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Understanding the Support for Municipal Green Bin Programs

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ABSTRACT

As food waste increases globally, many cities have implemented curbside collection of food waste (aka green bin programs) to divert food waste from landfills. However, not all municipalities in Ontario have green bin programs. A factor responsible for the adoption of green bin programs is the community support for the program. The study results are based on 407 completed surveys from randomly selected households in London, Ontario (a municipality without a green bin program) and Kitchener-Waterloo, Ontario (a municipality with a green bin program). Surveys were used to collect data to understand: i) the predictors of household green bin support and, ii) the difference in green bin support between both cities. Household food wasting and waste diversion variables were used to predict green bin support. As hypothesized, food wasting, and waste diversion variables were able to predict green bin support and Kitchener-Waterloo respondents were more supportive than those from London. Concern for environmental impact, convenience and norms favouring green bin use were the strongest predictors of green bin support in all three models (Kitchener-Waterloo, London and pooled sample). Composting, amount of food wasted, good provider identity, personal norms against food wasting, and food waste education were predictors in two models (London and pooled sample) while age was only a predictor one model (pooled sample). Municipalities looking to improve green bin support should consider educating their residents on food waste reduction and future research should investigate whether green bin support translates to green bin behaviour.

Keywords: Green Bin; Food Waste; Support; Waste Management; Waste Diversion; Composting; Theory of Planned Behaviour.

SUMMARY FOR LAY AUDIENCE

Around the world, the amount of food wasted continues to increase creating several known economic, social and environmental issues. To combat some of the economic and particularly environmental issues (such as greenhouse gas emissions), cities around the world have implemented food waste diversion programs (commonly known as green bin programs). Green bin programs help divert food waste from landfill. However, in Ontario, Canada, not all municipalities have green bin programs – a reason for the inconsistency is linked with the support for the program. Support for diversion programs (e.g., blue bin) is a common theme observed in waste diversion literature. Therefore, this thesis attempts to understand green bin support in and between a city with a green bin and a city without a green bin. This study was conducted in two similar, mid-sized Ontario cities – London (without green bin) and Kitchener-Waterloo (with green bin). Surveys were sent to random households across both cities to understand: i) the predictors of green bin support and, ii) the difference in green bin support between both cities. The study used several variables (such as the amount of food people reported they wasted, food overprovisioning, having time and space to sort food waste and concern for environmental impact etc.) normally found in food waste and waste diversion studies to predict green bin support. Environmental concerns, convenience and norms favouring green bins were significant predictors of support in all models. Alongside these variables, age, food waste education and the amount of food wasted were also significant predictors of green bin support for both London and the pooled sample. Additionally, Kitchener-Waterloo residents were more supportive of a green bin program. The findings suggest that if municipalities are looking to improve green bin support, an important step to take is educating their residents on food waste reduction. Food waste education has a two-fold impact: 1) it makes people aware of their food wasting amount (and its consequences) so they can actively try to reduce it and, ii) it shows the (environmental) benefits of a green bin program thus

improving the support. Future research should investigate whether green bin support translates to green bin behaviour.

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CHAPTER 1: INTRODUCTION

1.1 RESEARCH CONTEXT

Food waste is a serious environmental problem and a serious contributor to global climate change through greenhouse gas emissions. Curbside collection of food waste (green bin programs) reduces the environmental impact of food waste (EPA, 2020; CEC, 2017), but little is known about what predicts the support for green bin programs. For this study, food waste is the loss of edible food originally meant for human consumption (Lipinski et al., 2013) i.e. food thrown away after being bought for the purpose of consumption. It does not include food disposed prior to the food being purchased by a consumer. Minimizing and preventing food waste reduces the negative economic, environmental and social effects that result from not making good use of food (Parizeau et al., 2015).

Globally, an estimated one-third (1.3 billion tonnes) of the food produced is wasted (Gustavsson, 2011). To put it in perspective, if food waste were a country, it would be the third highest greenhouse gas (GHG) emitter in the world (Ontario's Food and Organic Waste Framework, 2018). Nationally, Canadians wasted at least $31 billion worth of food in 2014, a 15% increase from 2010, and this number continues to rise yearly (Gooch et al., 2014). Food waste reduces a landfill's lifespan, it takes up more space and purchasing a landfill is costly, for example, the City of Toronto spent about $250 million to acquire the Green Lane landfill (Solid Waste & Recycling, 2006). Alongside economic costs, there are environmental issues attached to food waste e.g. air pollution from farm machines and, emission of GHGs from anaerobic decomposition of food. In London, Ontario, methane produced from the anaerobic decomposition of household food waste in landfill is the fourth largest GHG emitter (J. Stanford, personal communication, 22 November 2019). Reducing food waste is integral in ensuring that future generations have enough resources for survival. Socially, the failure to reduce waste contributes to food issues like food

insecurity and food inequality, which is the unequal distribution of resources (Parizeau et al., 2015). The economic, environmental and social impacts of food waste underlines how solving this issue is both important and urgent.

Food waste diversion programs (such as Green Bin programs) have been implemented to reduce the environmental impacts (particularly GHG emissions and the extraction of compost) of food waste (EPA, 2020). Unfortunately, little is known about the impact of green bin programs on the discarding of edible food, as few studies such as Ghani et al. (2013) have looked closely about green bin attitudes and behaviours. Most food waste studies (Graham-Rowe et al., 2015; Parizeau et al., 2015; van der Werf et al., 2019; Visschers et al., 2016) focus on food wasting attitudes, behaviour and interventions as ways to reduce food waste. These studies investigate reasons for food waste and food waste prevention, and some use this information in intervention efforts to limit factors which contribute to food wasting, such as over-purchasing. But what happens if people still over purchase? Is there another line of defence that can be employed to discourage people from throwing out food? Most food waste studies (e.g., Graham-Rowe et al., 2015; Parizeau et al., 2015; van der Werf et al., 2019; Visschers et al., 2016) seek to provide ways to prevent food from become waste (which is a good thing) and if food is still wasted then perhaps, there is a food waste diversion program in place to manage the waste. Studies such as Metcalfe et al. (2013) have tried to understand how the disposal method influences food wasting i.e. do people's food wasting attitude and behaviour change based on the disposal method available to them?

1.2 RATIONALE FOR STUDY

In Ontario, there are three main ways of managing the disposal of food waste once in the household: 1) municipal curbside collection of food waste, aka a green bin program, where food waste is composted or anaerobically digested, 2) curbside collection of food waste in garbage bins

which ends up in the traditional landfill and incinerator stream; and, 3) home or community composting. Diversion means ensuring waste (food waste in this case) does not end up in a landfill or an incinerator. Several communities have green bin programs while others have yet to decide if the benefits outweigh the cost. This thesis research focuses on green bin programs. Ontario has an 80% waste diversion target set for 2050 for all its towns, cities and municipalities (Strategy for a Waste-Free Ontario, 2017) and is considering banning food waste from landfills (MECP, 2018). Green bin programs are viewed as an easy way to increase waste diversion and attain this target. Many large Ontario municipalities have implemented a green bin program to divert more food waste from landfill. A green bin program has three main benefits, it increases the lifespan of the landfill, reduces GHG emissions and transforms waste into useable resource (EPA, 2020). As the people become more environmentally conscious, people tend to seek green(er) alternatives (e.g. shopping with reusable bags, purchasing more sustainable products etc.). Therefore, municipalities without a food waste diversion program can be pressured (by residents or higher-level government policies to reduce landfill use) to implement one. Municipalities with green bins have had varying levels of success. The success of a green bin program is usually measured by waste diversion rates; however, it can also be done by the level of support, cost and improvement over time (Warring, 2018).

This research focusses on understanding the level of household support of green bin programs. It also explores the difference in support of the green bin program within two Ontario communities, one with a green bin program (Kitchener-Waterloo, Ontario) and one without one (London, Ontario). The overarching research question is:

How is a household's support for a green bin program associated with their current level of food waste generation, management practices (e.g. garbage and composting) and other

personal determinants (e.g., personal norms, good provider identity, concern for environmental impact)?

1.3 CONCEPTUAL FRAMEWORK

Within the discipline of geography, this study is situated in human geography, specifically in the sub-fields of food geography and waste geography. Food geography focuses on topics related to food production and food consumption, this includes patterns and routines among food consumers. Household food waste intersects with food consumption. In this stage, we see produced and purchased food transformed into waste and the factors responsible for the transformation. At this point, the sub-field changes into waste geography. Usually, food consumption and food waste are viewed as separate fields but studies like Benyam et al. (2018), Bulkeley & Gregson (2009), Metcalfe et al. (2013), argue for, and show, the importance and benefits of merging of both fields. Waste should not be viewed solely as what is left after consumption instead, it represents an extension of consumption as more can be done with discards than simply wasting it into landfill; it is potentially the beginning point for other beneficial processes like composting. Having this perspective changes the view of (food) waste from "icky", "something to get rid of", "disgusting" to, trying to prolong the social, cultural and economic lives of materials. An increasing global population contributes to more food produced and, food overproduction contributes to rising food waste levels, especially in developed countries.

Food waste is a multi-faceted problem and therefore different approaches must be considered when trying to understand and solve this problem. One common way researchers have tried to understand food waste is by using the Theory of Planned Behaviour (TPB). The TPB is used across various fields and most research that deal with environmental behaviour/psychology rely on this theory (Baxter et al., 2016; Cecere et al., 2014; van der Werf et al., 2019). The purpose

of the TPB is to predict and explain human behaviour (Ajzen, 1991). This theory explains a particular behaviour by using several predictor variables such as: attitude toward that behaviour, intention toward that behaviour, subjective norms and perceived behavioural control. The TPB is explained in more detailed in the next chapter, literature review. This research uses the TPB and other variables to assist in predicting and explaining the support for green bin programs.

1.4 CHAPTER SUMMARIES

The remainder of this thesis is comprised of five additional chapters: 2) literature review, 3) methods, 4) results, 5) discussion and 6) conclusion. Chapter 2 provides a review of the literature focused on food waste attitudes and behaviour, food waste diversion programs, and more specifically, the factors that affect food wasting attitudes and behaviour, and factors contributing to different levels of support for a green bin program. Chapter 3 explains the survey design, questionnaire and data analysis. Chapter 4 discusses the findings of the research, the results of the correlation analysis between the outcome variables (green bin support) and other explanatory variables as well as the results of the linear regression models to predict green bin support. Chapter 5 reviews and explains the findings in relation to the literature (discussed in chapter 2). It also explains the similarities and differences between the results and literature. Finally, Chapter 6 provides some conclusions on the research; it bridges what was discussed in chapters 2 and 5 and provides implications of the findings and recommendations for future research.

CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION

Are we inclined to unnecessarily waste more food if we know it is going into a green bin? Literature has extensively addressed food wasting attitudes, behaviour and ways to reduce food waste, as well as residential waste diversion generally. However, there is limited focus on food waste diversion programs and the support for curbside collection systems for food waste. Thus, this review examines both the food waste and waste diversion literatures. Specifically, there is a focus on the reasons people waste food, food waste reduction/prevention, the reason for general waste (glass, metal, paper) diversion and the support for a food waste diversion program.

2.2 WHY DO PEOPLE WASTE FOOD?

2.2.1 Food Literacy

There are food issues around the world. In developed countries, there is food waste which occurs as a result of excess and/or misuse of food while in developing countries, there is food scarcity or food insecurity from lack of food. Food security problems are often related to socio-economic status (SES) (Gustavsson et al., 2011; Roodhuyzen et al., 2017). Population growth without a change in habit(s) exacerbates issues associated with food scarcity and food excess. The food supply chain (FSC) is the pathway food takes from being sown by a farmer to when it reaches the consumer's table and there is waste along each part of the FSC (van der Werf & Gilliland, 2017). Within the FSC, several firms have been criticized for their influence on the quality, quantity, price of food throughout the food system (Weis, 2007), these firms promote tend to create the need for over-purchase and thus food waste. Further, the food economy is now characterized by an increasing food mile (the distance food travels from land to mouth) in industrialized nations (Weis, 2007). Creating efficiencies in the FSC can be used to help reduce the amount of food that

becomes waste. For example, efficient food transportation means food reaches the consumer sooner, increasing its lifespan and reducing the chances of spoilage where it is thrown out afterwards. It is important to acknowledge there are systemic problems along the FSC which contribute to food overproduction and food over-purchase. However, addressing waste (or the reason for it) at each step of the FSC is beyond the scope of this study. This review focuses on food waste at the household/consumer level i.e. from point of purchase to the final destination of the purchased food. When food is purchased, it may not necessarily be the intention of the buyer to waste the food (van der Werf et al., 2019) but sometime after purchase, edible portions of food may be discarded by the buyer. People throw away food for various reasons e.g. appearance, smell, taste, time past "best before date", diet change, picky eaters, prepared too much food, lack of time to prepare food, purchased too much food, and food spoilage (Hebroks & Boks, 2016; Parizeau et al., 2015; Roodhuyzen et al., 2017; Schanes et al., 2018). These reasons for food wasting tend to be addressed in the 'food literacy' literature which suggests lack of knowledge around household food planning, purchasing, storage, preparation and consumption (van der Werf et al., 2019)**.** They highlight that poor food planning includes purchasing more food than required, buying food without knowing what is needed resulting in excess food. Poor food preparation skills include little to no cooking skills, lack of time to properly prepare meal or preparing too much food. Poor food labelling is a communication problem which ultimately involves poor understanding of food labels such as: 'expiry', 'best before', 'use by' dates. Poor food storage skills includes not knowing what to do with leftovers and, not having (and/or using) the right facilities to store food (Graham-Rowe et al., 2015; Schanes et al., 2018). However, it is not just about lack of knowledge, there are instances where individuals with good food literacy skills displays poor food literacy skills. A common example is being a good provider, if an individual is hosting an event, they might feel

pressured to have more food available than they normally would or would like to – this is discussed later in the review.

Furthermore, there are several issues associated with poor food literacy skills which are only resolvable above the household level. In Canada, the lack of standardized food labels is an issue governmental and non-governmental organization are trying to resolve. The Canadian Food Inspection Agency (CFIA) is developing education programs on improving consumers' understanding on food labels (RFLWC, 2019). CFIA has also begun reviewing current labelling requirements for "best before" and "expiry" dates. The National Waste Zero Council, Provision Coalition and ReFED are also discussing the challenges associated with date labelling and possible solutions to reduce the impact of date labels on food waste (RFLWC, 2019). ReFED, (2019) suggests standardized date labelling (as a solution for reducing food waste) is the second-best option in terms of financial benefit to the society, behind consumer education campaign. Standardized labels and proper food label education improves households understanding and use of food, improvements in understanding contributes better use of food and, food waste reduction (Roodhuyzen et al., 2017; Schanes et al., 2018; Thyberg & Tonjes, 2016). Food packaging is another issue that impacts food literacy skills: poor food packaging affects food storage by failing or making it harder to keep the food fresh e.g. having a (re)sealable package for cheese (Quested et al., 2013). Another issue with food packaging is the size of certain products are often too large and not ideal for people living alone but, smaller, more suitable items are more expensive (Schanes et al., 2018; Roodhuyzen et al., 2017). Understanding food labels was not studied as a predictor of green bin support for this thesis for scoping reasons however, future research can benefit from studying this variable.

