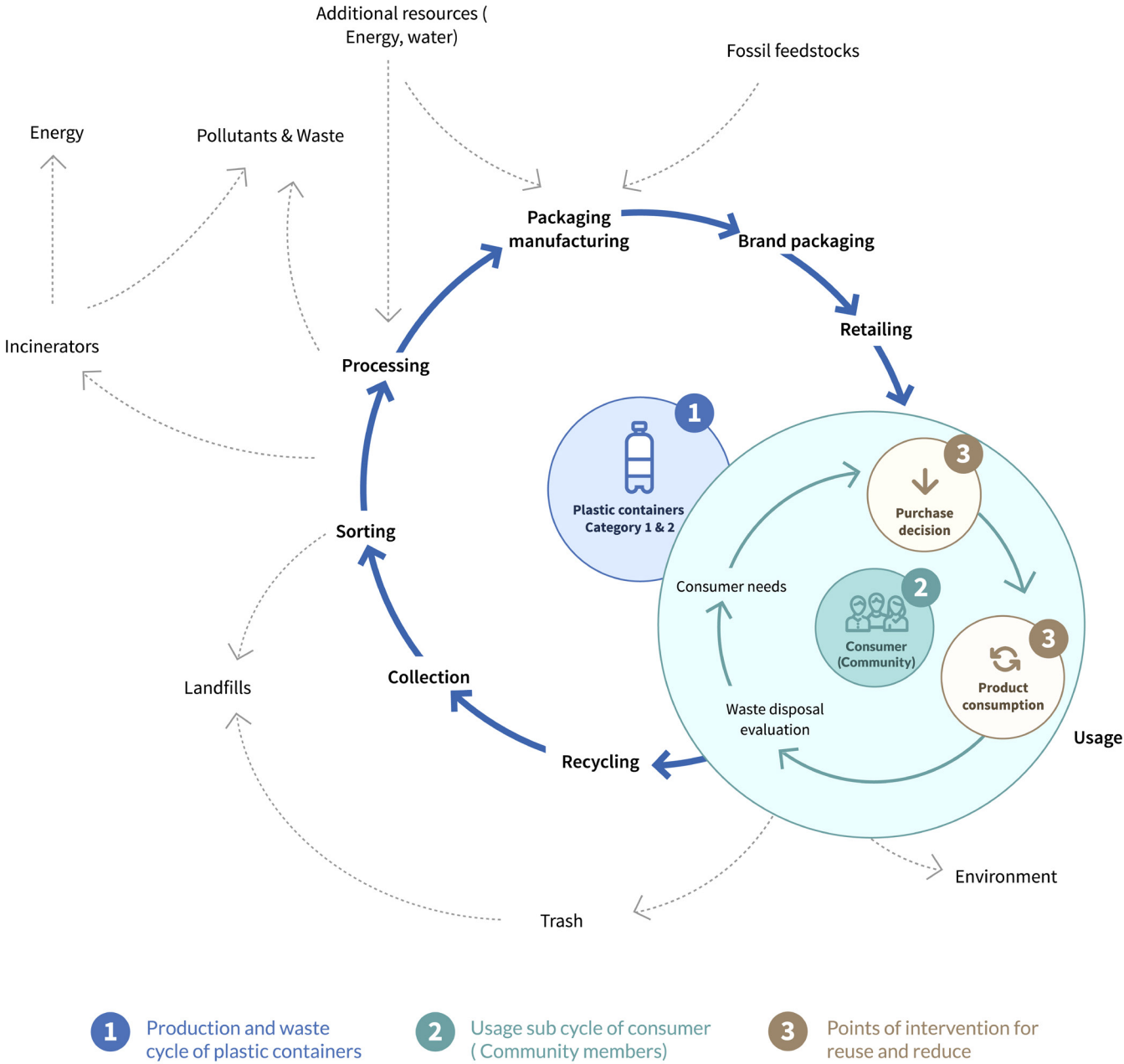


Figure 8. Understanding the relationship between 1. Plastic containers, 2. Community members, and 3. The waste management hierarchy (Reuse and Reduce)

This diagram shows how consumers (community members) can have a cascading effect, both directly or indirectly, on the larger system of plastic waste consumption by influencing the dynamics between the stakeholders and the larger loops. Finally, by reframing the problem and bounding the problem to a specific point of intervention and target group, it was possible to define a new How Might We statement.

The new 'How Might We' statement:

How might we ignite a community to reduce and reuse household plastic containers (category 1 & category 2) by designing processes that can be easily adopted and acted upon by the Toronto communities and its members?

5

Ideating the solution



Ideating the solution

The main purpose of the ideation phase is to generate a range of ideas that could potentially address the HMW statement of this research. The research leveraged a variety of ideation techniques such as brainstorming, sketching, contextual inquiry, and other methods to stimulate divergent thinking.

In order to understand and answer the HMW problem statement, different works of literature on behaviour change and change theory specific to sustainability (ex: recycling behaviour) were referenced.

One of the key findings from the literature review was the importance of circular economy for consumer behaviour change. Circular economy aims to reduce waste and maximize resources by moving away from the linear take-make-and-dispose approach to an innovative system that focuses on product longevity, renewability, reuse and repair (City of Toronto. 2019). According to Potting et al. (2017), prioritizing reduce and reuse is key in order to move toward a circular economy model. Furthermore, buying plastic containers is ultimately part of consumer behaviour that takes place within a community. Hence, the potential prototype needed to stimulate a circular economy within the community in order to ignite behaviour and attitude change.

Moreover, as the scope of the research was bound to the communities within Toronto, investigating existing city-wide initiatives and activities was one of the first steps in searching for sources of inspiration for ideation. It was also imperative to align with the city's existing sustainability initiatives when designing with the prototype's durability and scalability in mind.

The researchers attended the City of Toronto's town hall on single-use plastics and takeaway in September 2019. The goal of the town hall was to ideate with Torontonians on the implications and opportunities in regards to reducing single-use plastics and takeaways. The presenters also described the city's long-term waste management strategy, where the City of Toronto is working toward an aspirational goal of zero waste and a circular economy. One of the initiatives included workshops hosted by the city with local agencies, municipalities, and small-to-medium businesses (Working toward a Circular Economy, n.d.). The workshops and the

initiatives listed on the city’s website were also used as a reference in ideating for potential solutions.

After researching the City of Toronto’s initiatives and as well as existing community-driven activities such as “Toronto’s Tool Library,” three potential areas for the prototype were ideated:

1. **Coffee Shops & Reusable Mugs** - Partnering with local coffee shops to create a reusable mug rental/deposit system
2. **Accessibility & Sustainability** - Focusing on developing sustainable alternatives to plastic containers that do not hurt or hinder those with accessibility needs
3. **Plastic Bottle Planter Workshop** - Teaching gardening communities in Toronto how to reuse plastic bottles by creating planters for gardens that can also to be sold at a market-place.

In selecting the idea to explore further research, the Three Lenses of Innovation was used as a metric (Fenn, Hobbs, 2016) and the ideas were evaluated on its desirability, feasibility, and viability. The scores were quantified using a 3-point scale (1 - low, 2 - medium, 3 - high).

The first idea, coffee shop reusable mug rental, was rated as highly viable as it would involve a network of coffee shops in Toronto and had the potential to be part of a long-lasting business initiative that could easily be circulated around the city. However, the logistics of setting up this prototype would require a timeline that was beyond the scope of this MRP, which resulted in a score of low feasibility.

While the Accessibility & Sustainability idea scored high in desirability based on how important this top-

ic was during the city’s town hall, testing a prototype with people of limited accessibility would not be highly feasible in the given time period. Topics like this rightfully require a careful, ethical consideration in designing and recruiting and it was deemed that this topic would be better suited for a research project with a longer time frame.

Lastly, the plastic bottle planter workshop scored high in feasibility and desirability and medium in viability. In addition, online research on Youtube and blogs for plastic re-usage showed creative ways of reusing plastic bottles and containers for gardening purposes. These activities were feasible for an individual or a community, low cost, easy to make, and also pleasing and of high quality. It also had the potential to ignite a circular economy by having members of the gardening communities sell the planters at a local market. Therefore, the plastic bottle planter workshop was chosen as the prototype for this research.



6

Designing the prototype

The workshop as a solution prototype and a method for Research through Design(RtD)

The guiding design principles for the workshop

Metrics of success: Measuring the validity of the prototype

Designing with the target group

Designing the prototype

Prototyping is an important step of the Design Thinking process that allows for designers to test out the potential solution. This method involves producing an early, inexpensive, and scaled-down version of the product in order to reveal the limitations of the current design but also to uncover new insights that can be implemented in the next iteration (Dam & Teo, 2019).

The workshop as a solution prototype and a method for Research through Design(RtD)

For this research, the plastic bottle planter workshop served as the first iteration of a prototype. For instance, the surveys and experiments were built into the workshop in order to test, measure, and validate the workshop itself on its effectiveness as a potential solution to the HMW problem statement. However, the workshop was also intended not only as a prototype but also as a tool to conduct further research to help answer the HMW statement and to ideate on alternative solutions.

Stappers (2007) states that, “the designing act of creating prototypes is in itself a potential generator of knowledge, if only its insights do not disappear into the prototype, but are fed back into the disciplinary and cross-disciplinary platforms that can fit these insights into the growth of theory.”

This approach of leading first with design to conduct research is called Research through Design (Rtd). RtD draws on design’s strength as a reflective practice of continually reinterpreting and reframing a problem through a process of making and critiquing artifacts that function as proposed solutions (Rittel & Webber, 1973; Schön, 1983).

The collaborative and interactive nature of the plastic bottle planter workshop made it an ideal method for conducting RtD. The workshop was to foster the exchange and creation of knowledge by providing a space to build something new, both physically and intellectually. It was to provide an opportunity for the researchers to educate and share knowledge with the participants through internalization, an explicit to tacit knowledge transfer, but also an opportunity for participants with lived experience to share their knowledge through externalization, tacit to explicit, with other participants and the researchers.

The guiding design principles of the workshop

In order to increase engagement, adoption, and the success of the workshop, the following four principles were used to guide the designing process:

- **Accessibility**
- **Social norms & Culture**
- **Affordability**
- **Convenience**

It was imperative that the designed prototype was affordable for anyone in Toronto regardless of their income. Also, the design needed to be accessible to individuals of varying physical abilities. Partnering with spaces that allowed for wheelchair access and had access to interpreters was critical for the success of the workshop. In addition, lack of convenience is often cited as a reason for failing to engage in pro-environmental behaviours and studies have shown that increasing convenience can increase composting and recycling rates in high-density residential buildings (DiGiacomo et al., 2018). Therefore, the designed solution needed to consider things like proximity to the location of the workshop, preferred dates for the participants, and easy to source materials. Finally, the importance of social norms and cultural nuances in changing behaviour was observed in Thomas and Sharp (2013)'s research. Barr et al (2001) also concluded that social norms were a key determinant in changing recycling behaviour. Hence, creating a design that aligned with the social norms and cultural context the norms and the cultural context of the community was also important to consider.

Not only were the guiding principles meant to be leveraged in designing the workshop, but the workshop would later be used as a research method to explore those guiding principles further and validate their relevance.

Metrics of success: Measuring the validity of the prototype

The effectiveness of the prototype, the workshop, in solving the HMW problem statement was to be measured using the following metrics:

1. **Number of bottles reduced/reused before and after**
2. **Changes in general attitude and behaviour toward plastic reuse and reduce among participants**
3. **Scalability and durability of the workshop (evaluating how likely this workshop will live on and continue to impact communities beyond the given research scope)**

It was important to set the metrics prior to running the workshop series to help keep the objective of the research in mind as metrics help set priorities and define paths. The metrics also provided a multi-faceted yet objective way of validating the effectiveness of the prototype in solving the given problem.