2.2.2 Theory of Planned Behaviour

Psychological constructs are used to understand waste behaviour. The Theory of Planned Behaviour (TPB) (Figure 2.1) is commonly used in food waste studies to explain food wasting behaviour (Russell et al., 2017; Visschers et al., 2016). According to the TPB, actual behaviour can be explained or predicted by an individual's intention toward the behaviour, that is, the stronger the intention towards the behaviour, the more likely the individual is to perform the behaviour in question. As intention is an antecedent of actual behaviour, people are expected to follow through with their intention when given the chance. Intention is guided by three factors: a person's opinion/belief about the consequences of the behaviour (*attitude toward the behaviour*), social expectation to perform (or not perform) the behaviour (*subjective norms*), and the individual's ability to control presence of factors that may or may not hinder performance of the behaviour (*perceived behaviour control*). The more favourable the attitude and subjective norm, and the greater the perceived behavioural control, the stronger the person's intention to perform (or not) the behaviour in question. At times, a person's intention is limited, in such cases, perceived behavioural control can serve as a proxy for the actual behaviour (Azjen, 1991). Studies such as Stancu et al. (2016); van der Werf et al. (2019); Visschers et al. (2016) have tried to model or explain food wasting behaviour using the TPB. Although they were able to explain behaviour with these variables, they discovered food wasting behaviour was explained better after adding other external and situational variables. Adding external and situational factors such as convenience and food literacy variables (household planning habits and good provider identity) improved the food wasting behaviour model (Stancu et al., 2016; van der Werf et al., 2019). This predictive difference between only TPB and TPB + other variables is why several researchers (Bernstad, 2014; Graham-

Rowe et al., 2015; van der Werf et al., 2019; Visschers et al., 2016) have supplemented TPB food wasting models with other external variables as the model fails to account for them.

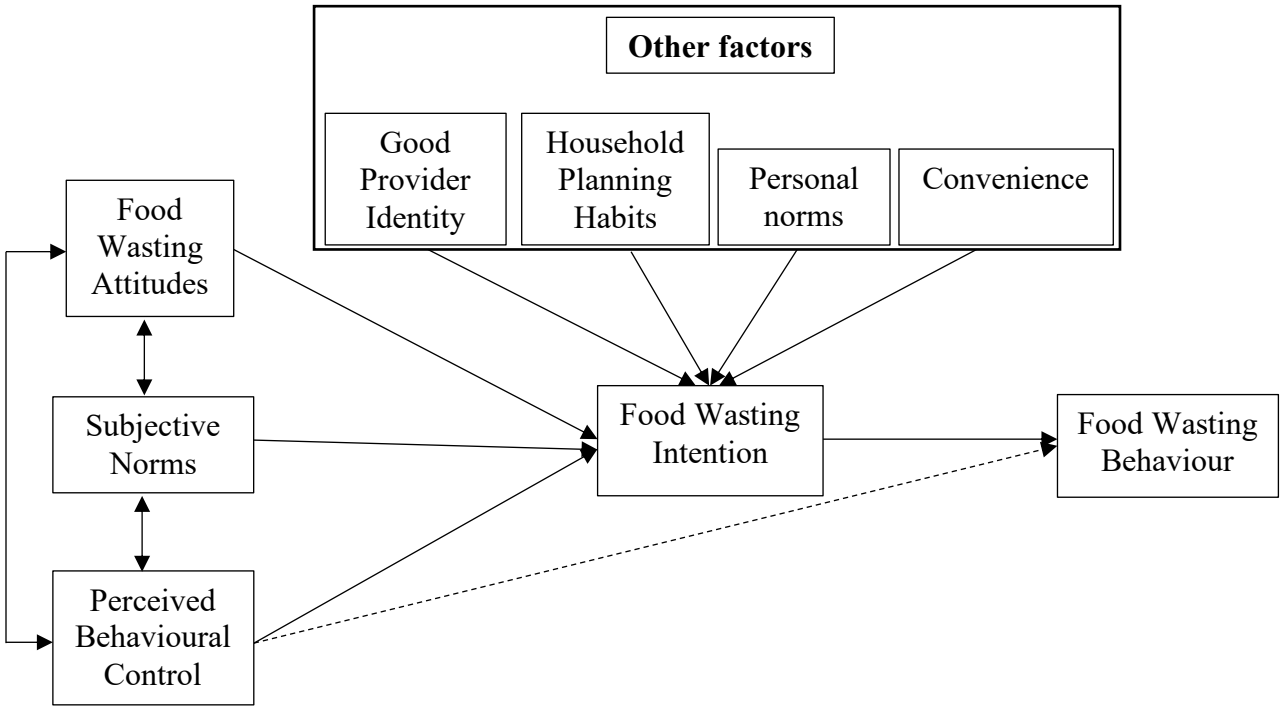

Figure 2.1: Theory of Planned Behaviour with other factors, adapted from Ajzen, (1991); van der Werf et al., (2019)

2.2.3 Other External Variables

Although TPB is an integral framework for food waste studies, several studies have discussed its limitations and have supplemented it with other psychological constructs like personal norms, good provider identity, household planning habits, and convenience (Bernstad, 2014; Graham-Rowe et al., 2015; Stefan et al., 2016). These factors help predict one of the three antecedents of the food wasting intention (subjective norms, perceived behavioural control and food wasting attitudes), food wasting intention or actual behaviour.

2.2.3.1 Personal norms against food wasting

Personal norms are the moral obligation to perform or not perform a certain behaviour, people act on their norms to avoid feeling guilty for doing otherwise. This is similar to an

individual's personal attitude within the TPB, the core difference is personal norms focuses on emotions and is mainly associated with the feeling of guilt when the individual performs a negative or less preferred behaviour (Stancu et al., 2016; Tonglet et al., 2004). Visschers et al. (2016) reported personal norms was a stronger predictor of food wasting behaviour than personal attitudes, although, van der Werf et al. (2019) reported the opposite and suggested personal attitudes was a stronger predictor of food wasting behaviour – the same study noted personal norms can also be used to explain intention. Further, personal norms were a better predictor of recycling intention than personal attitudes (Botetzagias et al., 2015). Usually, the stronger an individual's personal norms against food waste is, the less food waste they produce, however, intention can mediate this relationship (Gieger et al., 2019; Schanes et al., 2018; Visschers et al., 2016). Since the presence of waste diversion options tends to reduce or crowd-out the feeling of guilt (Cecere et al., 2014), people with stronger personal norms against food waste will likely be supportive of a green bin program.

2.2.3.2 Good Provider Identity

The good provider identity represents an individual's desire to provide an abundance of food such that some needs to be discarded. Good provider identity has links to food literacy skills and has been shown to increase the amount of food waste in a household (Visschers et al., 2016). On a household level, people overprovide as a result of several reasons such as: i) social gatherings, ii) differences in taste, iii) change(s) in diet, and iv) to appear as a caring family member by providing quality, healthy and nutritious food etc. When people host social gatherings, there is an inclination to overprovide to appear as a 'good' host because the alternative, not having enough food is viewed as being cheap which can be embarrassing to the host. People with high good provider identity would rather overprovide and end up wasting or storing the leftover than running

out of food (Schanes et al., 2018). Households with more than one inhabitant (especially those with children), have varying tastes and preferences to cater for causing more diverse food purchases. More money spent on grocery per individual leads to more food waste per individual (Parizeau et al., 2015; Schanes et al., 2018). Changes to people's lifestyle can affect their diet for example, people looking to lose weight or eat healthier will swap out their unhealthy food options for healthier options contributing to more food wasting. Furthermore, parents in households that eat meals considered unhealthy might feel guilty, to reduce the guilt, they purchase healthy food to appear as caring or healthy (Graham-Rowe et al., 2015; Roodhuyzen et al., 2017). However, buying healthy food does not guarantee the food will be eaten. Studies like Parizeau et al. (2015) and van der Werf et al. (2019) have shown fruits and vegetable (healthy foods) are the most wasted food group. Households with children wasted more food than those without children (Visschers et al., 2016; Roodhuyzen et al., 2017). In relation to the TPB, good provider identity could mediate the relationship between food wasting intention and behaviour. No study has looked at the relationship between good provider identity and green bin attitudes and behaviour. However, we can speculate that those who identify as good provider will produce more food waste and therefore have more use for a green bin program and consequently more support.

2.2.3.3 Household Planning Habits

Household's with good planning habits tend to have less instances of over-purchase and waste less food (Parizeau et al., 2015; Roodhuyzen et al., 2017). Some of these habits (e.g. creating shopping list) are associated with food literacy skills but others relate to communication with other household members to avoid purchasing the same thing twice (Schanes et al., 2018). Proper grocery shopping planning such as: creating a shopping list, checking current stock at home and planning meal in advance has been shown to be effective in reducing over-purchase (Parizeau et

al., 2015; Principato et al., 2015; Roodhuyzen et al., 2017). Another factor affecting household planning is lack of time, individuals who are busy with work (or have little spare time) usually: i) buy in bulk to reduce the amount of time spent grocery shopping, ii) buy items that already at home because they did not check prior and, iii) get take-out from restaurants or fast food places even though there is food at home (Graham-Rowe et al., 2015; Roodhuyzen et al., 2017; Schanes et al., 2018). Parizeau et al. (2015) recorded the positive relationship between good household planning habits and less food waste produced while van der Werf et al. (2019) and Visschers et al. (2016) found little to no relationship respectively. However, both studies reported a relationship between household planning habits and intention not to waste food – showing how intention, in part, mediates the household planning habits and food wasting behaviour relationship. Since people who have poor household planning habits tend to produce more food waste, it may be that they also might make greater use of the green bin program.

2.2.3.4 Convenience

Convenience issues relating to food wasting can be broken to two conceptual factors: time and space. Those who grocery shop frequently and buy lesser quantities tend to waste less food than those who buy in bulk and less frequently (Schanes et al., 2018). Limited cooking time also creates more opportunity for food to waste. Limited food storage space can prevent households from storing food (cooked or uncooked) or storing food the proper way (Schanes et al., 2018). For example, having a smaller fridge/freezer means being mindful of food being purchased or cooked so it fits. Limited space around the house makes it hard to store other food items such as canned or dried foods. As noted earlier, intention and behaviour can be manipulated based on external factors, therefore, inconvenience can negatively influence intention or behaviour. Convenience also plays a role in green bin usage; common issues are having the time and space to properly sort

waste. Other issues are the size of disposal bin, the odour from the food waste and the animals attracted to the waste (Metcalfe et al., 2013).

2.2.3.5 Sociodemographic Factors

Socio-demographic factors affect food waste, but the findings in the literature vary (Cecere et al., 2014; Graham-Rowe et al., 2015; Hebrok & Boks, 2016; Parizeau et al., 2015; Roodhuyzen et al., 2017; Schanes et al., 2018). Despite the inconsistencies, some variables (or the combination of them) are used to help explain/predict food waste. For instance, gender and age are used to explain food wasting levels, male and young(er) people waste more food, while females and old(er) people waste less food. Further, education, income and housing size have shown varying results (Cecere et al., 2014; Graham-Rowe et al., 2015; Hebrok & Boks, 2016; Parizeau et al., 2015; Roodhuyzen et al., 2017; Schanes et al., 2018).

2.3 INTERVENTIONS FOR REDUCING WASTE

Researchers have built on concepts such as food literacy and TBP to develop interventions meant to help change/motivate households to reduce food waste. Interventions that aim to alter people's routines/habits are the most effective type of interventions (Geislar, 2017; Hebrok & Boks, 2016; Stockli et al., 2018). Proper food literacy and education improves household meal planning, grocery list planning, food label understanding, food storage, food preparation and cooking skills (either from scratch or leftovers). Having these skills helps reduce the chances of food waste and improves household health because the household has healthier options to choose from (London Food Bank, 2016). Stockli et al. (2018) reported information-based interventions which provided food waste information and meal planning and storage items, helped reduced food waste. Some of the different types of informational food waste reduction interventions that attempt

to improve food literacy are: fridge magnets reminding people to reduce waste and use their leftovers, meal planners to help plan meals and keep track of grocery items to buy and educating people on the benefits of preventing food waste. Additionally, financial incentives (most effective) and social influences can be used to improve the effectiveness of an intervention (Cecere et al., 2014; Geislar, 2017; Stockli et al., 2018).

Graham-Rowe et al. (2015) suggests there might be benefits of interventions targeting one or more of the determinants of food wasting intention by using persuasive messages to target participants' thoughts. Predicting food waste behaviour is complicated because multiple factors interact to influence behaviour. Therefore, having interventions target key psychological mechanisms that reinforce motivations to reduce food waste is important (Graham-Rowe et al., 2015).

2.4 FOOD WASTE DIVERSION PROGRAMS

This section investigates how waste disposal options influences food wasting and food diversion behaviour. The TPB is also used in waste diversion studies to predict/explain diversion behaviours such as recycling (Botetzagias et al., 2015; Ghani et al., 2013; Miafodzyeva & Brandt, 2013). Waste diversion studies have also supplemented the TPB model variables (attitudes, subjective norms and perceived behavioural control) with other variables such as cost, knowledge, concern for environmental impacts and convenience (Baxter et al., 2020; Botetzagias et al., 2015; Gieger et al., 2019; Miafodzyeva & Brandt, 2013). These variables are discussed later in the review. Although these are waste diversion studies, little research has been done on food waste diversion behaviour, most diversion studies to date are centered on recycling or waste-to-energy.

Food waste diversion programs are important for improving waste diversion as food waste previously destined for landfill is now transformed into new resources. Common examples of these

programs are community composting (least common), home composting and green bins (most common). Although food waste diversion methods are beneficial, they are still end-of-pipe techniques which are less effective management techniques than waste prevention/reduction (i.e. reduce – reuse – recycle, the 3R waste hierarchy) as seen in Figure 2.2. Furthermore, in terms of GHG impact, there is a considerable difference between food waste reduction and food waste recycling (composting) or even landfilling as seen in Figure 2.3.