Designing with the target group

Several interviews with different community groups around Toronto were conducted to understand the different types of sustainability initiatives within the city and also to find out which community groups would be best suited for the Plastic Bottle Planter workshop. After discovering and connecting with the organizer of Toronto Urban Growers, several organizations ranging from community centres to gardening organizations showed interest in the workshop series. In the end, four community groups were interviewed to discuss the potential partnership.

After the interviews, two community groups were selected: The Centre for Immigrant and Community Services (CICS) in Scarborough and Building Roots in Moss Park. CICS' coordinator was highly engaged and interested in co-creating the workshop to best suit the needs of the community centre members and the existing sustainability initiatives at the centre. The centre was also willing to provide funding for the workshop including materials, transportation, translators, and other necessities, which made them an ideal partner. In addition, understanding the Reduce and Reuse angle from the new immigrants' perspective would be very relevant as a prototype for Toronto, a city where the number of immigrants outweighs those born in the city.

While Building Roots lacked the funding that CICS had, they were able to provide volunteers for the series of workshops. The organization was already running many sustainability initiatives, so the Plastic Bottle Planter workshop could fit seamlessly into the organization's culture and its members' expectations. In addition, as affordability was one of the guiding principles for the workshop design, working with members of a low-income community near Moss Park would contextualize and shape the workshop to be truly affordable and accessible.

The initial goal was to prototype and test the workshop with just one community, but by having two different community groups, it would be possible to compare and contrast the findings based on cultural and regional differences as this research was aimed to discover. For instance, CICS' members are predominantly made up of Chinese immigrants living in Scarborough, while Building Roots workshop attendees are mostly women, mixed socio-economic status, ethnically diverse, and living near Moss Park.

The coordinators of the organizations were able to articulate the nuances and context of their community and helped co-design the workshops so that it could be more engaging and adoptable by the members. For instance, Tinashe, the director of CICS, suggested creating a paper survey instead of an online survey, as their members were used to signing up for activities and conducting surveys all in-person at the centre. The centre did not communicate with its members online regarding its activities as much as the researchers had initially hypothesized.

Also, further research was conducted by attending another Building Roots workshop focused on sustainability in order to better understand the participants, setting, and interactions. The participants at the workshop were mostly women ranging from the age of 20 to 60 years. They all belonged to

different visible minority groups. Halfway through the workshop, an older man entered the workshop space without saying anything nor participating in the activities. As the workshop took place in a "container box market" on Queen street east, it was possible for anyone walking along to drop by. While this made the workshops very accessible, Moss Park is home to a safe injection site and it wasn't uncommon for the workshops to have unexpected drop-in guests from the streets. This was a valuable learning experience in preparing for the Plastic Bottle Planter workshop and setting expectations on how to manage and welcome the different types of participants.

Two days before the workshop series began, Building Roots coordinators asked if there was room for 20-30 more participants from another community association called The Neighbourhood Group. This group consisted of elderly Chinese ladies in their 70s and 80s and would all require an interpreter. This organization was very eager to participate and therefore, despite this last-minute request requiring a lot of flexibility and redesign, they were added and integrated into the existing Building Roots workshop sessions.



7

Testing the prototype

*The research sample demographics
The co-creation workshop
Workshop methods and findings*

Testing the prototype

At this stage of the design thinking process, the plastic bottle planter workshop was put to the test with real community members. The following section shows the actual research sample makeup and a comprehensive description of the different methods, activities, and initial learnings from the workshop.

1. CICS -Centre for immigrants & community services (Scarborough)
Number of participants (12)
3 teenage participants (16,16, 15)
2 participants under the age of 12
7 participants between the age of 40-80
Gender
10/12 participants were female participants
Ethnicity/Citizenship Status
Chinese immigrants
Language
Predominantly Cantonese and Mandarin - 4 participants required an interpreter

Group relationships
A mom with two young girls
Parents in their 80s with their 60-year-old daughter
Others came alone as individuals
Participants with accessibility needs
Two participants with limited mobility (a walker and a wheelchair)
Volunteers
2 (1 interpreter)
Notes
The participants did not seem to know one another nor interacted much with each other before and after the workshop.

Table 1. CICS sample

2.Building Roots (Moss Park)
Number of participants (4)
4 participants between the age of 20-60
Gender
All-female participants
Ethnicity
Mixed visible minority groups
Language
English

Group relationships
Most of the participants seemed to be regulars but did not engage with each other before the workshop. Came alone as individuals.
Participants with accessibility needs
1 participant with limited mobility
Volunteers
2

Table 2. Building Roots sample

3. The Neighborhood Group (Moss Park)
Number of participants (25)
25 participants between the age of 70-80
Gender
Female participants
Ethnicity
Chinese
Language
Mandarin - all participants needed a translator
Group relationships
The participants seemed to be friends with each other
Participants with accessibility needs
1
Volunteers
1 Interpreter

Table 3. The Neighborhood Group sample

Sample implications and limitations

The intention of the research was to be inclusive toward visible minorities, people with different levels of physical abilities, and those of lower economic means. By having three different sample groups from different communities, it was possible to capture a wide array of participants that satisfied the sample criteria.

It is important to note that the sample does skew heavily toward females and those with Chinese backgrounds. While this can be seen as a limitation in being able to generalize the research findings to the wider Toronto population, Chinese immigrants actually make up a large segment of the Toronto population. Furthermore, the learnings from an immigrant perspective is also something that is relevant for a city like Toronto where around half of the population is represented by immigrants (Young, 2017).

The biggest challenge in working with these groups was the language barrier. Having to design the workshop materials in both English and Chinese and to hold discussions with participants through an interpreter was difficult to facilitate. Getting the written responses translated by the interpreters was also a challenge in the given time frame. Getting an interpreter for not just the workshop but the follow-up synthesis would've made this process much easier.

The co-creation workshop

Summary

In this research, the Plastic Bottle Planter workshop, a co-creation workshop, served as a medium to facilitate the integration of multiple activities with the different community groups and their members.

The content of the workshop was designed following Lindenberg & Steg, (2007)'s notion of knowledge as a determining factor that influences change in pro-environmental behaviours. The workshop facilitation aimed to increase access to knowledge, generate more awareness of the problem space, increase absorption of knowledge, and convert the knowledge into action.

Process

The workshop series was designed to take place over two separate sessions during two consecutive week-ends. The activities for the workshop were organized as such: On arrival, the participants had to fill out an initial survey and were then introduced to the topic through an interactive presentation. Afterward, participants began their plastic bottle planter activity. The session ended with a behavioural challenge and a diary study where participants were asked to record how they reduced and reused plastic containers over the

course of the week. They were asked to complete the diary study and bring it back for the second session.

The second session started with discussions around the diary study activity, followed by a foresight exercise to hypothesize the different alternative futures for plastic waste. The participants engaged in a second plastic planter activity and finished with an exit survey. The following table breaks down the agenda for the two sessions.

The workshop followed the guiding principles of affordability, accessibility, social norms/culture, and convenience. The workshop was free to attend for all participants and the language used in the diary study and the presentation was simple and easy to comprehend. The content was also available in two languages English and Mandarin, given that over half of the participants were not completely proficient in English. Finally, the take-home activities including the diary study could be completed online or in-person.

Activities + Methods
Session 1
Presentation- Interactive quiz about recycling
Presentation- Recycling crisis
Presentation- Impact of plastic waste
Presentation - Waste management hierarchy
Presentation - Tips and Guides on reducing & reusing
Plastic Bottle Planter activity
Diary study kick-off
Session 2
Diary study results- sharing circle
Presentation - STEEP+V and trends
Foresight activity - 2X2 Scenarios
Generating strategies/action plan
Plastic Bottle Planter activity 2

Table 4. Activities and methods for the workshop sessions

Workshop methods and findings

The following section provides an overview of all the methods leveraged during the workshop series.

Workshop - 1) Surveys

Process

Surveys were distributed at the beginning of the workshop to measure the baseline of participants' levels of interest, awareness, and engagement when it came to their plastic consumption. The participants were also asked to provide an estimate of the number of plastic bottles they bought in the last week. The objective of this data collection was to be able to compare it with the data collected during and after the workshop about their plastic consumption.

The survey was initially distributed online via a SurveyGizmo link for ease of data collection and synthesis. However, in co-designing the workshop with the community group coordinators, the researchers concluded that in-person distribution of the survey would be more ideal as many participants were older and not as familiar with the online survey format. Therefore, paper surveys were printed prior to the workshop and distributed to the participants as soon as they walked in.

On the second and the final day of the workshop, participants were asked to fill out an exit survey. The purpose of this survey was to capture any behavioural and attitudinal change among the participants after participating in two workshop sessions and completing a diary study that tracked

their plastic waste consumption. The participants were asked the exact same questions as the initial survey in order to measure attitudinal and behavioural change.

Key findings

One of the biggest changes noted at the end of the workshop sessions was that participants felt more confident about their ability to make a difference as an individual in saving the environment. In the initial survey, 63% of participants agreed that they did not know how to make a difference as an individual (23% strongly agree, 40% agree). In the exit survey, this rate dropped to 36%. This was a significant improvement in participants feeling confident in their ability to contribute and make a difference.

I don't know how I can make a difference as an individual in saving the environment

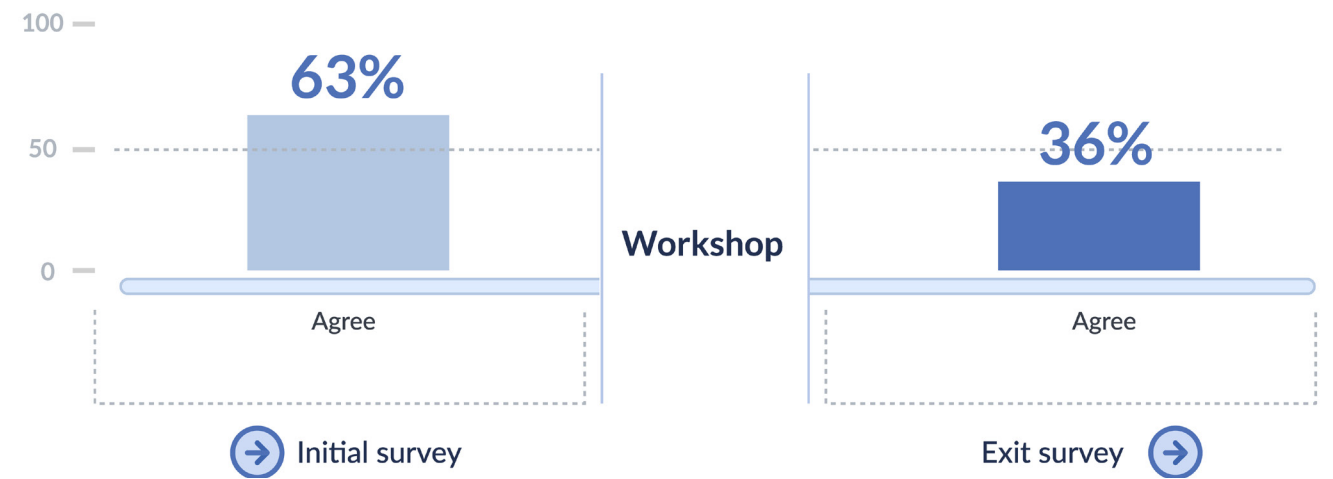


Figure 9. Individual levels of confidence

Before the workshop, 83% of participants agreed that they were already making a conscious effort to reduce and reuse plastic waste, which indicated that the participants were already environmentally conscious to begin with. After the workshop, over 91% of them stated that they were making a conscious effort to reduce and reuse plastic. It is possible that the participants may have exaggerated their prosocial behaviours, but the increase from before to after still shows that the workshop had some influence in the participants' plastic usage behaviour change, at least temporarily.