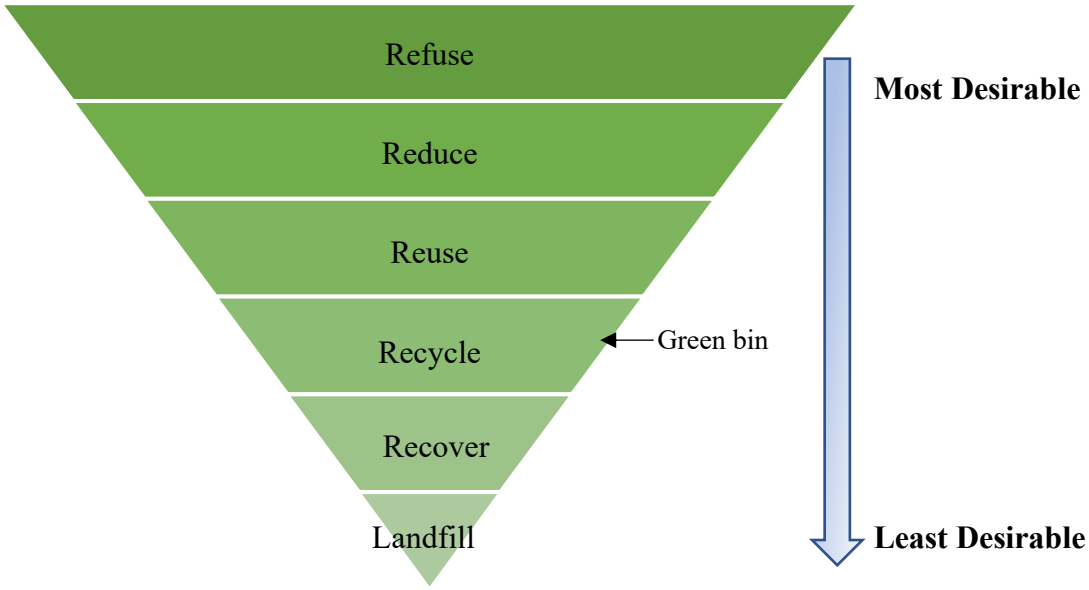

Figure 2.2: Waste Hierarchy (adapted from EU's Waste Framework Directive. Source: https://ec.europa.eu/environment/waste/framework/)

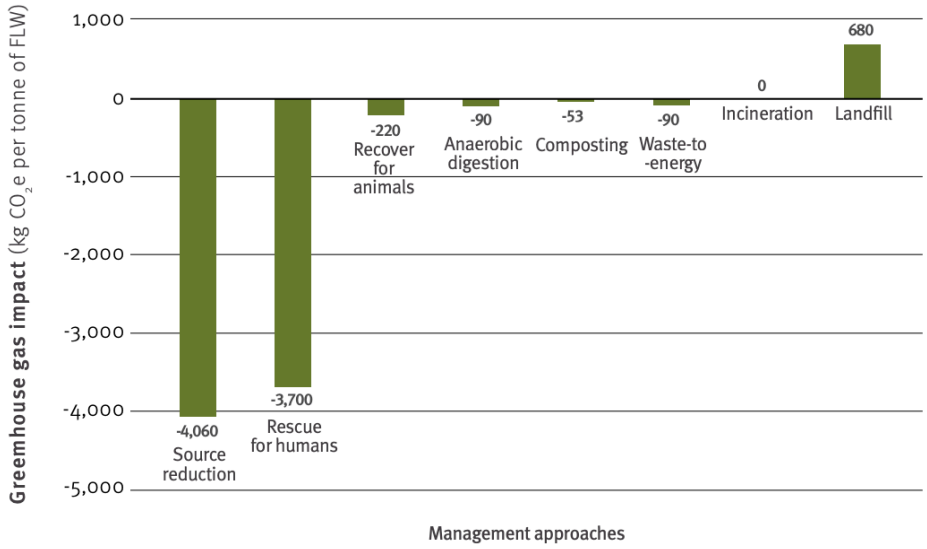

Figure 2.3: Greenhouse Gas Impacts of Management Approaches to Food Loss and Waste. Retrieved from http://www3.cec.org/islandora/en/item/11772-characterization-and-management-food-loss-and-waste-in-north-america-en.pdf

In terms of governance, the current law in Ontario, Canada governing organic waste management is *O.Reg. 101/94: Recycling and Composting of Municipal* (latest amendment was in 2011) under the *Environmental Protection Act* of 1990. This legislation does not require municipalities to have a green bin program, as a matter of fact, only 103 out of 444 (23%) Ontario municipalities have a green bin program and majority are located within southern Ontario (DeLorenzo et al., 2018). In 2017, the Resource Productivity & Recovery Authority (RPRA) reported ~555,000 tonnes of Ontario's household food waste were diverted (excluding home composting), this was an 8% increase from the previous year (RPRA, 2018).

Although green bin programs increase (food) waste diversion, the influence of the disposal method on the amount food wasted is understudied. Green bins are not the only city-wide waste diversion program, there is also the blue box program for recycling materials such as paper, plastics and glass. It is known that food waste diversion and recycling have similar/interchangeable attitudes and behaviour as they are both forms of waste diversion. Therefore, some recycling

studies in this review may be analogous for what might predict green bin support and behaviour. Placing too much focusing on a certain practice (e.g. recycling or composting) can reduce/crowd-out the motivation for preventing waste in the first place (Cecere et al., 2014; Qi & Roe, 2019). Loss of motivation can lead to increased waste because the individual's mindset is transformed to see the practice as the transformation of the old material into a new one, not the waste being produced. That is why it is important for municipalities to recognize the characteristics of their residents (Benyam et al., 2018). Further, Benyam et al. (2018) found that when households were provided with four options (home composting, community composting, residential food waste collection and an educational program to improve food waste prevention), the most preferred options were home composting and educational programs, in that order. These two preferred options are what are currently being offered in London, Ontario.

Catlin & Wang (2013); Metcalfe et al., (2013); Qi & Roe (2019) suggest that using an alternative disposal method (other than landfill) reduces the "guilt" associated with disposal of the product. For example, an interviewee in Metcalfe et al. (2013) explains how using the green bin made her feel environmentally conscious/friendly and absolved her of other environmental guilt. So as long as her food waste went into the green bin, she was doing all that needed to be done, instead of focusing on trying to reduce her food waste. The same is seen in the theory of risk compensation where people who are more protected feel the need to be less careful. In a waste-to-energy study conducted by Baxter et al. (2016), majority of the respondents disagreed to the question "I will divert less if the final destination for my waste is a waste-to-energy program", how this diversion affected the amount of waste produced by the respondents is unknown but, Catlin & Wang (2013) had similar findings in their study on paper recycling. The finding showed participants with an alternative disposal method (in this case, a recycling bin) threw out more paper

than their counterparts without a recycling bin. Qi & Roe (2019) also noticed a similar trend when studying food waste in a student dining room, respondents who knew their leftovers were going to be composted wasted more food than their counterparts who thought their waste was going to the landfill. Thus, the few studies (Catlin & Wang, 2013; Qi & Roe, 2019) that have been completed show a common trend/behaviour, people are more wasteful when there is a waste diversion program in place. This is a potential outcome in a green bin program especially with appearance being the most common reason food is thrown away (Parizeau et al., 2015). Other common criteria for people throwing food waste from Parizeau et al. (2015) were smell, best before date and time spent in the fridge.

Food waste diversion programs, particularly green bin programs represent a "get out of jail free card" of sorts: consumers develop an attitude that wasting food is acceptable or not that bad if it is composted. Therefore, the presence of (and access to) green bins makes food wasting easier because people will tend to overuse it. In a green bin waste audit conducted in Toronto, the majority of the content was edible food i.e. food that could have been eaten (2cg, 2016). This supports the notion of wrongful use of food waste diversion programs. By properly understanding the predictors of green bin behaviour, it is possible to improve how households use the green bin. The predictors of green bin behaviour can be identical to recycling behaviour and food waste behaviour. In addition to the TPB and the other variables discussed above, the support for food waste diversion programs is another variable that can explain food wasting behaviour. The following sections presents a review of the literature on the predictors of waste diversion, which together with the predictors of food wasting are merged into a list of predictors of support for green bin programs in this study.

2.5 SUPPORT FOR FOOD WASTE DIVERSION PROGRAMS

As food waste levels increase globally and most places shift toward a centralized, city-wide food waste diversion program, it is important to know how and why people's support for the program changes.

2.5.1 Policy

It is not surprising cities with a policy (or policies) on food waste and food waste diversion programs can increase their waste diversion rate (diversion rate = weight of diverted material / weight of total waste * 100). This is because households are encouraged or possibly mandated to divert from food waste (the heavier part of total waste) the garbage stream. Food waste diversion policies originate from either city residents (environmentally aware people willing to take action towards a positive environmental change) who turned genuine concern about an issue into actionable legalisation or from pressure by those in higher position of authority e.g. provincial pressure on municipalities to increase diversion rate. Policy is an important tool, a national stakeholder (members of public and private sector and member of organic waste management associations) survey showed the major barrier to preventing and diverting food waste was lack of government regulation, policies, enforcement and programs (GHD and 2cg, 2016). This shows for people or everyone to support and participate in a program, it is helpful to have policies/legislation which send a clear signal to encourage and where or when necessary, enforce that particular behaviour. This can be seen as cities switch to Pay as You Throw (PAYT) or reduced garbage bag limit and pick-up frequency to discourage residents from disposing food waste in garbage bags and promote the waste diversion initiatives. PAYT, as the name suggests means households pay based on the weight of their solid/landfill waste. Sterner & Bartelings (1999) reported a reduction in waste disposal after cities switched to a PAYT or weight-based billing system, Andersson & Stage (2018) also found a reduction but it was not statistically significant. Furthermore, having a

separate food waste collection system would increase diversion thereby reducing the amount of waste to be incinerated (Andersson & Stage, 2018; Pollans et al., 2017). Although PAYT is a good legislation, it inadvertently encourages illegal dumping as some people decide to dispose their household waste in places other than their houses (Andersson & Stage, 2018; Pollans et al., 2017). Reducing the amount of garbage bags that can be disposed is another way to increase waste diversion. Households are forced to be thorough with the items going into the bags so, recyclable and compostable materials that are not meant to be landfilled are placed in the appropriate receptacles. Additionally, reducing the frequency of garbage collection alongside a baggage limit deters households from accumulating too much waste as it becomes more difficult to dispose of them without paying an additional cost. In a London-based survey (n = 301), 31% of the respondents wanted the City to expand and enforce material bans and 23% want the garbage limit reduced further (60% Waste Diversion Action Plan, 2018). This suggests that residents of cities with a food waste diversion policy or policies will be more supportive of a green bin program.

2.5.2 Convenience

In Ontario, diverted food waste either ends up in an anaerobic digester (where it is converted to biogas energy and digestate) or a composting facility (where it is turned into compost). The kind of waste product accepted in a green bin program and the final destination both play a role in the support of a program. The design of the green bin (which includes a separate small kitchen bin and a larger green bin that is placed at the curb on a household's food waste collection day) also plays a role in program support and participation. Metcalfe et al. (2013) reports some respondents were worried about the: i) colour and size of the kitchen bin affecting the overall aesthetics of their kitchen; ii) ability of the kitchen and larger bin to contain liquid from the food waste; and iii) odour. Having sufficient space to house the kitchen and green bin can also impact

convenience. Further some people are concerned that their green bin will attract vermin although nowadays there are green bins that include control locks to prevent vermin access. Some people prefer to store their food waste in the house (either in a small food bin in the kitchen/under the sink or they freeze it) until collection day as it keeps insects and wild animal from their household, however, some people lack the space to engage in such practices. Nowadays, green bins are manufactured with pest control locks to prevent pests from going through it, this extra layer of safety reduces, and should possibly remove the concerns relating to wild animals. Aesthetic qualities such as size and colour of a green bin also affects its use as Metcalfe et al. (2013) reports. So, environmental officers in charge of making these decisions should ensure they have the proper characteristics selected for their cities. However, inconveniences such as lack of space can reduce support for a green bin program.

2.5.3 Need

Need is related to policy, the greater the need, the greater the chance of a policy change. For example, with increasing population and urban sprawl, people are living further out and, in some cases, closer to landfills. As landfills become full, expansion becomes harder because surrounding areas are being converted to commercial or residential areas and opposition to landfill is very high. So, there becomes an increasing need for other programs and facilities (such as recycling and green bin programs) to reduce the amount of solid waste sent to the landfill. In her study between London and Guelph, Warring, (2018) suggests space (or lack of space) as one of the reasons for Guelph's shift to a green bin program and London's delay. Now, several years down the line as the space London once had has reduced, more waste diversion options are being discussed, contributing to the support of a green bin program.

2.5.4 Cost

This is two-fold, cost for residents and for municipality. Residents that are willing to pay extra for a green bin program are more likely to support it. The opposite is also true, those who support the program are more likely to pay extra for it. This does not mean those who are unwilling to pay extra for it do not support it; there could be several reasons, one of them being how much more they need to pay. On the municipal side, the cost for a new food waste diversion program might cause them to carefully reconsider this decision, especially when there is no (strict) regulation from above to enforce food waste diversion. In London's case, rather than spending millions on a green bin program, the city decided to use and promote home/backyard composting. Composters could be bought at City-approved locations for a subsidized cost of $35, by doing this, the onus of food waste diversion shifts from the City to the individual because the appropriate food waste diversion tool has been provided. If cost is the greatest challenge for cities, residents might be willing to pay to cover some of the cost. For example, 76% of the respondents (n = 301, all Londoners) indicated they are willing to pay more increased waste diversion (60% Waste Diversion Action Plan, 2018). So instead of a household paying $35 for a new home composter, the money can be spent on a green bin program.

2.5.5 Home Composting

Home/backyard composting is a small-scale food waste (and leaf and yard waste) diversion practice performed at home, mostly in the backyard. Composting transforms food waste into compost which provides nutrients and organic matter for the soil. Benyam et al. (2018) found that when given the choice, people preferred to use home composters over other food waste diversion programs. Home composting is a good activity because the individual comes face to face with his/her waste, this can either prompt strong emotions of guilt (for wasting too much) or a warm

glow of pride/happiness (for little waste). Sterner & Bartelings (1999) found composting had a strong and significantly negative effect on food waste production. However, composting can also discourage people (especially beginners) because it is yet another thing to learn and monitor, especially for those with time constraints. Wonneck & Hobson (2017) discovered home composting rates dropped after the implementation of a green bin program, the common reason was the convenience of the green bin program.

2.5.6 Norms favouring green bin use (Green Bin Norms)

These norms are the attitudes, personal norms and subjective norms favoring green bins. As discussed in the TPB, these are the main antecedents to intention and also actual behaviour. Thus, individuals with environmentally conscious attitudes (i.e. those who show concern for the environment by trying to limit their negative impact on the environment while promoting positive environmental changes e.g. buying local food to reduce carbon emissions) and positive norms towards the green bin are more likely to support and use one.

2.5.7 Knowledge

Knowledge in waste diversion literature includes awareness of the current program in place, the advantages and disadvantages, the materials accepted by the program and consequences of food waste. Refsgaard & Magnuessen (2008) study of two Norwegian cities (one with a green bin vs one without) discovered that respondents in a city with a green bin had more knowledge about the program than those in a city without one. This is expected as experience with a program increases your understanding of the program (Gieger et al., 2019). However, increased familiarity can result in over-reliance as people become more dependent on the green bin program to transform their waste and stop focusing on reducing their food waste, which is the main problem. This has led to cities providing their residents with added information such as the environmental

impacts of food waste and the benefits of reducing it. Benyam et al. (2018) found education to be the second most preferred policy option (behind home composting) for food waste diversion. Thus, cities should be doing their best to educate their residents on the programs in place and how to properly divert food waste. By being aware of the diversion program(s) in place and environmental impacts of food waste, individuals are better suited to make informed decisions.

2.6 SUMMARY

As food waste increases, more cities might implement green bin programs or other food waste diversion programs to (particularly) reduce the environmental consequences of food waste. Although there have been separate studies on food waste reduction and food waste diversion, no study has bridge both fields together. This thesis is the first step in this direction as I try to understand the reason(s) for green bin support by drawing from both food wasting and waste diversion literature. There is an overlap between both fields. A summary of the predictors and the respective literatures where they are found in are shown in Table 2.1. Understanding green bin support will show how people in different green bin regime view the green bin program and is potentially the first step to understanding green bin participation. The next chapter introduces my research hypotheses, study sites and research design as a whole.

Table 2.1: Common predictors of food wasting and waste diversion behaviour

Variable name	Food wasting	Waste diversion
TPB	Yes	Yes
Personal norms	Yes	Yes
Good provider identity	Yes	No
Household planning habits	Yes	No
Convenience	Yes	Yes
Home composting	Yes	Yes
Knowledge	Yes	Yes

CHAPTER 3: RESEARCH DESIGN & METHODOLOGY

3.1 INTRODUCTION

This chapter provides an overview of the design and methods for this thesis research project. First, the research questions and hypotheses are introduced followed by the description of the overall research design including study sites, survey design, sampling and data analysis.