This could be attributed to the specific discussions and exercises in the workshop that focused on individual actions and impact. The objective of the workshop was to provide participants with tangible, actionable take-aways, hence, the results showed that this was effective to a degree.

I make a conscious effort to reduce and/or re-use single-use plastics in my everyday life.

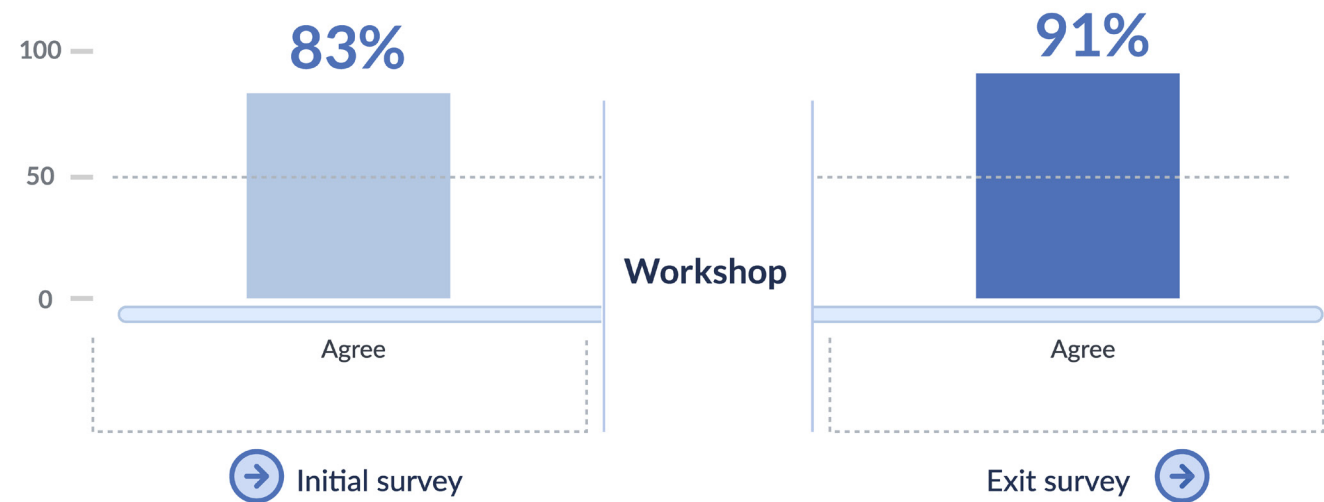


Figure 10. Conscious effort

Overall, participants scored an average [mean] of 8 on their likelihood to recommend this workshop to others (1 = Not at all likely, 10 = Definitely likely). The lowest scores came from the teenage participants (average mean = 3). Their feedback on the exit survey indicated that they found the workshop too long and the presentation (educational portion) not very entertaining. This contrasted with the rest of the adult participants who found the educational portion very interesting and informative. This difference was important to note as the workshop was designed to be more suitable for adults rather than young teens. This highlighted the limitation of the workshop and the importance of designing different methods of communication based on participants' demographics. For future workshop sessions involving teens and young children, the sessions will have to be redesigned to be much shorter and more interactive.

How likely are you to recommend this workshop to others?

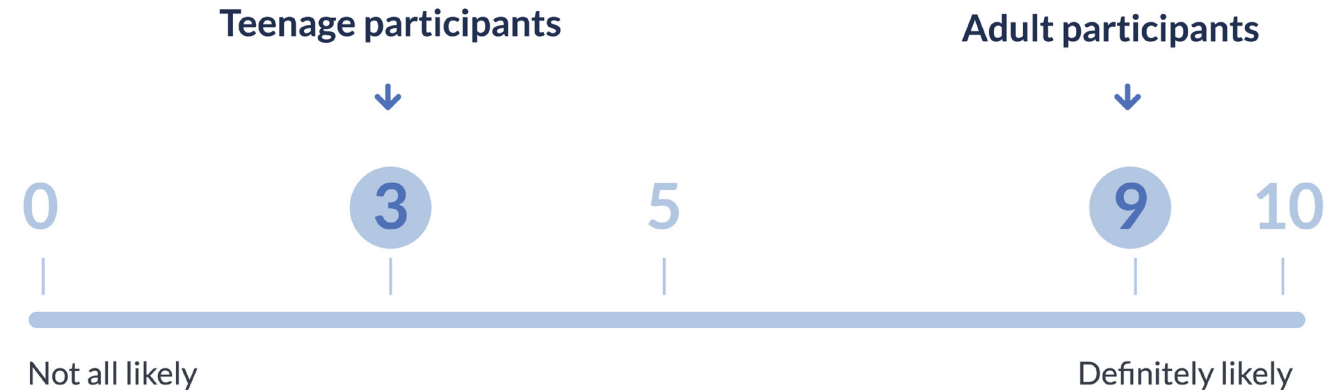


Figure 11. Likelihood to recommend the workshop to others

It is also important to note that the changes in behaviour observed through the survey should be seen as an initial gauge, rather than a conclusive result. The purpose of the survey was not to measure fundamental behaviour change, as this would require a longitudinal study, but rather, to see what immediate and potential impact the workshop could have on people's attitudes and behaviour in its prototype phase.

Workshop - 2) Interactive educational presentation

Summary

In the first workshop session, the aim of the interactive educational presentation was to help create awareness of the problem, then facilitate absorption of key facts to foster knowledge generation, and finally, stimulate desired behaviours of reducing and reusing for plastic containers.

This presentation portion was foundational and necessary as it set the tone of the workshop and provided a safe space for participants to collaborate and co-create ideas to help them shift the behaviours of their community.

Process

For the first session, the presentation covered topics including the state of recycling in Toronto, the global crisis of recycling systems, the impact of plastic consumption, waste management hierarchy, and tips and guides for reducing and reusing plastic containers.

At the beginning of the presentation, we used an interactive quiz, as an ice breaker, to test how much participants knew about recycling in the City of Toronto.

For the second session, the presentation content was organized in the context of the foresight activity. The presentation provided participants with a summary of trends for each of the categories from the STEEP+V framework. This educational presentation primed the participants with necessary knowledge in order to hypothesize the different futures as part of the Scenario planning activity.

Key findings

Knowledge creation and distribution builds the foundation for behavioural change.

At the end of the workshop, many participants indicated how much the workshop helped them to be more aware of the impact of plastic pollution. This awareness is a crucial step for individuals to internally initiate a behaviour change. According to De Young (1993), internal initiation is key to finding “their own reasons for recycling, to begin to even like doing so, and as a result, to continue to perform these behaviours on their own” (p.499)

Furthermore, Lindenberg & Steg, (2007) recognized the correlation between high environmental knowledge and environmental attitudes and behaviours. This suggests that people are more likely to act upon environmental issues when they are more aware of the impact of their choices and the expected behaviour in that specific context.

Participants have different levels of prior experience, awareness, and knowledge and therefore, a foundational educational presentation equips all participants for the subsequent activities so that they are better prepared to take on the behavioural challenges.

Interactive presentations that create space for participants to “socialize” can lead to better knowledge creation.

It is important to point out that knowledge creation and distribution didn’t occur unilaterally from facilitators to participants. Rather, the educational components sparked discussions within the partic-

ipants. The participants were very engaged and sought clarification of some of the facts presented in the presentation. They also shared previous personal experiences as well as tips and information on how they currently tackle plastic consumption. Nonaka (1994) refers to this process of creating knowledge through shared experiences as “socialization,” one of the four modes of knowledge creation. If knowledge creation is key to influencing environmental behaviours, then, how the individual transfers their tacit knowledge to the community is relevant for the purpose of this study.



Figure 12. Educational presentation during session one of the workshop

Workshop - 3) Diary study

Summary

The diary study was a fundamental part of the workshop that helped to capture the different behaviours, feelings, and challenges that participants faced when challenged to reduce and reuse plastic containers for a week. The diary study was essential in understanding and learning from the participants’ real-world experiences, outside the artificial workshop setting.

Process

Participants were challenged to reduce and reuse plastic for a week and to come up with creative ways of doing so. The printed journal was composed of a table for the participants to keep track of the plastic containers they purchased or reused during the given time. The participants were asked to do three entries throughout the week and for each entry, they had to include a picture relevant to the challenge, describe what specific actions they had taken, report any challenges, and describe their feelings.

 Plastic bottles	Day 1-2	Day 3-5	Day 5-7
 Buying (How many plastic containers did you buy?) (您购买了多少个塑料容器?)			
 Reuse (How many plastic containers did you reuse?) (您重复使用了多少个塑料容器?)			

Figure 13. Diary study tracking sheet



Figure 14. Diary study booklet

Key findings

‘Going back in time

Many of the elderly participants in their 70s and 80s were surprisingly very passionate about this issue and shared detailed descriptions of their experience. Interestingly enough, many of them were already partaking in some of the actions to reduce and reuse plastic waste. Several participants talked about how they were doing just fine living without plastic back in the day. Unlike some other younger participants, the elderly participants had already formed lived experiences of living without plastic and did not have to alter their behaviour drastically, which made the challenge a little easier. This was surprising as sustainable initiatives are often attributed to being led by millennials and Gen-Zs in the media, not the retirees.

“Why is it that it’s the most developed nations that have trouble living without plastics?” - Participant A

Boiled water and culture

In addition, there was another interesting pattern of participants lamenting that they had no choice but to buy bottled water when they were out in public and lacked access to boiled water and or filtered water. “Chinese medical systems have long held the view that drinking hot water is good for health. In fact, people are advised to drink a glass of hot water early in the morning to trigger their digestive processes” (Vision Times, 2018).

In addition, tap water in China is not safe to drink, unlike in Canada. 85% of the water in Shanghai’s major rivers was undrinkable in 2015 according to official standards and 56.4% was unfit for any purpose. (The Guardian, 2017).

From a North American perspective, one could think that the normalization of carrying a reusable water bottle is sufficient in reducing plastic bottle purchases. However, for Chinese immigrants who are used to the culture of drinking boiled water and filtered water, there would be no point in carrying a reusable water bottle with them when they cannot fill it up with the type of water that they typically consume. This belief and attitude based on Chinese cultural norms were not something that the researchers were conscious of when designing the workshop. This was an important learning and reminder of the importance of understanding the holistic life experiences of the participants, including the cultural context, that the design is for.

Acting against the social norm

On the other hand, While most Torontonians would be comfortable with drinking tap water, they would not feel the same way about bringing one’s own Tupperware to sit-down restaurants.

One way of defining culture is by the way of “norms” within a society or a group. Social norms are grounded in prevailing cultural value emphases (Licht, Goldschmidt, Schwartz,. 2007). Culture consists of whatever it is one has to know or believe in order to operate in a manner acceptable to its members (Goodenough, 1957). Specifically, descriptive norms describe what is “normal” and what is typically done (Cialdini, Reno, & Kallgren, 1990). When we act outside of the descriptive norms, it is often negatively perceived by other members of society. This was evident for a participant who described her experience of bringing her own Tupperware

to a restaurant in preparation for leftovers. When she took out the Tupperware, the server had looked at her strangely and told her that they provided their own takeout boxes. She noted that other patrons of the restaurant were also looking at her. This made the participant feel awkward and uncomfortable about her actions even though she knew it was the right thing to do for the environment. While many takeout restaurants in certain parts of the city have started BYOT (Bring-Your-Own- Tupperware) programs, like in Roncesvalles, bringing one’s own Tupperware to a sit-down restaurant is still seen as a transgression of the norm for most parts of Toronto. This aligned with other studies’ findings that showed social norms as one of the biggest determinants of behaviour (Cialdini, Reno, & Kallgren, 1990) and also validated the decision to leverage social norms as one of the metrics of success.