3.2 RESEARCH QUESTIONS & HYPOTHESES

The primary research goal is to understand the predictors of green bin support and to achieve this, the following research questions were asked:

1) How does current household food wasting behaviour predict support (or lack of) for a green bin program?
2) How do the known predictors (e.g. good provider identity, environmental impacts and convenience) of food wasting and waste diversion predict green bin support?
3) How does the support for a green bin program differ based on the green bin regime, that is, whether households have a municipal green bin program?

Based on the literature review, the following hypotheses were proposed:

1) People with higher current self-reported food waste per capita will have more support for a green bin program. Those who waste more will be more supportive as the green bin helps reduce the guilt associated with wasting food.
2)
    a. People with higher personal norms against food waste, higher good provider identity and poorer household planning habits, will have more support for green bin programs. These variables are used in food waste literature but have not been tested in waste diversion.

b. People with greater convenience (have no issue with food waste storage), people with greater norms favouring green bin use, people with greater concern for environmental impact and people with more knowledge will have more support for green bin program. People who prefer using the home composter will be less supportive of a green bin program. These variables are used in waste diversion literature, so it is being tested with the support of green bin programs.

3) Respondents living in a municipality with a green bin program will have significantly more support for a green bin program. Those who have used green bins are more familiar with it, which can translate to more support for the program.

3.3 STUDY SITE AND RATIONALE

To understand people's support for a green bin program, identical paper surveys (Appendix A) were distributed to a random selection of addresses in London and Kitchener-Waterloo, Ontario, Canada. These cities have a lot in common, as they are both mid-sized cities, in close proximity to one another and are comparable in population size, area, and other demographic variables. However, these cities operate different food waste collection systems, currently, London does not have a green bin program while Kitchener-Waterloo has one. The majority of household food waste in London is disposed of as solid waste which ends up in landfills; however, some household food waste also ends up in home/backyard composters, which can be purchased at a city-subsidized cost by interested households.

It is important to have similarity between the sample and larger population for generalizability, so we enlisted the help of a third-party service (Key Contact) to assist with the random survey distribution. We asked them to use a random cluster sample, focused on mail routes rather than individual households. They randomly select(ed) the appropriate mail routes to capture

and maximize sociodemographic representativeness of the data. We sent out 4,000 survey questionnaires, 2,000 per city. In each survey, there was a URL provided in case respondents preferred to complete it online (via Qualtrics). The paper mail containing the survey had a stamped, return-addressed envelope which participants used to return the mail. This method was selected for several reasons:

1. It is a relatively low-cost way for reaching targeting study sites;
2. It is reliable and can be filled-out at any time;
3. It is good at producing easily organized data for statistical analyses;
4. It is a common method used in similar research, which allows for easier comparison to similar studies (Romani et al., 2018; Viscchers et al., 2016)

This study was approved by the Non-Medical Research Ethics Board of Western University (#108899) (See approval certificate in Appendix D). The minimum age for participation was 18.

3.4 SURVEY QUESTIONNAIRE

To produce comparable results, identical questions were asked of participants from both cities, despite Kitchener-Waterloo having a green bin program and London not having one. That is, they were asked about green bin programs in general, not specifically the program used in their own community. General terms and explanations were used for consistency of understanding and clarity – to maximize both validity and reliability.

The survey was designed to evaluate household food waste behaviour and support for the green bin program. The survey had three sections, the first section was used to understand household's current food wasting behaviour and some of the underlying determinants of this behaviour (i.e., personal norms, good provider identity and, household planning habits). The second section sought to understand factors surrounding a green bin program (support,

convenience, environmental impact, knowledge etc.).The third section was used to ascertain current waste management practice and characterized the household. The questionnaire was adapted from previous studies (Baxter et al., 2016; van der Werf et al., 2019; Visschers et al., 2016).

Most survey questions were asked using a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree) with a neutral category at 4. Similar/related questions were summed to create an index. Indexes were created for variables such as: personal norms, good provider identity, convenience, household planning habits, environmental impact and self-reported food wasting behaviour. Table 3.1 shows the breakdown of the hypotheses and variables used to test them.

Table 3.1: Research hypotheses with corresponding index name

Hypotheses		Index Name
Respondents with higher current self-reported food waste per capita will have more support for a green bin program	H1	Frequency and portions
Respondents with greater personal norms against food waste will have more support for a green bin program	H2a	Personal norms
Respondents with greater good provider identity will have more support for a green bin program	H2a	Good provider identity
Respondents with poorer household planning habits will have more support for a green bin program	H2a	Household planning habits
Respondents with who have no issue with food waste storage will have more support for a green bin program	H2b	Convenience
Respondents with greater norms favouring the use of a green bin will have more support for a green bin program	H2b	Green bin norms
Respondents with greater concerns about the environment impacts will have more support for a green bin program	H2a	Environmental impacts
Respondents that prefer using home composters will have less support for a green bin program	H2b	Home composting
Respondents who prefer more food waste education will have more support for a green bin program	H2b	Knowledge
Respondents living in a green bin regime will have more support for a green bin program	H3	-

3.5 DEPENDENT VARIABLE

The dependent variable for this research, **green bin support**, is a derived variable calculated as a 3-question index including the following questions:

1) I am in favour of having a green bin program in my city
2)
    a. I am looking forward to the implementation of London's upcoming green bin program; or
    b. I am happy about the implementation of the green bin program (Kitchener-Waterloo's version)
3) An extra average of $25 per year per household in taxes is not too much to fund a green bin program

These questions are summed to identify the respondents' level of support for the green bin program from an attitude (being in favour) to behaviour (cost). These questions were asked using a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree) with a neutral category at 4. Thus, the scale ranged from a minimum score of 3 (least supportive) to a maximum score of 21 (most supportive).

3.6 PREDICTOR VARIABLES

This is a summary of all the variables used in this study to predict green bin support, Table 3.2 shows the breakdown of these variables.

3.6.1 Frequency and portions

This is a composite measure of how often food was wasted in week in a household by category. An individual's total frequency was calculated by summing the frequencies of the individual food type thrown out. In the survey, six different food groups (e.g., fruits & vegetables,

dairy, meat & fish, bread & baked goods, dried foods and other foods) were listed and respondents were asked to identify how many times per week they threw out food belonging to that food type. The questions had options ranging from 0 (times) to 7 (times) so with 6 categories the minimum score 0 (0 times x 6) and the maximum score is 42 (7 times x 6). The same was done for portions which measured how much food was wasted.

3.6.2 Personal norms against food waste

Two questions were used to assess respondents' personal norms towards food waste: "I feel bad when I throw food away" (1 = strongly disagree, 7 = strongly agree) and "I feel it is immoral to waste any food" (1 = strongly disagree, 7 = strongly agree).

3.6.3 Good provider identity

Five questions were used to assess respondents' good provider identity e.g. "When I am expecting guests, I like to buy more food than is necessary because I am a generous host" (1 = strongly disagree, 7 = strongly agree).

3.6.4 Household planning habits

Five questions were used to assess respondents' household planning habits e.g. "Before I prepare food, I always consider precisely how much I need to prepare and what I will do with the leftovers" (1 = strongly disagree, 7 = strongly agree).

3.6.5 Convenience

Five questions were used to assess respondents' convenience e.g. "I would be concerned about storing separated food waste in my household because I am concerned that the pests and insects might be annoying" (1 = strongly disagree, 7 = strongly agree).

3.6.6 Norms favouring green bin use

Five questions were used to assess respondents' norms favouring green bin use e.g. "I feel that using the green bin is the right thing to do" (1 = strongly disagree, 7 = strongly agree).

3.6.7 Environmental impact

Five questions were used to assess respondents' concern for the environmental impact of food waste e.g. "food waste should be banned from Ontario landfills" (1 = strongly disagree, 7 = strongly agree).

3.6.8 Home composting

The two questions used to assess respondents' home composting, were treated as individual variables.

3.6.9 Knowledge

The two questions used to assess respondents' preference for food waste education, were treated as individual variables.

Table 3.2: Descriptive statistics and internal reliability (Cronbach's α) for survey items per constructs

	M	SD	CA Score	M	SD
Green bin support (index) – Dependent Variable	5.95	1.56	0.83		
I am in favour of having a green bin program in my city				6.24	1.66
I am looking forward to the implementation of London's upcoming green bin program/I am happy with the implementation of the green bin program				6.09	1.75
An extra average of $25 per year per household is not too much to fund a green bin program				5.51	2.03
Personal norms against food waste (index)	5.57	1.43	0.72		
I feel bad when I throw food away.				6.08	1.33
I feel it is immoral to waste any food.				5.06	1.89
Good provider identity (index)	3.61	1.12	0.63		
It would be embarrassing to me if my guests ate all the food I had prepared for them. They would probably have liked to eat more				3.56	1.98
I regularly buy many fresh products although I know that not all of them will be eaten.				2.68	1.71
I like to provide a large variety of foods at shared mealtimes so that everyone can have something he or she likes.				3.67	1.84
I always have fresh products available to be prepared for unexpected guests or events (e.g. illness).				3.19	1.69

When I am expecting guests, I like to buy more food than is necessary because I am a generous host.				4.95	1.62
Household planning habits (index)	3.89	1.14	0.64		
When I have made a shopping list, I always keep strictly to it				3.94	1.67
Before I prepare food, I always consider precisely how much I need to prepare and what I will do with the leftovers.				4.80	1.69
I always plan the meals in my household ahead and I keep to this plan				3.54	1.79
I would buy less if I lived within a more convenient distance to a grocery store				2.61	1.66
My household communicates closely about food purchases prior to purchasing food (e.g. to avoid duplicate purchases when stopping at the store on the way home)				4.56	2.09
Convenience (index)	5.25	1.54	0.84		
I have enough time to sort my food waste and put it into a green bin				6.22	1.40
I have enough space in my kitchen to separately store food waste, prior to taking it to a green bin				5.36	2.07
I would be concerned about storing separated food waste in my kitchen because I am concerned that the odour might be annoying*				4.42	2.27
I would be concerned about storing separated food waste in my kitchen because I am concerned that the pests and insects might be annoying*				4.29	2.27
I have enough space in my garage or beside my house to store a green bin				5.94	1.79
Personal norms favouring green bin use (index)	5.22	1.13	0.61		
I feel green bins have no direct benefit to people				6.22	1.46
I feel that using the green bin is the right thing to do				6.11	1.69
Through their actions or words, people close to me suggest I should use the green bin				4.19	2.05
People should not feel guilty when they throw out food waste that is or was edible (as opposed to inedible food such as vegetable peelings, eggshells, coffee ground etc.) into a green bin*				4.32	1.94
People should not feel guilty when they throw out food waste that is or was edible (as opposed to inedible food such as vegetable peelings, eggshells, coffee ground etc.) into the garbage*				5.26	1.96
Environmental impact (index)	5.58	1.21	0.85		
Food waste should be banned from Ontario landfills				4.58	1.92
Food waste is a serious environmental issue we must solve				5.32	1.77
Green bins are good for the environment				6.18	1.29
Green bins divert food waste from the landfill				6.23	1.21
Green bins reduce greenhouse gas emissions (e.g. methane and carbon dioxide) from the landfill				5.61	1.46
Home/Backyard composting (non-index)	4.14	1.59	0.43		
People should home compost their food waste (e.g., fruit and vegetable trimmings) if there is an option to.				4.99	1.80
If I had access to both a home composter and a green bin, I would put all my food waste in the green bin*				3.29	2.18
Knowledge (non-index)	5.71	1.14	0.48		
My city can do a better job of educating people about reducing food waste				5.36	1.57

Being educated on food waste reduction before implementing a green bin program is useful	6.07	1.23

*Item was reversed coded. A 7-point Likert scale was used, higher scores corresponded to greater agreement with the statement

3.6.10 Sociodemographic information

Participants were asked to indicate their age, gender, number of people living in household, employment status, housing status, level of education, household income, dwelling type, income and ethnicity.

3.6.11 Descriptive Statistics

There were 407 survey responses (response rate = 10.2%), 227 responses from London (response rate = 11.4%) and 180 responses from Kitchener-Waterloo (response rate = 9%). A substantial majority of the respondents (n=356, 87%) completed the survey via paper mail-back while the remainder completed it online (n=51, 13%). The sex distribution of the mail-back group was 69% female and 31% male, while for the online group it was 63% female and 37% male. For the age distribution of the paper mail-back group, the largest portion (n=122, 34%) of the respondents were 65 or older while for the online group, the largest portion (n=16, 31%) of the respondents were between 45-54 years old. While the link that needed to by typed into a web browser was brief [https://tiny.cc/HFWLDN] or [https://tiny.cc/HFWKW], it may have been sufficiently onerous to ward off some people from the online version. The focus on mail back may have been a strange coincidence of COVID-19, and the desire to get out and stretch one's legs by going to a mailbox. The survey start and end dates were May 22nd, 2020 and June 20th, 2020 respectively – which was during COVID-19, a global pandemic. Generally, sample respondents were older, female, and with an above median income. Table 3.3 shows the comparison of demographic data between the survey sample, city and provincial census data, a more detailed breakdown can be in Appendix B.

Table 3.3: Comparison between sample data (s) and population data (p). StatsCan (2017)

	London		Kitchener-Waterloo		Ontario	
	S	P	S	P	S	P
Male	30.6%	48.4%	29.8%	49.4	30.2%	48.8%
Female	69.4%	51.6%	70.2%	50.6	69.8%	51.2%
Median age	55-64	40.5	55-64	39.2	55-64	41
Median income	$80,001-$100,000	$62,011	$80,001-$100,000	$77,229	$80,001-$100,000	$74,287
Household size	2	2.3	2	2.6	2	2.6
N (response rate)	227 (11.4%)	-	180 (9%)	-	407 (10.2%)	-

3.7 DATA ANALYSIS

The survey responses were entered and analyzed using IBM SPSS Statistics Version 26. Survey questionnaire data retrieved from surveys were used to answer the research questions using a two-stage process.

3.7.1 Stage 1

In stage 1, a bivariate analysis was used to assess the correlation between the indexes and the outcome variable, green bin support. To check the reliability of the outcome and predictor variable indices, Cronbach alpha (CA) tests were run on each index to see if there was a strong indication that an item should be dropped. CA is the internal reliability score of the index; it shows how closely related the questions are to each other – higher being better. CA scores range from 0 to 1, scores closer to 1 indicate the questions are more related; CA scores above 0.6 were accepted for this research. Table 3.4 shows the CA scores of the indexes. Initially, norms favouring green bin use had an unacceptable CA score, after removing one of the questions, the new score was accepted. Home composting and knowledge were two-question indexes, so the individual questions were used instead. The descriptive statistics for the indexes and questions are shown in Appendix C

Table 3.4: Cronbach Alpha Scores for indexes

Index Name	Question Number	CA score	Variable
Green bin support	6.1-6.3	0.83	Outcome

Personal norms	3.1-3.2	0.72	Predictor
Good provider identity	4.1-4.5	0.63	Predictor
Household planning habits	5.1-5.5	0.64	Predictor
Convenience	7.1-7.5	0.84	Predictor
Green bin norms	8.1-8.6	0.61	Predictor
Environmental impact	9.1-9.5	0.85	Predictor
Home composting	10.2-10.3	0.43	Predictor
Knowledge	11.1-11.2	0.48	Predictor

All the indexes that met the criteria were correlated (Pearson correlation) with the outcome variable. Variables which were significantly *($p<0.05$)* correlated with the outcome variable were included in stage two of the analysis, linear regression. Correlations scores were either weak/small (>0.1), medium (>0.3) or strong/large (>0.5) (Cohen, 2014). Sociodemographic variables significantly correlated with green bin support were added to the regression model. Variables that were not significant were excluded from the regression analysis.