Workshop - 4) Behavioural nudging

Summary

The participants were also asked to participate in a challenge where they were primed with different nudging techniques, a concept that lives within behavioural science, political theory, and behavioural economics. The nudging techniques were based on the literature review of Byerly et al, (2018)’s paper, Nudging pro-environmental behaviour: evidence and opportunities. The paper conducted experiments to test several different nudging techniques to see which ones would elicit the biggest changes in pro-environmental behaviour.

According to Byerly et al. 2018, the two nudging techniques that showed the most promising results for waste reduction behaviour change (including plastic containers) were commitments and rewards/incentives. Similarly, De Young (1993), also identified commitments and rewards as very effective techniques with high potential to generate pro-environmental behaviour change. Therefore, the two nudging techniques were chosen to be tested out with the workshop participants.

Rewards/Incentives refer to interventions that encourage or entice people to change their behaviour by making it clear that they will gain something of value if they act upon the expected behaviour (De young, 1993). Commitments, on the other hand, refer to a pledge made at a personal level to adopt the desired behaviour for a period of time, without expecting any retribution for doing so (De young, 1993).

Process

For this challenge, the participants were split into two different groups: group rewards and group commitments. The participants were not aware that nudging techniques were being administered as this could have biased and influenced the participants' actions.

For the commitments group, they were given commitments forms to fill out where they had to write their names and describe the specific actions they were going to take to reduce or reuse plastics for the week. Afterwards, all the commitments were shared with other participants then posted on the bulletin board of their respective community centres so that it would be visible to other members of the community. The objective of this test was to determine if these public commitments would affect the plastic consumption behaviours over the course of the week and also to see how it would be reflected in their diary study.

For the rewards group, the participants were told at the end of the workshop that there would be prizes for those who participated in reducing and reusing plastic containers through creative means. The reward would go toward individuals who reduced or reused the greatest number of plastic containers or came up with the most innovative ways of doing so. The main objective of this specific technique was to see if the offer of rewards would impact the participants' behaviour change in reducing and reusing plastic.

Overall, the goal of the experiment was to see if the nudging techniques would increase the number of plastic bottles reused and decrease the number of new bottles bought by comparing their diary study recordings with their answers from the initial survey. Furthermore, It was also to be able to compare and contrast the effectiveness of the two different nudging techniques.

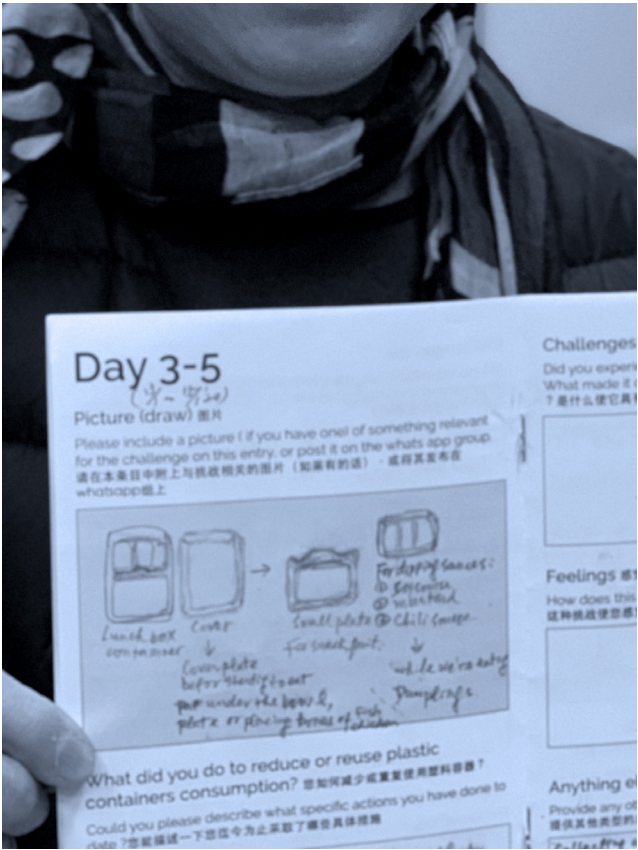


Figure 15. Participant sharing one of the entries of the diary study

Key findings

No significant difference in the number of plastic containers reduced and reused

For both rewards and commitment groups, the number of plastic containers reduced and reused did not change between before and after the nudging technique was applied. However, many of the participants' diaries showed that they were exerting a large amount of effort in finding creative ways of reducing and reusing plastics. Also, in their ini-

tial survey at the beginning of the workshop, most participants recorded using only one-to-two plastic containers per week, which was much lower than expected. It is possible that the participants did not accurately remember the number of plastic containers they had bought before the workshop, as they were not actively tracking their usage at that point, whereas they were during the diary study.

Higher level of engagement from the rewards group

The group that was nudged using rewards demonstrated higher levels of engagement with the diary study than the commitments group. The ideas from this group featured more innovative solution ideations. For example, one of the participants shared how they created a small plate and three dipping sauce containers out of a single takeout container. This demonstrated their level of creativity as well as investment in partaking in more pro-environmental activities to reduce plastic waste. While it is unlikely that rewards were solely responsible for this higher level of engagement (other uncontrolled variables were also likely present), the data findings show that rewards had some influence in increasing participants' level of engagement, at least more so than commitments.

No difference in the level of engagement for the commitments group

There are some hypotheses as to what might have influenced the lack of effectiveness of the commitments technique on changing the participants' behaviour.

The level of participation and engagement for this group during the second week of workshops was drastically reduced by a snowstorm that took place on the day of this group's workshop. As a result, less

than half of the group attended the session, which meant not all of the participants had a chance to share their results from the diary study.

Also, as stated by De Young (1993), the commitments technique is very particular in the sense that it is not always universally valid and it tends to be more effective with specific small subgroups or better yet, individuals. The commitments group was composed mostly of 70 to 80-year-old elderly participants, which meant that the crafting of the commitments had to be done together in a large group for translation purposes. Also, due to the ratio of one interpreter to 12-15 participants, the commitments were written down rather quickly, which also would've had a direct repercussion on the effectiveness and validity of this technique. A more reasonable amount of time and better interpreter-to-participant ratio should have been allocated to this workshop to test for the full impact of the commitments nudging.

The biggest limitation of this method was that the experiments that leverage techniques such as the nudging techniques require careful consideration of all the variables that need to be controlled in order to be able to make conclusive statements about its effectiveness. Unfortunately, not all of the controlled variables were thought out before testing with the techniques and this could have impacted the validity of the research results.



Figure 16. Participant finishing last details of the planter from recycled bottles



Figure 17. Participant adding soil and seeds to the planter

Workshop - 5) Strategic foresight scenario planning

Summary

The educational portion of the workshop for week two was presented using the STEEP+V framework. The participants had the opportunity to discuss the trends that were shared and also generate other trends that were relevant to plastic waste. Following the STEEPV discussion, the participants were introduced to the 2X2 scenario planning exercise, an activity commonly used in strategic foresight.

Strategic foresight is the identification of the major alternative futures and the envisioning and creation of preferred futures that guide subsequent strategic planning activities (Dator, 2009). The purpose of strategic foresight is not to pinpoint future events but to highlight large-scale forces that push the future in different directions by using methods and tools that futurists have developed, tested, and applied in recent years which have proven useful and exciting (Gates, 2010).

2x2 scenario planning is just one of the many ways of constructing future scenarios. Scenarios are used to assist stakeholders in expanding their mental models, moving beyond 'the official future' to consider multiple possible future worlds. They should tell plausible and provocative stories about the future, using narrative to make sense of the various trends and drivers identified during the earlier trends scanning activity (Hines & Bishop, 2006). Scenarios are not about predicting the "correct" future but about understanding and working toward the "preferred future." Hence, including elements of strategic foresight via scenario planning in the workshop was imperative as plastic waste management and climate change is a topic that matters not

only for today but also for the near and long-term future. The society's ability (or inability) to decrease plastic waste will have a significant impact in determining how the planet earth will survive and thrive. Therefore, the purpose of the foresight scenario planning was to help orient the participants to be more future focused in their thinking.

Process

Typically, there are several steps required in creating the 2x2 scenarios with many iterations. Considering the time limitation of the workshop as well as the participants limited knowledge on strategic foresight methods, a condensed version of this exercise was designed and set up before the workshop.

Normally, the participants would review the drivers identified through the STEEP+V scanning and come to an agreement on which drivers to use as the two main polarities. However, in order to facilitate a 2X2 scenarios exercise in 45 minutes, the researchers selected the two drivers that were the most polarizing and uncertain ahead of the workshop. Driver one was Economic Growth (Boom vs recession) and driver two was Power (in the hands of climate change believers VS deniers). Participants were given prompts to help them ideate and hypothesize what each of the worlds could look like 30 years from now in 2050. The timeframe of 2050 was also selected by the researchers as it was important to keep it tangible and personally relevant for the participants but also far away enough in the future to speculate some drastic changes to the world.

In addition, instead of a traditional wind tunnelling strategy exercise to follow up after the scenario planning exercise, the process was simplified with post-it prompts asking the participants to ideate on the different actions they could take today as an individual and also as a community in order to build toward the preferred future.

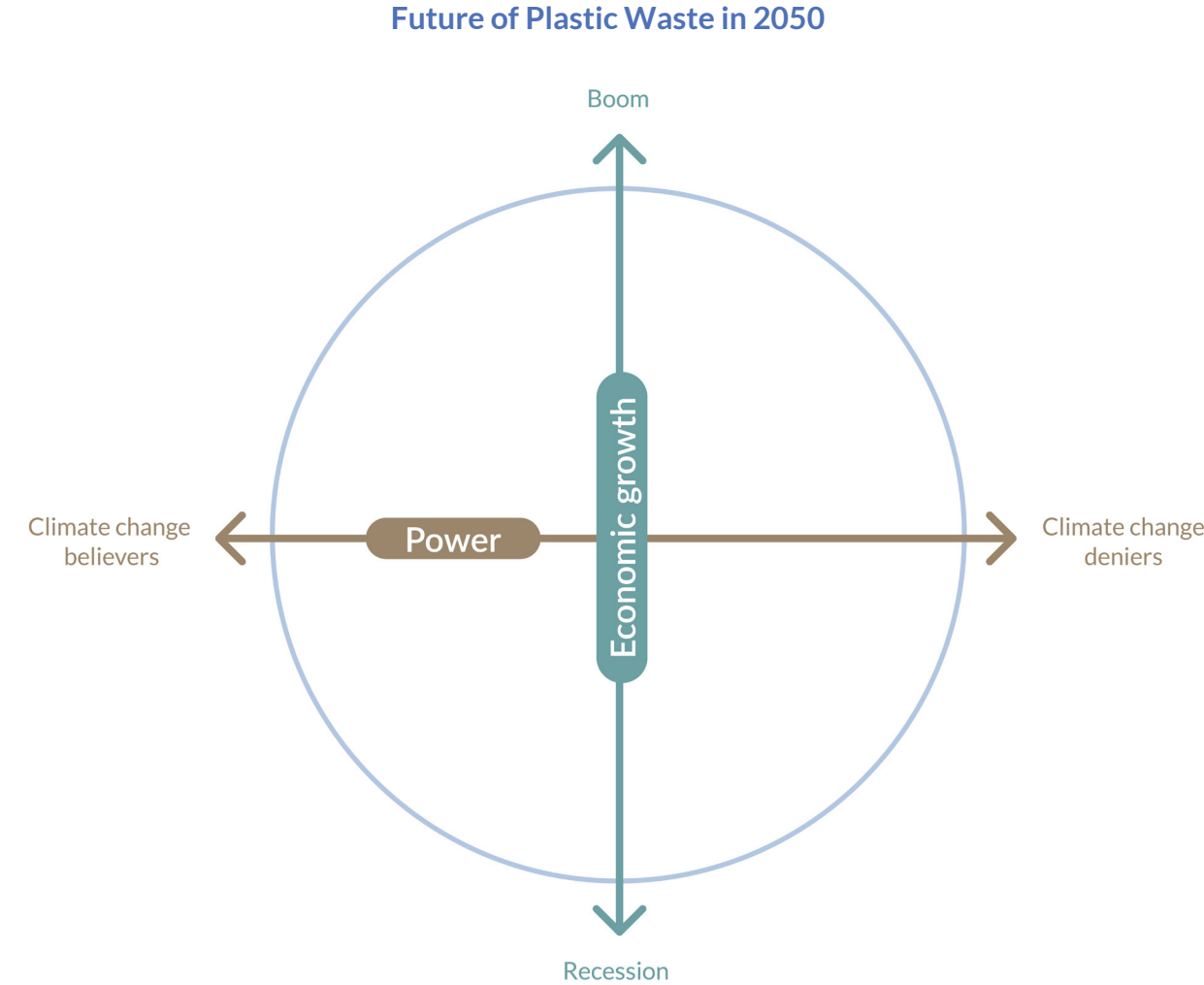


Figure 18. 2X2 Matrix: drivers and polarities

Key findings

The worlds were hypothesized by the participants based on the discussions of the current trends and issues. The participants interacted and collaborated with one another to build upon each other's ideas. This was not an easy task to do in such a short duration, especially for those unfamiliar with the method. Yet, the participants were able to create colourful yet plausible worlds with the moderator's guidance.