3.7.2 Stage 2

For stage 2, a linear regression model was used to identify the significant determinants of green bin support. Linear regression analysis was used to determine how well independent variables predicted/explained green bin support. The variables used in the regression model were those that were significantly correlated with the dependent variable from stage one. A two-sided p-value <0.05 was considered statistically significant. Per Cohen (1988, p. 413), regressions scores are small (>0.02), medium (>0.13), or large (>0.26).

3.8 Expected Outcomes and contributions

For this research, residents living in a city with a green bin program are expected to have more support for a green bin program than residents living in city without such a program. Additionally, it is expected that most respondents (in both locations) will have positive norms toward green bins and will be supportive of the program which can potentially influence green bin usage. Findings will provide municipalities with information on current self-reported food wasting

behaviour and ways to improve support of green bin programs. Furthermore, by understanding the differences in attitude, knowledge and behaviour among households from both cities, findings can identify areas to improve new (and already existing) green bin programs. Ultimately, the findings should show city managers the provision and presence of green bins does not solve the issue of food waste reduction but will point to the need for more education on food waste reduction. This study will thus advance Ontario's cities and urban populations towards the ultimate goal of food waste reduction and prevention.

3.9 SUMMARY

This chapter introduced the research hypotheses, study sites and the process of data collection and analysis. It also explored the rationale behind the study sites, data collection method, limitations and expected contributions. The next chapter presents key research findings, comparing the findings between both sites including the predictors of green bin support, self-reported food wasting frequency and the difference in green bin support.

CHAPTER 4: RESULTS

4.1 INTRODUCTION

This chapter presents survey findings by hypothesis, the first section focuses on the combination of hypotheses 1 and 2 followed by hypothesis 3. In the first section, there is a descriptive breakdown of self-reported food waste data, one of the predictor variables. This is followed by Pearson correlation analyses of all the predictor variables with the dependent variable, green bin support. The correlation analysis was run to filter and reduce the number of variables used in the regression model. Finally, the significant variables from the correlation analysis were included in a linear regression model to predict green bin support. The second section tested green bin support for respondents in the two locations, it also looked at how other predictor variables varied based on their location.

4.2 HYPOTHESIS 1 & 2: PREDICTORS FOR THE SUPPORT OF A GREEN PROGRAM

The dependent variable, green bin support is an index variable formed from three 7-point Likert questions, with index scores ranging from a minimum score of 3 (1 x 3) to a maximum score of 21 (7 x 3). Generally, respondents were supportive of a green bin program (M = 17.8, SD = 4.68), as about 77% of the respondents had relatively high (scores between 16-21) green bin support scores.

Hypothesis 1 tested whether self-reported food wasting frequency was a predictor of green bin support. Self-reported food wasting frequency and portions are two index variables from 6 questions each. The minimum score of self-reported food wasting frequency for this study was 0 (0 times x 6) and the maximum score was 42 (7 times x 6), while the minimum score of self-reported food wasting portions for this study was 0 (0 portions x 6) and the maximum score was 36 (6 portions x 6). Respondents reported they threw out food about 4 times/week and an average

of 4 portions/week. Fruit and vegetables were the most wasted food type, respondents reported they threw out fruit and vegetables more than once every week. After fruit and vegetables, bread and baked goods were wasted the most – only 80 respondents reported no food waste. For self-reported portions, fruit and vegetables were the type of food wasted the most, followed by bread and baked goods – only 92 respondents reported no food waste. Table 4.1 and Table 4.2 show the breakdown of self-reported food wasting frequency and portions by food type.

Table 4.1: Self-reported food waste frequency per food type

Food types	Frequency/household/week			Households reporting no food waste
	M	SD	Mdn	
Bread and baked goods	0.76	1.14	0.00	201
Meat and fish	0.56	1.10	0.00	277
Dairy (e.g. milk)	0.36	0.80	0.00	294
Fruit and vegetables	1.32	1.62	1.00	155
Dried food (e.g. cereal)	0.24	0.85	0.00	345
Other food	0.61	1.23	0.00	253
Total	3.79	5.14	2.00	80

Table 4.2: Self-reported food waste portions per food type

Food types	Portions/household/week			Households reporting no food waste
	M	SD	Mdn	
Bread and baked goods	0.98	1.37	0.00	206
Meat and fish	0.57	1.12	0.00	277
Dairy (e.g. milk)	0.46	0.99	0.00	293
Fruit and vegetables	1.39	1.70	1.00	163
Dried food (e.g. cereal)	0.24	0.81	0.00	344
Other food	0.61	1.18	0.00	260
Total	4.21	5.05	3.00	92

Table 4.3 shows the correlation result for green bin support and the indexes/predictor variables for their separate locations and as a pooled sample (London and Kitchener-Waterloo combined). All variables were weighted by gender to control for under/over reporting. Among London respondents, concern for environmental impacts (0.69), norms favouring green bin use (0.68) and convenience (0.59) had the strongest correlations with green bin support. All variables

except household planning habits, housing type, education and ethnicity were significantly correlated with green bin support. Londoners who were supportive of a green bin program: believed their city can educate people better on reducing food waste (0.44), would not home compost if there is a green bin (-0.38), found food waste reduction education useful for a green bin program (0.35), identified themselves as good providers (0.28), were older (-0.26), were working (0.26), were more frequent food wasters (0.26), were higher wasters of food per portions (0.24), were house renters (0.19), had more household inhabitants (0.19), had more personal norms against food waste (0.18), will compost when possible (0.16), had higher income (0.15), were white (-0.10), were good household planners (0.09), lived in detached/semi-detached houses (-0.03) and were more educated (0.02).

For Kitchener-Waterloo respondents, convenience (0.57), concern for environmental impacts (0.46) and norms favouring green bin use (0.44) had the strongest correlations with green bin support. Only household planning habits, convenience, norms favouring green bin use, concern for environmental impacts, food waste education is useful and number of people in the household were significantly correlated with the outcome variable. Kitchener-Waterloo residents who were supportive of a green bin program: believed food waste reduction education useful for a green bin program (0.25), had more household inhabitants (0.16), were good household planners (0.14), were white (-0.13), would not home compost if there is a green bin (-0.12), had higher income (0.11), had more personal norms against food waste (0.11), were more frequent food wasters (0.10), were older (-0.08), were more educated (0.08), lived in townhouses (0.07), were higher wasters of food per portions (0.06), were working (0.06), were house owners (-0.05), identified themselves as good providers (0.03), will not compost when possible (-0.01) and believed their city can educate people better on reducing food waste (0.01).

For the pooled sample, norms favouring green bin use had the largest correlation (0.64) with the outcome variable followed by environmental impact (0.63) and convenience (0.61). All the variables (except "people should compost when possible", housing type, and education) were significantly correlated with the outcome variable. Those who were supportive of a green bin program: believed food waste reduction education useful for a green bin program (0.34), would not home compost if there is a green bin (-0.31), lived in Kitchener-Waterloo (0.254), were older (-0.21), were working (0.20), identified themselves as good providers (0.20), believed their city can educate people better on reducing food waste (0.18), were more frequent food wasters (0.17), had more personal norms against food waste (0.17), had more household inhabitants (0.16), were higher wasters of food per portions (0.15), had higher income (0.15), were house owners (0.13), were white (-0.11), were more educated (0.05), lived in detached/semi-detached houses (-0.03), will compost when possible (0.01) and were good household planners (0.01).

Table 4.3: Pearson correlation analysis with green bin support and predictor variables

	London	**KW**	**Pooled Sample**
Green bin support	1	1	1
Waste regime (London = 0, KW = 1)	-	-	0.25**
Self-reported food wasting frequency	0.26**	0.10	0.17**
Self-reported food wasting portions	0.24**	0.06	0.15**
Personal norms against food waste	0.18**	0.11	0.17**
Good provider identity	0.28**	0.03	0.20**
Household planning habits	0.09	0.14*	0.01*
No issues with food waste storage (Convenience)	0.59*	0.57**	0.61**
Norms favouring green bin use	0.68**	0.44**	0.64**
Environmental impacts	0.69**	0.46**	0.63**
People waste more when there is a green bin	-0.40**	-0.19**	-0.36**
Compost when possible	0.16**	-0.01	0.01
Prefer composting to green bin	-0.38**	-0.12	-0.31**
Better education about food wasting from city	0.44**	-0.01	0.18**
Food waste reduction education is useful for green bin program	0.35**	0.25**	0.34**
Age	-0.26**	-0.08	-0.21**
Housing type	-0.03	0.07	-0.03

Housing tenure	0.19**	-0.05	0.13**
Number of people in household	0.19**	0.16*	0.16**
Education	0.02	0.08	0.05
Employment	0.26**	0.06	0.20**
Income	0.15*	0.11	0.15**
Ethnicity	-0.01	-0.13	-0.11*

*p<0.05, **p<0.01

Table 4.4 shows the regression models for green bin support using the significant variables from the correlation analyses for their separate study sites and as a pooled sample. There were eight significant predictors of green bin support in London – these variables explained 71% of the variance. The strongest predictors were concern for environmental impacts (0.37), norms favouring green bin use (0.24) and convenience (0.24). All the variables except portions and "prefer composter to green bin" were statistically significant. There were only three predictors of green bin support for Kitchener-Waterloo, all three variables were statistically significant and explained 43% of the variance. The three variables were convenience (0.39), concern for environmental impact (0.26) and norms favouring green bin use (0.18). For the pooled sample, there were nine variables that were present in the final model, these variables explained 64% of the variance and all variables except good provider identity were statistically significant. The strongest predictors were convenience (0.31), norms favouring green bin use (0.29) and concern environmental impact (0.25).

Table 4.4: Green Bin Support Regression Model

	London	KW	Pooled Sample
Self-reported food wasting frequency	-	-	0.09**
Self-reported food wasting portions	0.09	-	-
Personal norms against food waste	-0.14**	-	-0.08*
Good provider identity	0.15**	-	0.07*
No issues with food waste storage (Convenience)	0.24**	0.39**	0.31***
Norms favouring green bin use	0.24**	0.18**	0.29***
Concern for environmental impact	0.37**	0.26**	0.25***
Prefer composting to green bin	-0.07	-	-0.10**

Food waste reduction education is useful for green bin program	0.09*	-	0.07*
Age	-	-	-0.08*
Model statistics	$R^2 = 0.71$	$R^2 = 0.43$	$R^2 = 0.64$

*p<0.05, **p<0.01, ***p<0.001
Table presents Standardized Regression Coefficients

4.3 HYPOTHESIS 3: DIFFERENCE BETWEEN GREEN BIN REGIMES

The third hypothesis tested whether green bin support is higher in a city with a green bin program versus a city without a green bin program. The result supported this hypothesis as Kitchener-Waterloo had a higher mean score (M=6.36, SD=1.10) for the green bin support than London (M=5.59, SD=1.81), the mean difference (0.77) was statistically significant (p<0.05). Generally, both cities were supportive of the green bin program. The frequency distribution for both locations is shown in Figure 4.1. For clearer data dissemination, the index scores were organized into three main categories: High, medium and low. Respondents with green bin support index scores between 16-21 were labelled as "high", "mid" scores were between 10-15 while "low" scores ranged from 3-9.

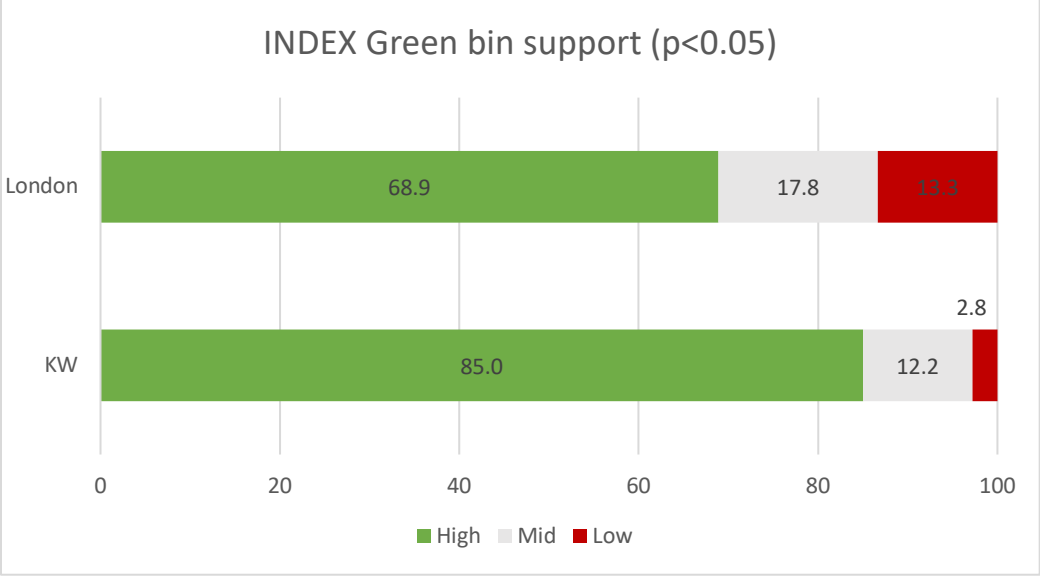

Figure 4.1: Green bin support index scores for London and Kitchener-Waterloo (p<0.05)

Mean differences of the other variables used were also tested for statistical significance, asides from green bin support, only norms favouring green bin use had a significant mean

difference. Figure 4.2 and Figure 4.3 shows the distribution for self-reported food wasting frequency and self-reported food wasting portions between both cities respectively. The mean differences were not significant. Respondents who reported they threw out no waste were labelled as "never", those who threw out food 1-7 times were labelled as "sometimes", and those who threw out food 8-42 times were labelled as "often".