Figure 19. 2X2 Matrix: four futures

World 1: “World of Teslas”

In this economic boom, the government and corporations would invest heavily in new sustainability innovations. Thanks to those innovations, there would be fewer health problems and better overall air quality. Participants also imagined a future with innovative agricultural systems such as automated water irrigation tunnels. It was particularly interesting to see the younger participants, aged 12-16, come up with sci-fi-type narratives for this world. Those narratives included flying electric cars powered by solar panels and a holographic/VR future where nothing is “physically” made in order to reduce the use of plastics and other materials.

World 2: “Trump’s America”

Despite the economic boom in this scenario, participants imagined a world where only those with a certain amount of money could afford access to clean air, food, and water. This world would have even worse air pollution caused by the mass production of plastics due to the lack of investment in sustainability and climate change initiatives by those in power. This would also be the reason for higher healthcare costs, further exacerbating the different levels of access between the rich and the poor. In this world, and in every other world, the importance of “health” was evident, as participants saw air pollution creating various health issues. This was especially evident among elderly Chinese immigrants who may have previously experienced the negative health consequences of living in highly polluted cities. The importance they placed on health can also be attributed to their age, as those immigrants are well into their retirement years. According to the Sun Life survey, the biggest retirement concern among Canadians is health with only 22% feeling prepared for a health emergency (The Canadian Press, 2014).

World 3: “Creative Hippies”

The most complex ideas came from World 3. Participants had to be particularly innovative in their thinking for this world, where people would care deeply about fighting climate change and reducing and reusing plastics but would have limited economic resources to do so.

In this world, current trends, such as the sharing economy and minimalism, would become the mainstream norm in order to combat plastic waste. People would co-live, co-drive, co-work, and always aim to minimize their personal impact on the environment. They would rely more on low-tech sustainability initiatives such as only using bikes for transportation. To escape the Earth’s rising temperature without economic resources, more people would live underground inside the hills (Reilly, 2018). There would also be an increase of people creating sustainable, liveable homes out of garbage in order to reduce and reuse waste with limited financial means.

Given that saving the planet would be the top priority for this government, plastics would be banned completely and there would be stricter regulations and a personal carbon tax that aim to have citizens reduce their carbon footprints. The government may even impose population controls like China once did in order to reduce the human impact on the environment.

World 4: “Mad Max: Climate War”

World 4 was perhaps the most dystopian world of them all. Participants hypothesized a world inundated with countries fighting for clean resources such as water and fresh produce as the food ecosystem collapses. There would only be a select few elites with access to the remaining resources. Par-

ticipants even hypothesized that these elites would plan to desert the dying planet to start a new colony on Mars. Similar to the other worlds, food by way of agriculture and access to fresh resources were key priorities and concerns.

Strategies

When asked to brainstorm initiatives and actions that one could take today as an individual and also as a community to get to the preferred future, there were many ideas around community gardens and urban farming. Many organizations already have urban agriculture/farming initiatives today and based on the foresight activity, it’s likely that such initiatives will only expand and develop further. People also noted that more workshops like the one facilitated needed to take place in order to educate and engage community members, especially the younger generation.



Figure 20. Participant during the scenario creation activity

8

Validating the prototype

Insights and Discussions
Validating the workshop as a prototype



Validating the design prototype

As one of the final steps of the design process, the idea is to materialize, evaluate, and potentially provide guidelines for further research and implementation. As previously stated, the workshop was designed to serve both as a prototype for the solution and also as a research method (Research through Design). The workshop as a research method was validated through the insights uncovered as part of the research process.

Insights and Discussions

Retired elderly citizens are the untapped leaders of the sustainability movement for Toronto communities

The media often discusses the burden that Gen Zs and millennials have to carry due to the mistakes of the past generations before them. Greta Thunberg has become the poster child of the future generation of young teens stepping up to save planet earth. Indeed, for these young citizens, the fact that they may not have an earth to live on during their lifetime is a genuine concern. On the other hand, the older generations are often portrayed as the ignorant ones responsible for damaging the environment to the current state. An example of this disdain is the popular phrase used on social media, “Ok boomer.” The disdain that the younger generation feels for those over the age of 50 can be summarized by this short online slang.

However, the plastic planter workshop revealed a very different story. Over half of the workshop participants were Chinese immigrant retirees over the age of 70 and they showed a surprising amount of passion and engagement toward the topic of plastic waste. For instance, many of the elderly participants shared what they were already doing to reduce and reuse plastic in their everyday lives. When new information regarding plastic consumption was presented to these participants, they were excited and curious to learn and discuss more about it. Despite the language barrier and having to use an interpreter on-site, participants were unfazed and actively shared their thoughts and opinions on tackling plastic waste.

One of the reasons for their active engagement can be attributed to the fact that the behaviour of reducing and reusing came more naturally for them. As previously discussed, this was not a new behaviour they had to learn from scratch but rather, part of tacit knowledge that they've acquired over the years. Unlike many of the young Gen Zs and Millennials, the elderly population (The Silent Generation) lived through the times of rations and austerity. The idea of using less and reusing often wasn't just a trend but a way of life that they had lived through (Parkinson, 2019). Also, having lived through a time before plastic bags and Uber Eats, reverting back to the old ways would likely take less effort for this group of participants than it would for the younger generation.

“We used to live just fine without plastics.”

- Participant B

Another reason that the participants cared about the problem of plastic consumption was related to the concerns that they had about the consequences of plastic pollution and its impact on their health. As retirees in their 70s and 80s, the impact of pollution on their health and overall wellbeing was a very real concern. This was a pattern that was evident throughout the workshop series. In addition, it is possible that having lived in cities in China with poor air quality made this problem even more personal and relevant for the participants, which could have served as a source of motivation to take action to reduce and reuse plastics.

Furthermore, the fact that the elderly participants were retired meant that they had more time to engage in sustainable practices. Lack of time, not lack of interest, is often cited as the barrier for engaging in sustainable practices (Horhota, Asman, Stratton, and Halfacre 2014). However, the retired elderly participants had a lot more time to not only engage in community activities such as the plastic bottle planter workshop, but also to engage in sustainable practices in their everyday lives that may be considered less convenient and more time-consuming. For similar reasons, these participants also have more time to lead sustainability initiatives within their communities. This could be used as an opportunity to transfer their knowledge through socialization and externalization to other generations and members of the community.

Giving the elderly community members more opportunities to lead initiatives to reduce and reuse plastics does not mean that the contribution from younger members of the community is less valued. Not only is the cross-generational exchange of knowledge important to foster diverse thinking, but the imaginative powers of the young participants can also add so much richness to strategic foresight when it comes to planning for the future of plastic

waste. As noted in the scenario planning activities conducted with the participants, it was the young participants in their teens and preteens that pushed the boundaries when imagining the potential futures.

Creating future scenarios as part of a strategic foresight process requires both art and science. On the science side, it requires extensive research and understanding of past events as well as current trends and frictions. The art side of scenario planning requires imaginative creative thinking, which the young participants excelled at during the workshop session. These stories of the future, or also known as the “speculative fictions” narrated by children, can also be useful in recognizing and foreseeing technology’s social consequences (Bergman et al., 2010; Birtchnell and Urry, 2013; Fowles, 1978; Miles, 1990; 1993).

While speculative fiction has been adopted as a framework tool by many organizations, leveraging children and young teens as codesigners and researchers of strategic foresight through speculative fiction is only now beginning to emerge. For instance, the Climate Change and Me project is a project that mapped children and young people’s creative and ontological relationships with climate change through an emergent and child-framed research methodology to imagine possible futures of climate change (Rousell, 2017).

According to Rousell, “speculative fiction has the potential to empower young people to respond to the challenges of the Anthropocene “through aesthetic modes of address which are not confined by adherence to moral, scientific or discursive regimes of expression (Turpin & Davis, 2015).”

By socializing and externalizing the elders’ knowl-

edge to the young, this can nurture the young members of the community in speculating a new future that is creative yet grounded in history and the lived experiences of the elders.

Understanding the generational differences and the potential synergy between the different groups is key in order to develop a suitable solution for plastic waste reduction and re-usage for the community.

Re-evaluating the value of convenience culture

In developed nations, people are accustomed to living in a society where all basic necessities and luxuries are easily available at all times. This culture of convenience has been perceived lately as a powerful force that shapes individual behaviours and even our economies (Wu, 2018).

When it comes to plastic consumption, it is difficult to change people’s behaviour especially when they have ingrained attitudes and values that predispose them to accept relatively short-lived products or the convenience of disposable products. (Walker & Giard, 2013) Many participants revealed in their discussions and in the diary study how much easier it was to choose the plastic container/packaging options when purchasing as that was what was readily available to them.

In a culture where everything you need is available at your fingertips and 2 day-shipping becomes the rule, not the exception, it is easy for people to become annoyed by tasks that remain at the old level of effort and time. (Wu, 2018). Unfortunately, the task of reducing, reusing, and recycling requires a considerable amount of physical and cognitive ef-

fort compared to other activities that can be performed seamlessly and efficiently in this culture of convenience. The price of convenience often has devastating effects on the environment as seen by the single-use plastic waste problem that the world is faced with today. Yet, it is still difficult for people to change their behaviour when it comes to plastic usage despite stating that they feel motivated to be more environmentally conscious. This dissonance can be attributed to people's different ways of goal framing.

In the goal framing theory based on motivational and cognitive social psychology, Lindenberg & Steg (2007), identify three different types of goals that are relevant for environmental behaviours: Hedonic goal frame, gain goal frame, and normative goal frame. People in a hedonic frame will be very sensitive to what increases or decreases their pleasure and affects their mood. A concrete example of this was recurrent among participants during the workshop. Participants talked about the inconvenience of having to clean the food off the plastic containers, which was necessary in order for it to be reused or recycled appropriately without contaminating other items in the recycling bin. When participants prioritize their hedonic goals, the physical and cognitive efforts involved in these tasks can hinder the adoption of pro-environmental behaviours like re-using and reducing plastics.

On the other hand, a normative goal frame activates all sorts of sub-goals associated with appropriateness (such as behaving the right way, contributing to a clean environment, showing exemplary behaviour), making people especially sensitive to what they think one ought to do (Lindenberg & Steg, 2017). The sense of what one "ought" to do, has given rise to the convenience economy's countertrend, minimalism and slow-living. Those who prioritize their normative goal of contributing to a clean environment over the hedonic self-inter-

est goal are the ones leading this movement. From living in tiny homes to starting their own backyard farms, this subculture is fighting back against the convenience economy and choosing to live the life of the past before the proliferation of plastics. As subcultures become the main culture, the sense of what one "ought" to do can also evolve among the members of society.

Workshops like the plastic bottle planters can play an important role in increasing the awareness of the serious consequences of plastic waste, which in turn, helps shift the communities' hedonic goal-frame more toward normative goal-frame.

Behaviour is difficult to change without understanding social norms and cultural implications

While there are many variations to the definition of culture, social scientists often leverage ethnicity to represent culture. Both culture and ethnicity delineate how people think, behave, make decisions, and define events and experiences (Murry, 2004). As Berry (1985, cited in Betancourt & Lopez, 1993) noted, "because ethnic groups are likely to interact with each other, ethnicity becomes a means by which culture is transmitted."

As the research participants were predominantly part of the Chinese immigrant population, the diary study and the discussion sessions gave further insights into the specific cultural implications when it came to the participants' plastic consumption activities.

Cultural values and assumptions are rarely questioned within the cultural group. However, when the cultural group joins another more dominant culture, it is often not easily learned, the nuances of it, by the dominant culture (Denison et al., 2012). Without the learnings from the diary study, the distrust of tap water and the need for boiled water among the Chinese Immigrant population would not have been taken into the researcher's consideration. Furthermore, values specific to environmental practices are different between Asian countries and western countries (Midori Aoyagi-Usui et al. 2003). In a city like Toronto with a large ethnic diversity, solutions developed without such cultural implications will fail to have an impact on the behaviour change of the participants.

According to Denison et al. (2012), if cultural values and assumptions are something that is rarely questioned, not visible, and held subconsciously within the group, on the opposite end are norms, behaviours, and artifacts that are visible and tangible. Hence, transgressing the social norm is often visibly noticeable and questioned by other members of society. This was very evident when a participant explained how she tried to use her own Tupperware for the leftovers but felt awkward because the server and the attendants had looked at her strangely for her actions. Subconsciously, this experience made her feel like she was doing something wrong even though she was trying to do the right thing. This unpleasant feeling brought on by violating the social norm can be intense and the social consequences of these feelings, and of anticipating them, can be substantial (Sunstein, 1996).

This is partially rooted in the notion that social norms are closely tied to one's identity. "The social nature of identities is important as they both form through social interaction and also influence how people respond to the broader social world (Crompton &

Kasser, 2009); and which in turn connects them with social norms (Thomas et al 2013)." Hence, due to its ties with identity formed through social interaction and subsequently, personal values, social norms are not actually as rigid as it initially may seem. If one's social identity becomes more strongly attached to pro-environmental behaviours, what is "normative" socially for the individual can change.

The strength of social norms in controlling pro-environmental behaviours has been tested by many social psychologists. Experiments show that behaviour can be changed remarkably when the cues arise from within a social group in which individuals feel a sense of belonging (JF Helliwell, 2014). In one study that aimed to increase recycling participation, the most effective feedback used social pressure by reporting that participation in their neighbourhood is worse than another neighbourhood (Helliwell, 2014). Experiments like this show that people are prepared to change their behaviour dramatically for purposes that they and their norm-sharing social group believe to be legitimate and important. Therefore, reframing the norm within a community to be more pro-environmental is key to changing the attitude and behaviour of that community.

A sense of empowerment is a prerequisite to pro-environmental behaviour change

From the beginning of the workshop, the participants expressed their desire in wanting to make more environmental choices. For them, part of the reason for signing for the workshop series was to gain more knowledge on this topic. However, many participants did not feel completely confident that they could make a difference as an individual toward saving the environment. They had the desire and motivation but lacked the tangible tools and confidence in one's ability to control the outcome of plastic waste management.

For instance, in the diary study challenge, participants were very motivated to find alternative options to plastics in their everyday lives. While there were some great alternative and creative solutions that the participants engaged in, they also noted specific cases where they felt like there were no sustainable alternatives available in the market. Levett et al, (2003) explain these limitations as the contemporary way of life, describing that individuals often have no option but to consume in unsustainable ways if they are to participate fully in society (as cited in Southerton, Warde and Hand, 2004).

"Consumer sovereignty" is a term used to convey a belief that societal welfare is maximized when consumers are given the freedom to choose products (Walker & Giard, 2013). In today's world, consumers are inundated with options to choose from, but this choice diminishes significantly when you take into consideration the available pro-environmental options. Even in the cases where there are more sustainable options to choose from, the high cost of such items often limits motivated customers from being able to choose the more sustainable option.

In addition, the survey results and discussions from the workshops made it evident that the participants felt frustrated and somewhat helpless when it came to their purchase options for specific items.

The workshop aimed to empower participants by showing tangible steps that they could take and also by getting participants to participate in plastic reduction and re-usage activities during the workshop. As a result, the workshop was successful in increasing the participants' internal locus of control when it came to plastic waste management. Locus of control refers to the extent to which people believe that they have the ability to affect outcomes through their own actions (Rotter, 1966). People with a higher internal locus of control believe that they have control over their future and believe that outcomes are related to the work they put into them (Lefcourt 1991). Hines, Hungerford, and Tomera (1987) concluded that an internal locus of control is positively related to environmentally responsible behaviour. The willingness to be accountable as an individual stem from the belief that one can make a difference and also play a part in improving the environment (McCarty & Shrum, 2001). This sense of empowerment and control is part of the foundation that must be in place in order for people to commit to an effort that supports plastic reduction and re-usage.

Validating the workshop as a prototype

In order to validate the effectiveness of the prototype in answering the HMW statement, how might we ignite communities and individuals to reduce and reuse plastic, three metrics of success set prior to the workshop were leveraged. The three metrics were as follows:

1. The number of bottles reduced/reused before and after
2. Changes in general attitude and behaviour toward plastic reuse and reduce
3. Scalability/Durability of the workshop (evaluating how likely this workshop will live on and continue to impact communities beyond the given research scope)

1. The number of bottles reduced and reused

As stated in the previous section, the effectiveness of this prototype based on this metric is inconclusive. There was no difference between the number of plastic containers reduced and reused before and after the workshop. However, this differed from the qualitative findings from the participants' diaries where the participants were highly dedicated to reducing and reusing plastics for the week. This difference could be due to a sampling error or participant bias. For instance, the participant's estimate of the plastic containers they used per week in the initial survey could've been under-reported as they were not consciously tracking their usage. On the other hand, the diary study explicitly asked participants to track their plastic consumption several times a week, which would've yielded a more accurate result. The language barrier, even with the translations, also

could've prevented some of the participants from answering the questions correctly. A possible way to mitigate such error could be to provide necessary guides and information ahead of the first workshop so that the participants are better prepared and also have time to ask clarifying questions.

2. Attitude change and behaviour change

The prototype showed positive attitude and behaviour changes both qualitatively and quantitatively. Survey results showed that after the workshop, participants felt more empowered to make a difference as an individual and also reported making more of a conscious effort to make a difference. Qualitatively, the diary study findings and subsequent discussions revealed that many participants, at least for the duration of the week, were actively engaging in creative ways to reduce and reuse plastic containers in their lives.

Ideally, a longitudinal study that could measure the long-term behavioural and attitudinal changes would also be valuable. Conducting a follow-up survey with the participants to measure the lasting impact of the workshop on the participants could also help determine the fundamental attitude and behaviour changes. Behaviour change theory emphasizes the importance of changes that are consistent and durable in the long-term even without external incentives or motivations.

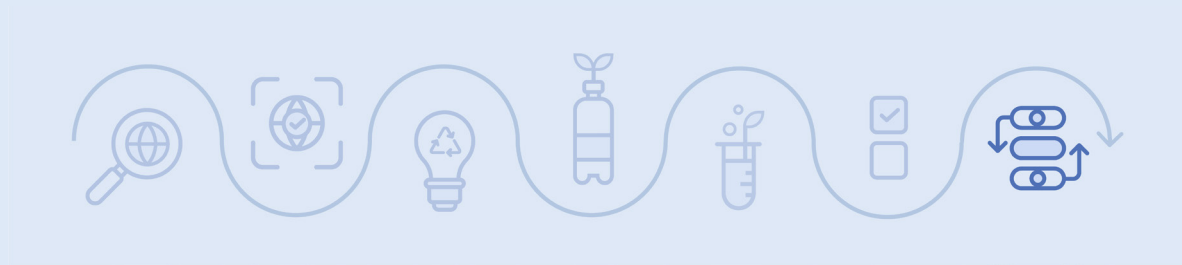
3. Scalability and durability

There were several indicators that helped hypothesize the scalability and durability of the workshop. All the community groups that took part asked the

researchers to organize another similar workshop. Additionally, other communities reached out after hearing about the workshop to see if they could run a similar program. The researchers were also invited to demonstrate the workshop at an event called Parkdale Seedy Saturdays, where many gardening and urban agriculture vendors came together for a day. This was a great opportunity for the researchers to see how the workshop could fit within the context of a circular economy, using the community marketplace as a platform.

While these examples are positive indicators of how scalable and durable the workshop and its impact could be, it is difficult to measure the precise extent. The survey results were strong indicators of a positive impact, but they weren't sufficient enough to determine the lasting impact. More importantly, it must still be determined how to improve and iterate on the prototype while finding ways to make it even more scalable, durable, and impactful.

This realization, along with the insights gathered from conducting Research through Design, triggered the need for a framework that could transform the insights into action as part of the sense-making process, and to future-proof the positive changes brought about by the workshop.



9

Implementing the solution

Theory of Change
Limitations

Implementing the solution

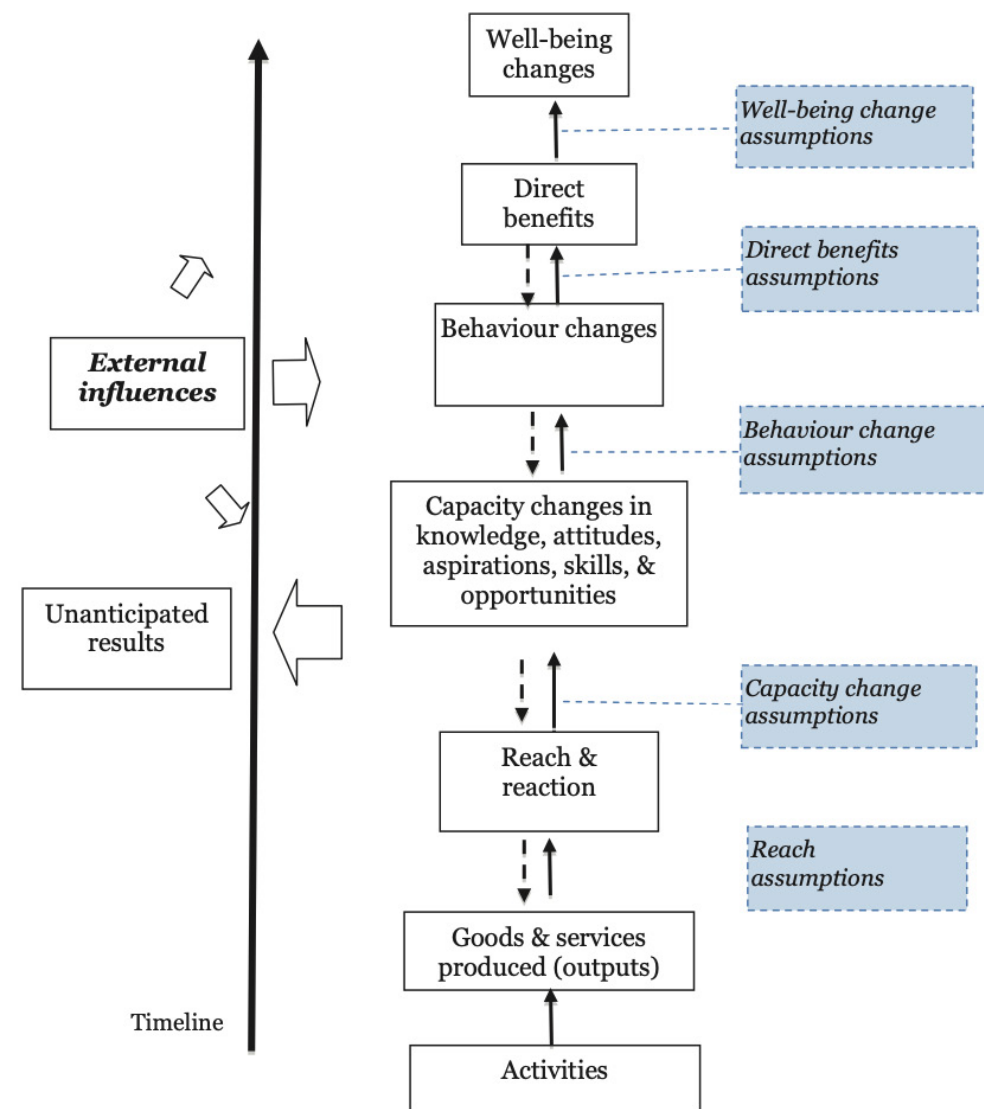
Theory of Change

Ultimately, the research sought to understand how to better empower communities and its members to change their attitudes and behaviours within a complex system of plastic pollution and waste management. The Theory of Change was selected as the ideal framework in consolidating and visualizing all the different paths, influencing factors, and interventions of the plastic consumption journey discovered throughout this MRP process.