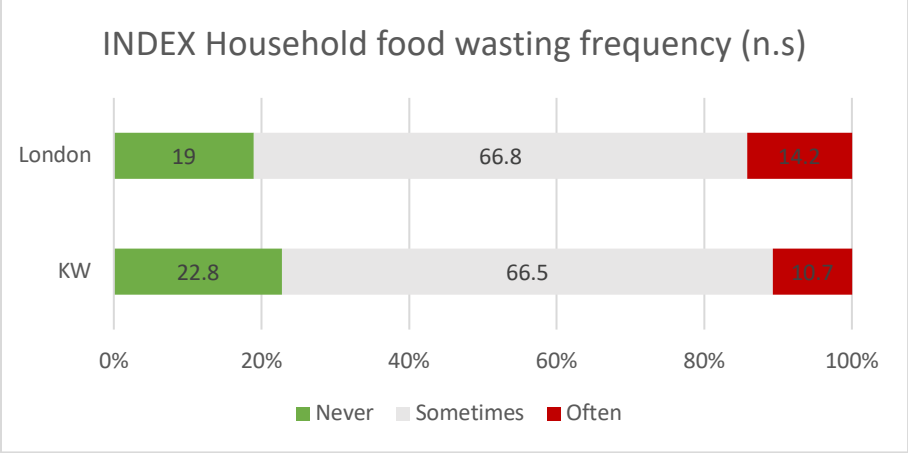

Figure 4.2: Self-reported food wasting frequency for London and Kitchener-Waterloo (p>0.05)

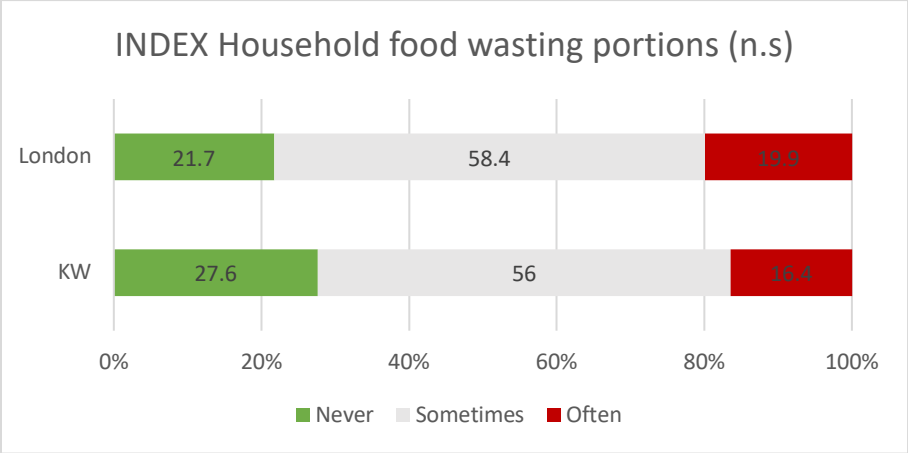

Figure 4.3: Self-reported food wasting portions for London and Kitchener-Waterloo (p>0.05)

Figure 4.4 shows the distribution for personal norms against food waste between both cities. The mean difference was not significant. Personal norms against food waste was a two-question index meaning respondents final scores ranged from 2 to 14. Respondents with scores

between 11-14 were labeled as “high”, those with scores between 7-10 were labelled as “medium” while those with scores between 2-6 were labeled as “low”.

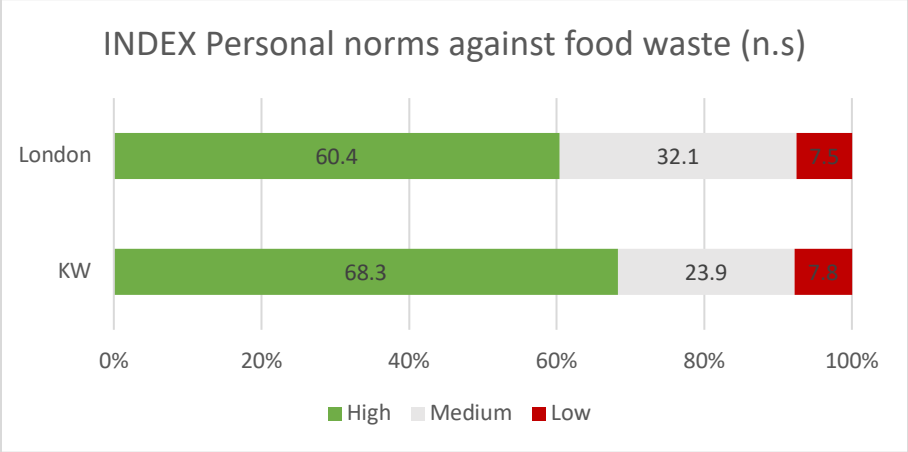

Figure 4.4: Personal norms against food wasting for London and Kitchener-Waterloo (p>0.05)

Figure 4.5 and Figure 4.6 shows the distribution for good provider identity and household planning respectively between both cities. The mean differences were not significant. These are five-question indexes meaning respondents final scores ranged from 5 to 35. Respondents with scores between 26-35 were labeled as “high”, those with scores between 16-25 were labelled as “medium” while those with scores between 5-15 were labeled as “low”.

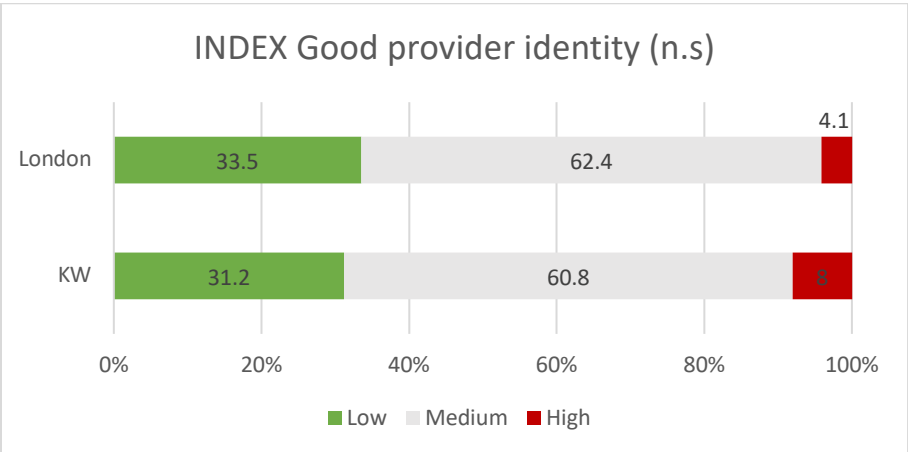

Figure 4.5: Good Provider Identity for London and Kitchener-Waterloo (p>0.05)

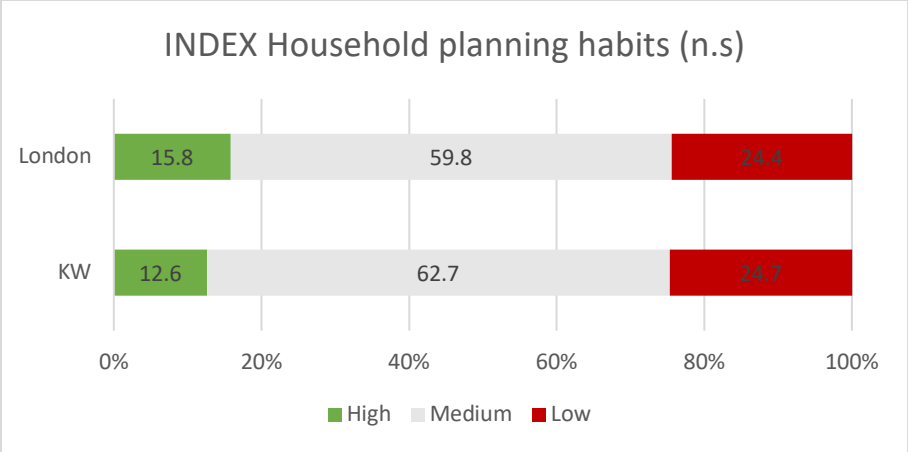

Figure 4.6: Household planning habits for London and Kitchener-Waterloo (p>0.05)

Figure 4.7 and Figure 4.8 shows the distribution of convenience (no issues with food waste storage) and the distribution of norms favouring green bin use respectively between both cities. The mean differences of both variables are significant (p<0.05). Convenience and personal norms favouring green bin use were a five-question index meaning respondents final scores ranged from 5 to 35. Respondents with scores between 26-35 were labeled as "high", those with scores between 16-25 were labelled as "medium" while those with scores between 5-15 were labeled as "low".

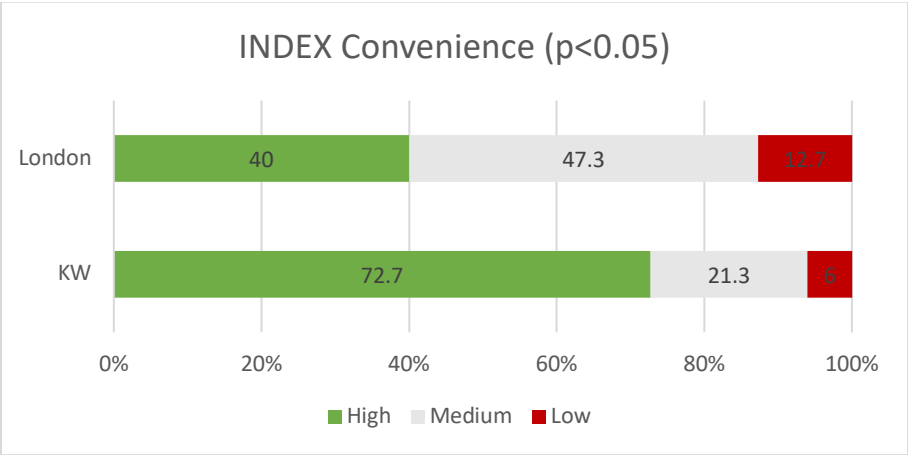

Figure 4.7: Convenience for London and Kitchener-Waterloo (p<0.05)

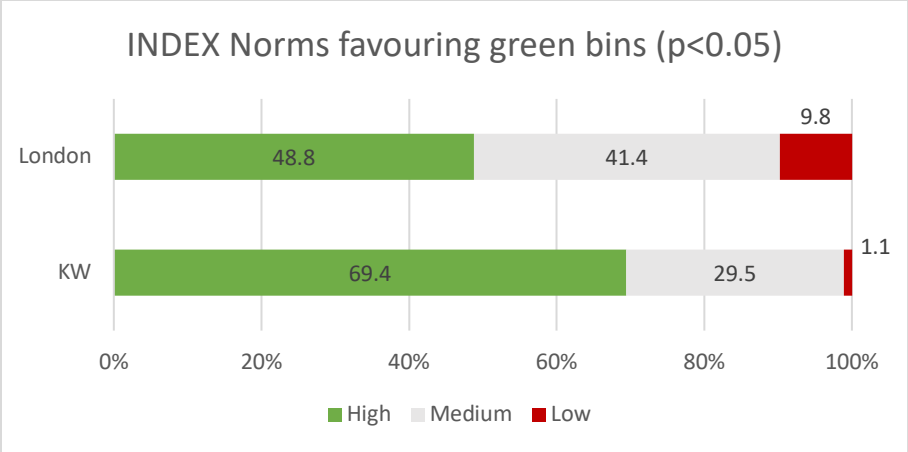

Figure 4.8: Norms favouring green bin use for London and Kitchener-Waterloo (p<0.05)

Figure 4.9 shows the distribution of the concern for the environmental impact of food waste between both cities. The mean difference was not significant. Concern for the environmental impact of food waste was a five-question index meaning respondents final scores ranged from 5 to 35. Respondents with scores between 26-35 were labeled as "high", those with scores between 16-25 were labelled as "medium" while those with scores between 5-15 were labeled as "low".

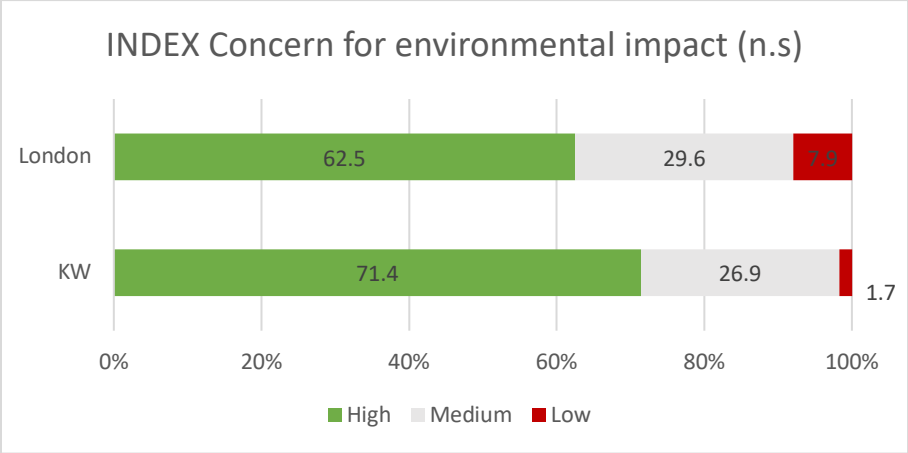

Figure 4.9: Environmental impact for London and Kitchener-Waterloo (p>0.05)

4.4 SUMMARY

This chapter divides the results into the different hypotheses that were tested, Table 4.5 summarizes the results, all the decisions were the same for all models. For hypothesis 1, self-reported food wasting frequency was a positive, significant predictor of green bin support,

therefore, we failed to reject it. For hypothesis 2, all the hypothesized variables, (except household planning habits) were significant predictors of the green bin support and they were also in the expected direction, so we failed to reject it. Although there was not an index formed for home composting and knowledge (low CA scores), the individual questions were still significant in both the correlation and regression analyses, so we failed to reject them too. Lastly, for hypothesis 3, Kitchener-Waterloo respondents had higher green bin support than those in London, so we failed to reject the hypothesis.

Table 4.5: Predictors of Green bin Support

Hypotheses		Index Name	Decision
Respondents with higher current self-reported food waste per capita will have more support for a green bin program	H1	Frequency and portions	Fail to reject
Respondents with greater personal norms will have more support for a green bin program	H2a	Personal norms	Reject
Respondents with greater good provider identity will have more support for a green bin program	H2a	Good provider identity	Fail to reject
Respondents with poorer household planning habits will have more support for a green bin program	H2a	Household planning habits	Fail to reject
Respondents who have no issue with food waste storage will have more support for a green bin program	H2b	Convenience	Fail to reject
Respondents with greater norms favouring the use of a green bin will have more support for a green bin program	H2b	Green bin norms	Fail to reject
Respondents with greater concerns about the environment impacts of food waste will have more support for a green bin program	H2b	Environmental impacts	Fail to reject
Respondents that prefer using home composters will have less support for a green bin program	H2b	Home composting	Fail to reject

Respondents who prefer more food waste education will have more support for a green bin program	H2b	Knowledge	Fail to reject
Respondents living in a green bin regime will have more support for a green bin program	H3	-	Fail to reject

CHAPTER 5: DISCUSSION

5.1 INTRODUCTION

This chapter bridges the literature review of chapter 2 with the study results in chapter 4. This discussion chapter highlights where findings are consistent with or contrary to empirical findings in the literature, it also makes suggestions on some tweaks to current concepts and the way they are measured. It is organized into the three hypotheses and identifies in more detail the predictors of green support and difference observed between both locations.

5.2 HYPOTHESIS 1

The first hypothesis tested whether people with higher self-reported food wasting frequency had high(er) green bin support, the assumption being that such people would like a convenient place to put that food waste while simultaneously easing any guilt associated with such wasting. Self-reported food wasting is used as a proxy for actual food wasting in food waste studies. Therefore, it is inferred that respondents with higher self-reported frequency waste more food than respondents with lower frequency. As expected, food wasting frequency was a significant predictor of green bin support in the pooled sample model and food wasting portions was a predictor of green bin support in London, however, about 88% of sample respondents reported they had little to no food waste, which might explain the weak predictive power.

People with high frequency might not be concerned about the amount of food they waste but, there is a chance they feel bad their waste ends up in landfill. This is consistent with the idea that the addition of a green bin in their household presents an opportunity to continue in their ways of wasting food but with less guilt attached to it. Further, Catlin & Wang (2013); Metcalfe et al., (2013); Qi & Roe (2019) discuss how the presence of an alternate waste disposal option (other than garbage) reduces the guilt feeling that comes with disposal, causing and justifying (excessive)

wasting. These people prefer this downstream approach, as opposed to upstream approaches that would result in more efficient use of food (e.g. smarter food purchasing and preparation). Another explanation is perceived behavioural control over food wasted, especially for households with more than one inhabitant. Although my research did not test how perceived behavioural control affects green bin support, TPB and several food waste studies have shown its influence on actual behaviour (Russell et al., 2017; Visschers et al., 2016). In some cases, people (may) have no control of the amount food wasted in their household but are still worried about the environmental impacts of food waste so, the green bin provides an environmentally friendly option compared to landfill. So, although food is wasted in their household, there is relief the food being wasted will be recycled. Furthermore, 71% of the survey respondents agreed/strongly agreed that people should feel guilty when they threw out food waste into a garbage, while 48% of the survey respondents agree/strongly agreed that people should feel guilty when they threw out food waste into a green bin. This shows the change(s) in emotion/guilt and perhaps attitude towards food waste based on the available waste disposal option as noted earlier. Emotions, feelings and attitudes are easier to change, or influence compared to behaviour as seen in the TPB. Behavioural change is a much longer and a more difficult process, so if respondents can reduce or remove the guilt of wasting food without reducing or preventing their food waste, there is a better chance of them following that route.

Taking a closer look between cities, self-reported food wasting frequency was only a significant predictor of green bin support in London – where respondents reported they threw out more waste compared to Kitchener-Waterloo respondents. Those with little to no food waste will personally have no need for a green bin because it would not be used as frequently or as much which explains why it was not a predictor of green bin support for Kitchener-Waterloo. Lastly,

since the relationship between self-reported frequency and green bin support was weak, added focus can be placed on properly understanding the relationship between self-reported frequency, green bin support and actual green bin waste data.

5.3 HYPOTHESIS 2

Hypothesis 2a anticipated that respondents with higher personal norms against food waste, higher good provider identity and poorer household planning habits will have higher green bin support; because people who exhibit these traits tend to produce more food waste (except those with higher personal norms) which can increase their need for an alternative food waste disposal option. Indeed, this was the case, all of these particular food wasting variables had a positive and significant correlation with green bin support. However, only personal norms and good provider identity (overprovisioning of food for family or guests) were predictors of green bin support in the regression model for London and the pooled sample, no food wasting variable was a predictor in Kitchener-Waterloo's regression model.

Personal norms focus on the individualized beliefs against food wasting such as feeling it is immoral to waste food or feel bad for wasting food, these are ingrained, reflex feelings. These norms are a result of several variables including how a person was raised. So, when people have high personal norms, they are less likely to waste food (Schanes et al., 2018; Stancu et al., 2016; Visschers et al., 2016). However, if they were to waste food for whatever reason, they are consoled because their waste does not end up in the landfill. Personal norms were positively correlated with green bin support in the bivariate analysis; however, this relationship was flipped in the regression analysis i.e. higher personal norms reduced their support for green bin. Although this relationship was not hypothesized, there is a possible explanation for this occurrence. Kitchener-Waterloo was the only result that personal norms was not a significantly negative predictor of green bin support

– Kitchener-Waterloo respondents also had higher personal norms than their counterparts in London. Drawing on hypothesis 1, particularly with self-reported food wasting frequency, we see a disconnect wherein London residents are still throwing out food at a high frequency although they have high personal norms against food wasting. Personal norms against food waste influences people's attitudes towards food waste and intention towards food waste and although these norms might be mediated by other variables (depending on the situation/scenario), it inherently has a negative relationship with food wasting behaviour (Schanes et al., 2018; Stancu et al., 2016; Visschers et al., 2016). Therefore, although Londoners had high personal norms against food wasting which "should" prevent them from throwing out food frequently, respondents still reported they threw out food at a high rate which is a source of concern. About 32% of London respondents (24% for Kitchener-Waterloo) had average personal norms index score, this middle group does not have "strong" good or bad feelings on food waste so their reasons for support (or lack) can be easily influenced by other factors. Kitchener-Waterloo's regression results show (higher) personal norms is at worst not a predictor of green bin support.

Another explanation for this finding is simply those who are opposed to wasting food (people with high personal norms against food waste) are less supportive of green bin programs because they are against food waste so there is no reason to have a green bin program if/when people can just stop wasting food (Tonglet et al., 2004). Further, Tonglet et al. (2004) points out that respondents who displayed higher personal norms were more likely to engage in waste minimization behaviours and they felt the only time or reason to waste anything was only when it was past the point of reusability. So, if food can be used or reused in some way, it should not be thrown away, hence the lack of support. Alas, for some, having a green bin lessens the importance

and significance of food waste thus encouraging less food waste reduction efforts and consequently, more food waste.

So, although we reject this hypothesis, the flipping of the relationship from the correlation stage to the regression stage and the low regression score shows there might be other mediating factors at play for this relationship. To improve understanding of this variable, more questions should be asked to determine whether personal norms against food waste affects food waste diversion behaviour or food waste reduction behaviour.

As far as the good provider identity is concerned, we anticipated respondents with a high good provider identity (those who feel the need to overprovide for family and guests) will be more supportive of a green bin program. Graham-Rowe et al. (2015); Roodhuyzen et al. (2017); Schanes et al. (2018); van der Werf et al. (2019) have shown good provider identity as a predictor of food wasting behaviour. Good providers are those who would rather overprovide for guests or have extra food for unexpected guests and situations, because of this overprovisioning, they are more likely to waste more food. Almost all respondents (94%) reported low to medium good provider identity meaning there is limited desire among our survey respondents to overprovide. Kitchener-Waterloo respondents identified more as good providers compared to Londoners; however, this difference was not statistically significant ($p>0.05$). Further, Kitchener-Waterloo's good provider identity was weakly correlated (0.034) with green bin support while for London respondents, good provider identity had a significantly positive relationship with green bin support – even appearing as one of its final predictors. Surprisingly, Kitchener-Waterloo had more respondents with high(er) good provider identity but yet, they reported less waste, while London which had more respondents with lower good provider identity, reported more waste. However, Kitchener-Waterloo had a significantly positive correlation (0.237) with self-reported food waste while London had a

positive but not significant correlation (0.103). As expected, good provider identity a significant predictor of green bin support in the regression model (for London and the pooled sample). Those who identify as good providers tend to throw out more food (Schanes et al., 2018; van der Werf et al., 2019). Similar to those with high self-reported food wasting frequency, good providers should be more supportive of a green bin program because, they presumably look towards the green bin as a way to ensure their waste ends up somewhere other than a landfill as they are aware and cautious of the environmental impacts. Alternatively, good providers can be supportive of all waste disposal options because of their tendency to produce more waste**.** Good provider identity was a significant predictor of green bin support in London and the general sample. Since this variable is one of the signs of poor food literacy skills, it is important to research ways to educate residents on how to provide for their families and guests without overprovisioning (van der Werf et al., 2019). Additionally, educating residents about food waste reduction was also only a (significant) predictor of green bin support in the final regression model for both London and the sample. Food waste reduction education is explained later in the discussion but, the fact these two variables (good provider identity and food waste education) are significant in London and not in Kitchener-Waterloo shows an opportunity for improvement in London. Correcting people's tendencies to overprovide contributes to food waste reduction, which is part of the "reduce" stage of waste diversion hierarchy (Reduce-Reuse-Recycle).

The third food wasting variable hypothesis tested was household planning habits. This index variable covers a wide array of household dynamics – food purchasing and meal planning – households with low planning habits are expected to have more waste and it was hypothesized poor household planning habits will translate to increased green bin support. Unsurprisingly, about 24% of the sample had poor household planning habits and as mentioned in Section 2.2.1, poor

food literacy skills are a huge reason for household food wasting (Schanes et al., 2018). The mean difference between both cities was not significant which shows having a green bin does not have an effect on planning habits. This finding raises a bigger issue – poor household planning and the need for increased education to improve food literacy skills such as meal planning, food preparation and food storage. At the same time, the finding is partially explained by the good provider finding to a certain extent, at least in London. Wherein respondents may plan, but to (over) provide and not save food per se. This gap offers an explanation for why food waste education appears as a predictor for green bin support, this is explained further in the latter part of the discussion. Out of all the food wasting variables, household planning habits was the only variable unable to predict green bin support. Perhaps, van der Werf et al. (2019) and Visschers et al. (2016) findings that household planning habits was a weak and non-significant predictor of food wasting behaviour, offers further reason for current finding. If household planning habits is indeed a weak predictor of food wasting behaviour then it is somewhat understandable why it is also a weak predictor of green bin support. However, the lack of predictive power suggests researchers need to reconsider the influence of household planning habits and/or review the questions asked when trying to assess respondent's household planning habits. Perhaps, the breadth or directness of the questions is responsible for the limited associations (Visschers et al., 2016). Household planning habits which is a part of food literacy is a diverse topic, accounting for various moving pieces in the household. However, some of these pieces are unrelated with each other, while others might not applicable to all households or circumstances (Quested et al., 2013). For example, an individual can be good at making and following their shopping list but have poor food preparation skills; so, although they are able to buy what they need, they are unable to properly prepare it, this disconnect creates an opportunity for food wasting to occur. Future

research might benefit from having several (or all) questions focused on understanding a specify food literacy theme (e.g. household communication, understanding food labels or shopping routine) rather than one question on household planning habits or several questions which focus on separate themes.

We must keep in mind that most of the literature cited in this thesis relates to predictors of food wasting rather than green bin support. Thus, we are seeing whether the non-TPB food wasting predictors can also predict green bin support, so that we may determine if perhaps green bins are, in effect, having a negative influence on food wasting (i.e., resulting in more food discarded). Food wasting variables had weak correlations with the other waste diversion variables and in some cases, green bin support. However, some variables were predictors of green bin support in the final regression model. A reason for the observed limited relationship is the variables individually have a small or indirect effect on green bin support. By using a more robust variable (such as self-reported frequency or intention towards the behaviour) which encapsulate these smaller variables, the effect on green bin support should be larger and more direct, yielding better results. This reasoning is supported by van der Werf et al. (2019), personal norms against food waste, good provider identity and household planning habits were weak predictors of food wasting behaviour but, were better at predicting food wasting intention. Whatever the case might be, our findings show that non-TPB food wasting variables are transferrable and can be used to predict green bin support. Future research may explore how other TPB and food wasting variables explain green bin support and even food waste diversion behaviour.

Hypothesis 2b predicted respondents with higher concern for environmental impact, convenience, norms favouring green bin use, preference for food waste education will have higher green bin support; while those who preferred home composters will have lower green bin support.

The results supported all of these hypotheses. All waste diversion variables were significantly correlated in the expected direction with green bin support; these variables (except preference for food waste education and preference for home composters) were also significant in all regression models.

Generally, respondents had medium to high convenience index scores, meaning they had enough time and space to sort their food waste and did not think having a green bin would be or was inconvenient. In the case of Kitchener-Waterloo, a reason for this is their experience with the green bin, respondents have been using the bins for a couple of years, so it has become part and parcel of their daily lives – as discussed in Gieger et al. (2019). This difference is seen clearly when the convenience scores are compared with each other – Kitchener-Waterloo had far more respondents with high convenience compared to London (73% vs 40%). These respondents might still experience inconveniences (such as occasional odours or presence of pests) however, they are better prepared for such occasions. Those with high convenience scores (respondents who felt they had no issues with food waste storage) not only preferred using the green bin when given a chance but they also believed having a green bin causes people to waste more – this is potentially because they do not (or think they would not) waste more food so the assumption is others currently do or will do the same. Regardless, this is a positive finding for cities interested in implementing green bin programs. Having a good green bin educational/outreach program provides opportunities to answer questions about food waste and alleviate some of the general concerns residents might have regarding the potential green bin program – thus increasing support and potential participation. Respondents who felt that dealing with food waste and green bins was not an issue also felt food waste reduction education before a green bin program was important and had more positive norms

favouring green bins. With improved outreach, residents can receive information on green bin program and food waste reduction which influences green bin attitudes and behaviour.

Another positive finding was norms favouring green bin use and support – this index measured people's attitudes and norms towards the green bin, higher scores meant people would use or prefer to use the green bin. Like convenience, majority of respondents had high green bin norms scores i.e. they had positive norms favouring the use of a green bin, which is consistent with Ghani et al., 2013 and Refsgaard & Magnussen (2009) finding for similar food waste diversion attitudes. As expected, there was a positive and significant relationship between norms favouring green bin use and green bin support in all three models. This finding is similar to what is observed in TPB and food waste studies (Schanes et al., 2018; Visschers et al., 2016; van der Werf et al., 2019) i.e. attitudes towards a behaviour being influential to actual behaviour. Because people reported they felt a green bin is of importance to them and using it is the right thing to do, it has a positive influence on their support for the program – reinforcing the need for education. There is also a significant ($p<0.05$) difference in the mean of norms favouring green bin use between both cities, the presence of a green bin program can be an explanation for this occurrence. As mentioned in the methods and results section, one of the "norms favouring green bin use" questions (I feel having a green bin causes people to discard more food) was not included in the index so it was treated as an independent variable. However, this independent variable had a significantly negative correlation (-0.364) with green bin support i.e. respondents who believed having a green bin caused people to waste more food were not in support of the green bin program. Respondents with this view are justified by Qi & Roe (2019) study which found subjects in a dining room wasted more food when they were aware their food waste was going to be composted compared to those who thought it was going to the landfill. Although not analyzed in my thesis, there is a chance majority

of the people with this belief are older and probably have a home composter or do not waste food, which is also a reason why this variable does not appear in the regression model, but self-reported frequency, age and composting do.

As hypothesized, respondents with higher scores for the index "environmental impacts" were more supportive of the green bin program, this was also a significant predictor in all the regression models for green bin support. Respondents who express more concern for environmental impact are aware of the consequences of food waste (especially when it ends up in the landfill) and the role a green bin plays in trying to reduce these consequences. Those who had more concern for environmental impact of food waste also had more norms favouring green bin and felt dealing with food waste and green bins was not an issue – showing the relationship between concern, attitude towards waste diversion and convenience. In this case, the consequences of food waste going to the landfill influences people's views/feelings on green bin and outweighs any inconvenience that might be faced within the household to accomplish the goal of preventing food from reaching the landfill – which in this case is through a green bin. The findings on the predictive power of environmental impacts are consistent with both food wasting and waste diversion literature (Diaz-Ruiz et al., 2018; Gieger et al., 2019; Miafodzyeva & Brandt, 2013; Sterner & Bartelings, 1999; Tonglet et al., 2004).

Another (small-scale) way of diverting food waste from landfills is through home composting. Although home composting has several limitations (such as size, materials accepted, weather etc.), its use is promoted in city without green bin programs. The two questions that were asked in this section were treated as individual variables because Cronbach alpha scores were unacceptable (<0.6). Surprisingly, composting when given an option to was positively correlated with green bin support, although this was a weak correlation (0.014), future studies can look further

into this. Unsurprisingly, the other question (the preference of composting to green bin) had a significantly negative correlation (-0.313) with green bin support and was a significant predictor in the regression models for London and the pooled sample. This means those who preferred to compost were less supportive of a green bin program, a similar trend was observed in Benyam et al. (2018). Often times, those who home compost use their newly formed compost for gardening amongst other things. Switching to a green bin is less beneficial to them because there is no longer access to compost (unless they buy it), contributing to reduced support.