Theory of Change is visually represented as a graphic representation of the causal pathways between what a program or change initiative does and how these lead to desired goals being achieved (Centre for Theory of Change,n,d.). It does this by first identifying the desired long-term goals and then works back to identify all the conditions (outcomes) that must be in place for the goals to be satisfied (Centre for Theory of Change,n,d.). There are also external factors and unintended consequences that play a role in the model. The strength of this framework is that it allows for stakeholders to see the precise links and pathways required to get to the long-term goal.

To summarize, A **Theory of Change (ToC)** as a framework and actionable model is the best approach for planning, understanding, measuring and scaling how behaviour change could be attainable in a community looking to reduce plastic waste. (Mayne, 2015)

Many different ToC models were referenced in creating a model that was most suitable for the research question at hand. The final framework developed by the researchers to solve the research HMW problem statement is primarily based on, but not identical to, the model suggested in the Useful Theory of Change Models (Mayne, 2015).



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Figure 21. Theory of change model. (Mayne, 2015)

The proposed model by Mayne (2015), is both generative and evaluative. This means that it can be used as a framework for designing and planning the solution initiatives, whether it is a workshop or another solution, but also as an evaluative model to measure the effectiveness of these initiatives or interventions. Such characteristics of this model aligned perfectly with the current MRP's dual approach of leveraging the workshop as a method of research through design and also as a prototype for the design solution.

The core of the model focuses on the initiatives or interventions specific to the communities and community members within the scope of the research. For this MRP, the workshop serves as the main initiative or intervention. However, the model allows for the introduction of external events and conditions that are not directly related to the core of the initiative but that could contribute, support, and influence the realization of the intended results (Mayne, 2015). It still acknowledges that there are external forces at play that impact the communities and the system as a whole.

Based on Mayne's proposed model, A new framework was developed based on the plastic bottle planter workshop to address the HMW problem statement.

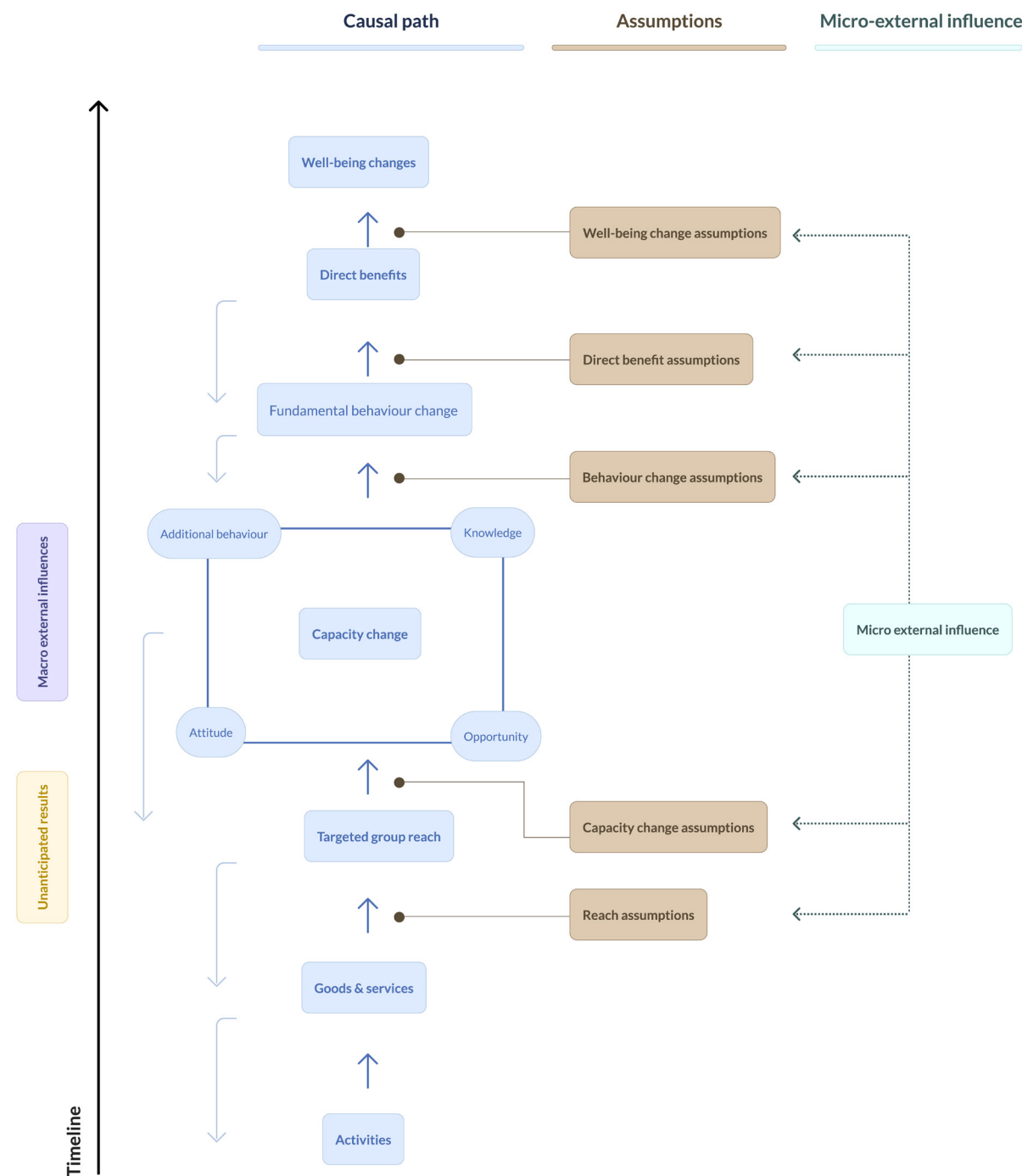


Figure 22. Reinterpreted Theory of Change for igniting communities to reduce and reuse plastics.

Leveraging the ToC to ignite communities to reduce and reuse more plastic containers

The following definitions of the different components of the Theory of Change model is based on, but not identical to, Mayne's definitions:

Causal path: the core of this ToC model, which is made up of seven different levels of causal links. It includes Activities, Goods and services, Targeted group reach, Capacity change, Fundamental behaviour change, Direct benefits, and Well-being changes. In order to reach the different causal links, specific assumptions need to be met for each causal link stage.

Activities: The first causal link of the causal path. These are actions undertaken by those involved in the initiative/intervention. For the purpose of this research, the activity consists of researching and learning about plastic waste management and behaviour change theories.

Good and services: Direct outputs resulting from the activities undertaken. The output created from the research activities is the Plastic bottle planter workshop and all the different components of the workshop (ex: surveys, diary studies, and behavioural nudging).

Targeted group reach: Those who are intended to receive the goods and services and their initial reaction to the goods and services being met. For this research, the targeted group is represented by the Toronto community members of mixed socioeconomic status and ethnicity.

Capacity change: Changes in knowledge, attitudes, opportunity, and also additional behaviour that are necessary for the new fundamental changes to take place. Additional behaviour change refers to changes that are incremental and new, still temporary to the target group. For this ToC, capacity change is met when community members acquire new knowledge and shift their attitudes and behaviours in reusing/reducing plastic containers.

Fundamental behavioural changes: Changes in actual practices and behaviours. Through changes in knowledge, attitudes, opportunity, and additional behaviour, fundamental behavioural change can take place. The goal is met when the community members are reducing and reusing plastic containers habitually.

Direct benefits: This is the improvement in the state of individual beneficiaries. The benefit for the community members is the decrease in plastic pollution in the communities.

Well-being changes: These are the long-term cumulative improvement in the overall well-being of individuals. In this case, it would be improving environmental health and subsequently, human health in Toronto.

Causal link assumptions: These assumptions are salient events and conditions that need to take place for each link in the causal path to take place. For instance, in order to be able to reach the targeted group, the assumption is that the workshop has been communicated in the appropriate language and channel for the target. It would not have been possible to reach the audience for the workshop if the workshop was not ad-

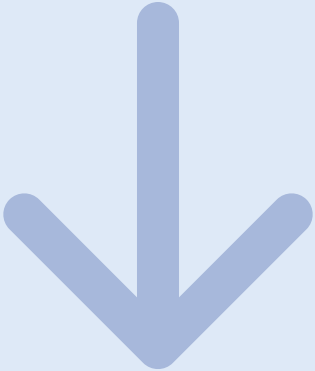
vertised in Chinese on the community newsletter. Similarly, if the workshop content does not take the cultural context into consideration, it will be much more difficult to change the participants’ attitude and behaviour. Understanding such contexts, like the hesitations that the Chinese immigrants have toward tap water, is crucial in designing activities that are valuable and actionable for the group.

Micro-external influences: external influences that are outside of the causal path and the main initiative (the workshop) but are still within the realms of the community. For instance, goods and services providers within the community, like restaurants that offer bring-your-own-container options, is a micro-external influence that is outside the workshop scope but is within the community and can impact the process of behaviour change for the community members.

Macro-external influences: in Mayne’s model, he calls it solely “External influences” and it refers to events and conditions that are unrelated to the intervention but could still influence the realization of the intended results. For the new ToC, it has been renamed as “Macro-external influences” to describe the influences that are outside of the workshop and the community but are macro factors that play a role in changing the community’s behaviour from a systemic point of view. Forces such as federal government policies regarding plastic waste or adoption of EPR would be considered macro external influences.

The following Theory of Change model examines the causal path and its links when leveraging the Plastic bottle planter workshop as the initiative.

Theory of Change for igniting communities to reduce and reuse plastics.



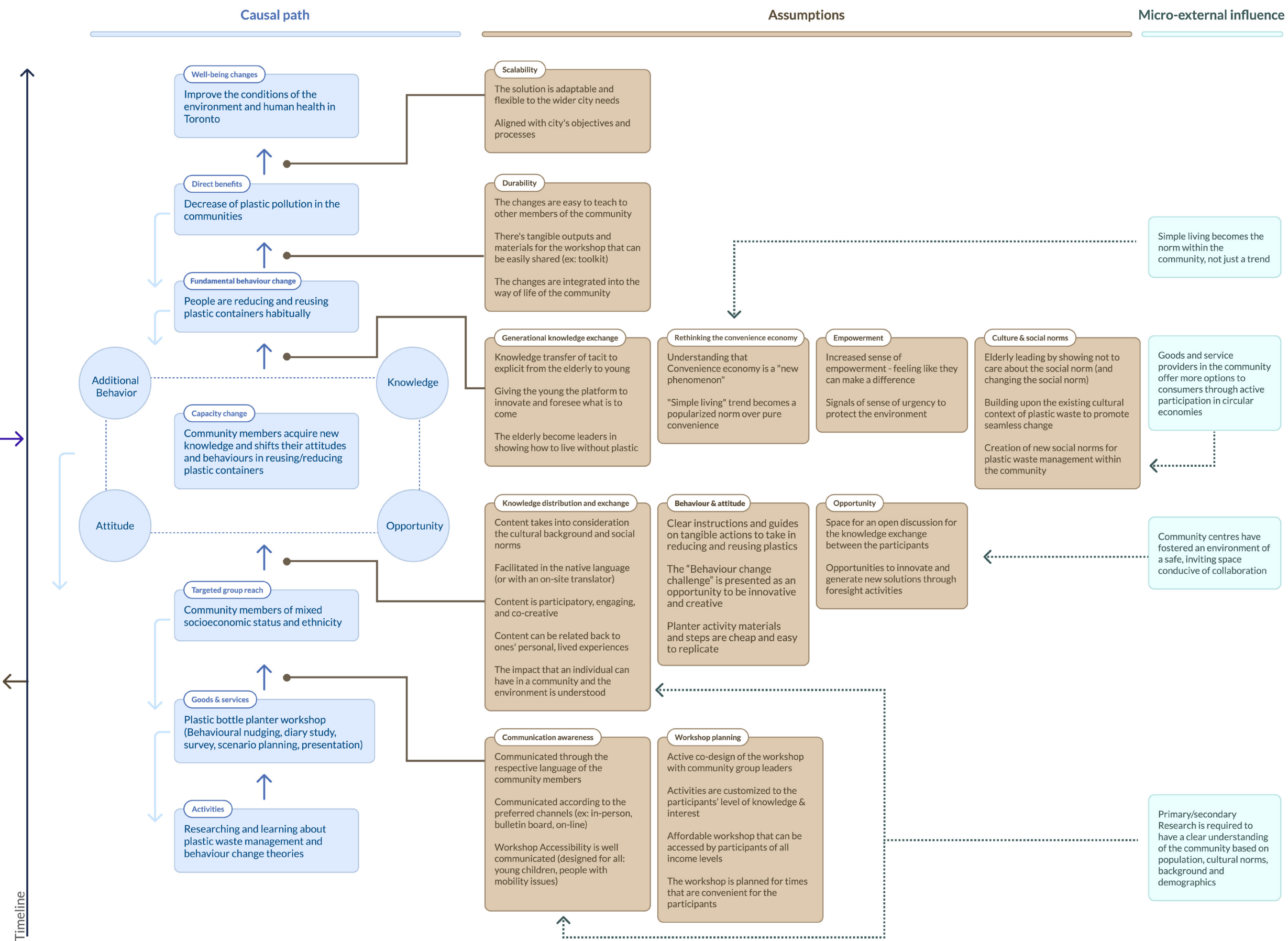


Figure 23. Detailed Theory of Change for Igniting communities to reduce and reuse plastics.

This framework for Theory of Change represents the culmination of all the research learnings and key insights cultivated through the plastic planter bottle workshop and supporting literature reviews. While this is a fairly robust ToC model, it should not be taken as a finite, concrete solution. It should also be seen as a fluid, evolving model that can be iterated on through further research and development. This model is to be used as a starting point for organizations planning to launch initiatives such as the plastic bottle planter workshop, with the same goal of reducing plastic pollution in the community. They are also encouraged to build upon this Theory of Change framework as it aims to be “developed and modified throughout the intervention development and evaluation process through an ongoing process of reflection to explore change and how it happens” (De Silva et al., 2014).

Limitations

While the workshop was successful in changing the participants’ attitude and behaviour to a certain degree, there are several limitations to the study that need to be addressed.

The participants for the workshop series were mostly self-motivated to sign up. They signed up understanding that the workshop would consist of planter making activities as well as educational sessions on plastic waste management. Therefore, the participants were already predisposed to care about the impact of plastic waste and were already motivated to learn and change their behaviour. This might indicate that this group cares more than the average Canadian on the issue of plastic waste. However, being concerned about the environment is actually representative of the Canadian population. According to National Observer, 77 percent of Canadians either strongly or partially agreed with the statement “The world is facing a climate emergency and unless greenhouse gas emissions fall dramatically in the next few years global warming will become extremely dangerous (Wood, 2009).

Another limitation of the study is centred around the language barrier. For the sessions with the elderly Chinese participants, the discussions and presentations were translated on-site through an interpreter. There would be some incidences where the participant would provide a lengthy explanation, but the given translations were much shorter. Sometimes, the interpreters struggled to find the right translation. Overall, the interpreters did a great job interpreting the exchanges and feedback, but some nuances were likely to have been lost. The researchers paid close attention to the participants’ body language and emotional feedback to make up for this limitation as much as possible.

The study was conducted with a predominantly Chinese immigrant population. While this was expected for The Immigration Centre in Scarborough, Building Roots and also the Neighbourhood Group had a high level of Chinese participants. Even among the non-Chinese participants, the majority of them were visible minorities. While this may be a limitation in that the research findings can only be generalized to the visible minority population of Toronto, particularly the Chinese, in reality, it is still relevant to the initial scope of the research as more than half of Torontonians identify as a visible minority (CBC, Whalen, 2017). While the findings and the analysis need to take these specific demographics into consideration, the cultural implications and insights uncovered through this group are still transferable for other Toronto communities.

Finally, while the Theory of Change was developed to highlight the priorities and implications for communities to consider when developing their own initiative (such as cultural nuances and social norms), the ToC lacks in the specificity of explaining exactly how to adopt and incorporate such priorities and implications. As a follow-up, it would be beneficial to create a type of checklist that includes the types of questions for the organizations to ask and probe in order to better incorporate the implications and priorities.

Conclusion

The initial objective of this research was to design a way of igniting a community to collectively reduce and reuse plastics on a daily basis. As a result, a co-creation workshop was developed as a prototype for a potential solution. It is important to note that one workshop alone cannot shift behaviour permanently. That is why a Workshop Toolkit, which includes all the workshop materials such as instructions, planter templates, and the diary study booklet, will be available in an open-source link for any organization to access and use. This toolkit can help establish the longevity and continuity of the workshop, allowing communities to establish permanent behaviour change. Furthermore, this workshop is just one of the many ways that communities can come together to collaborate and co-create. The Theory of Change should be used as a guide and a starting point to foster other similar initiatives as communities iterate upon the prototype.

It is also important to acknowledge that individual behaviour change among small communities alone cannot change the system of plastic consumption and waste management. True systemic change will require shifts in the relationships between government policies and regulations, manufacturing practices, and other larger systemic players. However, this does not indicate that there is no value in empowering communities and their members. Prototyping on a smaller scale is an effective way of testing and co-creating potential solutions before heavily investing in a scaled-up solution. It is also possible for local initiatives to grow into national and international movements. Even if this prototype is not sufficient in expanding to a national or international scale, empowered local grassroots movements from communities can still influence and impact the larger key stakeholders indirectly. Empowering local organizations and community members to believe in their ability to make a difference can foster more empathy and passion for the problem space. As a result, this empowerment can encourage people to demand policy and regulation changes, contemplate their purchase decisions based on sustainability, and educate others through knowledge transfer and exchange to spark a bigger movement. This systemic loop shows that a small initiative like the workshop in this MRP, though it may seem insignificant at first, can help ignite a positive change in the plastic waste management system.

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Appendix A

Plastic bottle provenance study and life cycle

Manufacturing

“PET bottles manufacturing requires combining ethylene glycol and terephthalic acid to produce PET resin in the form of small pellets that resemble rice. These pellets are then melted and injected into a mold to produce a ‘pre-form’, a thick walled test tube with a finished neck and set of cap threads. The preform is then heated, stretched, and blown into the final bottle shape.” (Gleick and Cooley, 2009)

For the Dasani bottle of water, the required PET (Polyethylene Terephthalate) resin, of which 30% of the raw material is made from sugar cane based on ethanol provenent from Brazil and the rest 70% from Coal-tar Distillate and natural gas. (The Coca-Cola Company, 2012) Additionally, the production of plastic bottles requires copious amounts of water electricity from the local electric grid. This process also generates greenhouse emissions and health risk associated with manufacturing.(Simeone, 2014)

Additionally, more energy is required to prepare water for bottling. Bottled water comes from two primary sources: municipal water systems (tap

water) and surface and groundwater systems. Depending on the provider the water is treated or not at the bottling plant. The treatment processes can include micro or ultrafiltration, ozonation, ultraviolet radiation, and reverse osmosis. (Gleick and Cooley, 2009)

After the bottle production and treatment of the water if that’s the case; machines rinse, fill, cap and label PET bottles. There are different materials that should be included in this phase of manufacturing. Caps are made out of High Density Polyethylene which requires similar consumption of energy and resources as the plastic used for the body of the bottle. For the Dasani bottle, the label is also made of Polypropylene. The inks used by the printers at the bottling plant for labeling are composed of Dyes, pigments carbon black, solvent, drying agents, resins, humectantes and dispersants. Additional packaging like cardboard, paper and more Polypropylene might be required to get the product ready for distribution. (Simeone, 2014)

Distribution

Once the bottle of water is manufactured and ready for consumption the distribution of the product requires some energy and use of resources that depends on two factors: the distance from the bottling plant and the mode of transportation. In Canada, the water comes from underground formations, from which the water flows naturally. This water is collected at the spring or via a hole that taps the underground formation. (Beck, 2018). The water is then purified using ozone or ultraviolet light (Beck, 2018) in the different local bottling company in the city located in North York, Toronto and Brampton. The bottling company is responsible for distributing the product to distribution centres, then to customers such as grocery stores, restaurants, street vendors, convenience stores, movie theaters, and vending partners who are in charge to sell the product to the final customer.

Consumption

When the bottle of water is ready for consumption there might be other factors that need to be considered regarding the use of resources and energy. Some retailers will offer a cool bottle of water which means there is some energy consumption from the refrigerators for this purpose that has to be included in the life cycle of the bottle of water. (Gleick and Cooley, 2009)

Recycling

Once the water is consumed, the bottle of plastic is placed by the customer in the blue bin or any other containers available for recycling in the city of Toronto. There are three possible scenarios for the bottle of plastic at this phase. First scenario: If the bottle becomes part of the 9% of plastic that is recycled in Canada (Pedersen, Szeto, Common and

Denne, 2019), the bottle will be sorted with other plastic of the same type, it will be transported to a processing plant, the bottle will be shredded, washed and pelletized for further use as a raw material in the creation of more plastic. Second scenario: the bottle of plastic may be exported overseas in a shipping container as a recycling material to developing countries offering cheap labor and limited environmental regulation and where around 70% of their own plastic waste is mismanaged (McCormick, Murray, Fonbuena, Kijewski, Saraçoğlu, Fullerton, Gee and Simmonds, 2019). Third scenario: the plastic will be deposited in a landfill or a waste to energy facility for incineration producing a surplus of CO2 and toxic materials that are more dangerous than the original product. (Pedersen et al, 2019)

In completing the provenance study of a plastic water bottle, The amount of energy it takes to produce single-use plastics like the water bottle is overwhelming. This emphasizes the need for individuals to be proactive and creative about reusing plastics while government regulations around prohibiting single use plastic are slowly being discussed and developed.