The last hypothesis 2b tested was preference for food waste education, it was anticipated that people with preference for food waste education will be more supportive of a green bin program. Like composting, the two questions that were asked in this section were treated as individual variables because the Cronbach alpha scores were unacceptable (<0.6). Being educated on food waste reduction before implementing a green bin program was an important predictor of green bin support in London and the pooled sample. Not everyone is sold on the idea of green bins, for example, 7% of respondents felt green bin caused people to waste more food. This subset of the population is opposed to the green bin because it is counterproductive as it might lead to more unnecessary waste. To convince this group of people and other members of the public, educating people on food waste reduction (and its benefits) might help mediate/influence some of the negative attitudes they might have towards green bin programs. Also, a majority (~52%) of respondents agreed or strongly agreed their city could do a better job on educating people about food waste. This shows there is room for improvement from a city education/outreach standpoint and more room to increase green bin support. Environmental campaigns have been strongly linked with environmentally friendly behaviours (Gieger et al., 2019; Miafodzyeva & Brandt, 2013), it can promote either waste diversion (the individual focuses more on preventing the waste from

going to the landfill by diverting) or waste minimization (the individual focuses more on preventing the waste from going to the landfill by reducing the amount of waste generated) behaviour. As noted earlier, respondents have low/poor household planning habits, educating households on good food literacy skills will improve their ability to properly food purchase, food preparation and food storage – resulting in reduced food waste, the overall goal.

Age was the only sociodemographic predictor of green bin support (only in the pooled sample). Age intersects with household size, those who are older (senior citizens) tend to have fewer household inhabitants. Ultimately, this can contribute to reduced amount of food waste produced. Older people (especially retirees) also tend to have more time; therefore, time-related convenience issues should have less of an effect on them compared to those who are younger. Additionally, past food waste studies have shown older people create less waste, primarily because of the way they were raised, some might have been born during the war where food was scarce or were raised by parents/guardians who lived during this period. Therefore, they are more likely to be opposed to food wasting regardless of its destination because to them, food should not be wasted no matter what. Waste diversion variables were able to predict green bin support better than food wasting and sociodemographic variables. Potentially, the issue of green bin support is more of a waste diversion behaviour than food wasting behaviour.

5.4 HYPOTHESIS 3

Hypothesis 3 tested whether there was a difference in the level of green bin support between both cities. As expected, respondents in Kitchener-Waterloo were more supportive of a green bin program, similar to Refsgaard & Magnussen (2009) finding. This is likely because they already have the program established in their city and they are familiar with the process so issues like convenience, increased food waste which are common in the earlier days are more of an

afterthought now as households are used to the process. This does not mean having lower support is bad, as discussed earlier, people might prefer other methods of food waste diversion thus leading to reduced support. Although the difference was statistically significant, the high green bin support in London is a good sign for city officials. For a city that is thinking of implementing a green bin program, they are in an acceptable shape however, there is still an educational gap that needs to be filled before moving forward. Convenience, norms favouring green bin use and concern for environmental impacts were the only variables that were significant predictors of green bin support in all three regression models. The findings in my study corroborate previous studies, as well as adds new contribution to literature showing the importance of waste diversion variables play a large role in determining how much people support green bin programs.

5.5 RESEARCH CONTRIBUTIONS

This thesis aims to make four contributions to knowledge around food waste. First, food waste is recognized as a global problem with households accounting for a large percentage of food waste, therefore, it is important to focus on ways to combat household food wasting. This study also adds to existing research on household food wasting behaviour. Secondly, this study documents the current support for a green bin program. This helps researchers and city official to better understand how best to communicate/present the green bin program and provides information on how people view or think about such programs. Thirdly and more specifically, this study investigates the factors that affect the support of a green bin program, that is, what are the determinants of the support of a green bin program? Fourth, this study offers insights and recommendations for food waste reduction initiatives and how to improve the support for a green bin program.

5.6 SUMMARY

This chapter went through the hypothesis and explained the findings – there were four major takeaways from this. First, food wasting variables had weak(er) relationship with green bin support compared to waste diversion variables, this can mean the issue of green bin support is more of a waste diversion issue than a food wasting issue. As this is one of the first studies to test this, more research needs to be done to confirm or refute this point. Second, convenience, concern for environmental impact of food and norms favouring green bin use are key variables for predicting green bin support – they were key predictors for all three regression models. Third, both cities are supportive of the green bin program, however, it is yet to be studied how the support affects participation. Fourth, majority of respondents reported their city could do a better job on educating people about food waste so both cities have to develop better food waste reduction outreach programs to educate and inform their residents.

CHAPTER 6: CONCLUSION

6.1 SUMMARY

The goal of this thesis is to gain a better understanding of the predictors of green bin support, which is not well studied compared to predictors of food wasting and waste diversion more generally. More specifically, this thesis aimed to see if it is possible to use common predictors of food wasting and waste diversion found in the literature to predict green bin support. The literature review identified the predictors of food wasting behaviour and waste diversion. The most common predictors in the both literatures were included in this study including variables related to convenience, concern for environmental impact, personal norms. I surveyed residents of London and Kitchener-Waterloo to determine the predictors of green bin support and to examine the difference in support between green bin regimes. The questions asked in the survey were based on the predictor variables from the literature review. The findings of this study were expected in the sense that they extend from the predictors of food wasting and waste diversion literature. In general, the findings support my hypotheses, those with more food waste, higher good provider identity, norms favouring green bin use, convenience (no issues with food waste storage), concern for the environmental impacts of food waste, preference for food waste education also had higher green bin support. While those with greater personal norms against food waste and preferred to home compost had lower green bin support. Further, people in green bin regimes were more supportive of a green bin program and had slightly different set of predictors of green bin support than those in a non-green bin regime. Lastly, waste diversion variables remained significant predictors in all regression models used to predict green bin support while food wasting variables were significant in some cases. There are several contributions of this study which will be discussed further as well as the research limitations and recommendations for future research.

6.2 PRACTICAL CONTRIBUTIONS

This thesis extends our understanding of green bin support by providing reasons people may or may not support green bins programs. Further, the results suggest ways to improve green bin support, if that is indeed what a municipality chooses to pursue. As Ontario municipalities implement green bins programs to improve waste diversion, several cities are yet to take this step. Lack of actionable municipal legislation on food waste diversion exists partly as a result of limited concern for environmental impact wherein there is political inertia because both government and residents who are unwilling to make an effort. The government does not change the current program because there is a general sense of comfort and convenience which occurs when the current system works acceptably well and there is not enough pressure from residents or higher authorities to demand change. If there is more awareness about the environmental effects of food waste among residents, they are able to raise their concerns to the authorities who then are inclined to consider alternative options**.** This was the case in London, a survey (n=301) found over 90% of respondents within the city of London think waste diversion is important and over 75% want a change in food waste diversion (60% Waste Diversion Action Plan, 2018). This was similar to the findings in this thesis, as ~70% of London respondents expressed a high level of support for a green bin program. London respondents also reported they threw out more food waste (compared to Kitchener-Waterloo respondents) so it is important to be cautious when designing green bin programs. As seen in the both the findings and literature, an important way to increase green bin support and reduce food waste is through educational campaigns. Educating residents is not easy or straightforward however, it is necessary. Education should include information on food literacy, convenience and concern for the environmental impact of food waste which were the biggest actionable predictors of green bin support. Proper education ensures households are informed of

ways to improve their food literacy skills which was poor amongst all respondents. In both locations, household planning habits were low and good provider identity was high; this shows the need for an outreach program to assist households struggling in this area. Another reason for education is to inform households about the negatives of throwing out food, whether or not it is going to a green bin. As reported in the study, respondents did not think people should feel guilty for throwing out food wasting in a green bin; however, they felt people should feel guilty when they threw out food into the garbage. This shows the change(s) in emotion/guilt and perhaps attitude towards food waste as the waste disposal option changes. Change in attitude and emotion based on disposal option is not akin to food waste and green bins but can be translated to other waste practices such as recycling. If households are made aware that food waste is environmentally harmful and inefficient at some levels regardless of where it ends up, it might change the way food waste is viewed, the amount of food wasted and their green bin views. Lastly, the educational campaigns should teach people how to use a green bin, part of this is providing individuals with information on the acceptable materials and how to store their food waste to reduce unwanted visits from odour and pests. With proper education, households opposed to green bins (for whatever reason) can be convinced of the benefits of using a green bin and may end up adopting one for diverting their food waste. This is timely as London has just announced it is going to implement a green bin program. Proper environmental education before the green bin roll-out can improve awareness of environmental issues associated with food waste which is instrumental for waste reduction (D'amato et al., 2016). Alongside the increased environmental knowledge, education can provide residents with more information on materials acceptable in a green bin program.

6.3 THEORETICAL CONTRIBUTIONS

There is very little research on the predictors of green bin support, and this study shows that some of the key variables in the food wasting and waste diversion literatures also predict green bin support. This study contributes to the ongoing debate on green bin programs by shedding light on green bin support and its predictors. This study adds to conceptual literature, paving a new path in food waste diversion studies by bridging the oft-separated fields of food wasting and waste diversion. For green bin support, this study found cities were supportive of green bin programs, regardless of the green bin regime, however, a city with a green bin program is more supportive. This study found that although locations might have different green bin regimes and support levels, concern for the environmental impact of food waste, convenience and norms favouring green bins remain significant predictors of green bin support. This study also found food wasting variables can be used to predict green bin support, especially for cities without green bin programs.

6.4 LIMITATIONS

Although this study makes several contributions to research, it is not without limitations. First, although surveys allow us to efficiently achieve a greater breadth of coverage through a large sample size, using this method alone sacrifice depth of understanding which can be achieved by using direct interviews with households in each city. Although the survey can show relationships or patterns between several variables, it can only offer limited reasons for such patterns. To increase the survey response rate and making the survey more engaging, it is important the researched is mindful of the length of time it takes to complete a survey, and therefore there must be a limit to the amount and complexity of questions asked. All questions asked were closed-ended to allow for quick and efficient coding and analysis; however, this limited the opportunity for

respondents to provide more reasoning behind their choices. However, because of the numerous responses a survey offers (compared to interviews), this study is able to make statistically sound inferences.

Second, the survey was conducted during COVID-19, a global pandemic which maybe have altered normal household food wasting behaviours. Although the survey was sent months after most respondents would have been under lockdown and would have been well-adjusted to their new life, there is no telling how the pandemic has altered their views on food waste, green bins and other variables measured. However, given these limits to the design and timing, pilot tests, literature reviews and previous surveys were used to make the questionnaire as effective and comprehensive as possible.

Third, as is with most surveys, respondents are inherently biased, to negate this, I used a large random sample and, provided financial incentive (a chance to win a $100 gift card) for survey completion, to motivate uninterested households. Further, the fact that more women responded to the survey suggests that woman are more interested in these matters than men. Women may also be more likely to take on the responsibility of responding to mails and other general work around the household. In an ideal world, the ratio of men to women respondents should be like the population. I handled this issue by weighting the analysis by gender to reduce any bias and avoid under/over reporting.

Fourth, despite using a large sample size, the analysis only involves two cities. To generalize findings beyond medium sized cities in Southwestern Ontario, more locations need to be included. London is on the verge of implementing a green bin program which may have played a role in some responses. Future research should include communities who are not in the process of developing a green bin program or who have no considered it at all.

Fifth, this study asked generalized questions on environmental impacts and makes general assumptions about household food waste production and green bin support. It is important to note there are more drivers of food waste and green bin support other than what was studied in this research, however, they were beyond the scope of this research. The conclusions reached are from and for a small(er) part of a larger food system dynamic.

6.5 Future Recommendations

Given that London has agreed to implementing a green bin program, there is further opportunity for a longitudinal study. This makes it possible to assess the difference/change in green bin support in a city rather than between two cities. Interviews and focus groups could be used to better understand the predictors of green bin support, and their relationship with green bin support. Further research can be conducted to understand questions such as why are food wasting variables not (significant) predictors of green bin support in cities without a green bin program? Or what are the other variables that can be used to explain green bin support? Lastly, waste audits could be included to have better behavioural outcome with quantitative data to compare their levels of support with actual wasting behaviour. This would establish whether those who support green bins are actually wasting more or less than those who do not support them. That is, is the lack of support associated with more extreme environmental views, such that green bins are seen to provide a license to waste food. Finally, this study shows the importance of waste diversion variables particularly concern for environment impact, norms favouring green bin use and issue with food waste storage (convenience) in understanding the support for municipal green bin programs.

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APPENDIX A

Household Food Waste and Green Bin Survey

The City of London is planning to implement a curbside green bin program to collect food and organic waste from households and divert it from landfill. Western University researchers, in association with the City of London (Environmental and Engineering Services), are working to develop a better understanding of current household food waste generation and current attitudes/opinions on:

- your household's current food wasting behaviours
- the upcoming green bin program
- your predicted impact of a green bin program on your household's food wasting behaviours

The results from this study will be utilized in the development of programs and policies to help reduce and sustainably manage food waste. We are looking for adults, 18 years and older, to complete this survey.

All of the information collected in this survey is kept strictly confidential. All of the survey responses will be combined for analysis and no one will be personally identified or identifiable by name in any of the results or documents related to this survey. The survey should only take you about 15-20 minutes to complete. While we would appreciate if you answered all questions as honestly and completely as possible, you are not obligated to answer any question, you are able to skip any questions you do not want to answer

Western University Research Team: Dr. Jamie Baxter and Dr. Jason Gilliland (principal investigators), Dr. Paul van der Werf, Oluwatomilola (Tomi) Ladele. Should you have any questions you may contact us at **foodwastestudy@uwo.ca**

For your convenience, we have also created an online version of the survey, it can be accessed at: www.tiny.cc/HFWLDN

Once you have completed the survey, please place it in the pre-posted envelope provided and mail it back. You will be entered for a draw to win a $100 gift card/certificate from the local Farmer's Market.

City of London Disclaimer: All information collected will be kept completely confidential and protected under the Municipal Freedom of Information and Protection of Privacy Act, and will only be used anonymously to develop programs and policies to help reduce and manage food waste. Names and addresses will be destroyed at the end of the study, and all other personal information will be anonymized. The personal information will not become part of the public record. Questions about this collection of personal information should be addressed to Jay Stanford, Director, Environment, Fleet & Solid Waste, City of London, 300 Dufferin Avenue, London, Ontario, N6A 4L9 or by email at jstanfor@london or by telephone at 519-661-2500, ext. 5411.

PART A: Food Waste Attitudes and Behaviour

For this Part, please identify the degree to which you agree with each of the following statements on food wasting attitudes and behaviour based on your previous actions/experience.

SECTION 1:

Frequency and Portions of Food Waste

1.1 The following table concerns HOW OFTEN your household throws out edible food waste. Please provide an answer, per food type – one response per row. In the last SEVEN DAYS, my household has thrown out the following food that is or was edible (as opposed to inedible food such as vegetable peelings, eggshells, coffee grounds etc.), approximately these many TIMES:

Please fill/check ONE box per row:	0 times	1	2	3	4	5	6	7+ times
Bread and Baked Goods	☐	☐	☐	☐	☐	☐	☐	☐
Meat and Fish	☐	☐	☐	☐	☐	☐	☐	☐
Dairy (e.g. milk, cheese, yoghurt)	☐	☐	☐	☐	☐	☐	☐	☐
Fruit and Vegetables	☐	☐	☐	☐	☐	☐	☐	☐
Dried Food (e.g. cereal)	☐	☐	☐	☐	☐	☐	☐	☐
Other food	☐	☐	☐	☐	☐	☐	☐	☐

1.2 The following table concerns HOW MUCH your household throws out edible food waste. Please provide an answer, per food type – one response per row. In the last SEVEN DAYS, my household has thrown out the following food that is or was edible (as opposed to inedible food such as vegetable peelings, eggshells, coffee grounds etc.), approximately this MUCH:								
Please fill/check ONE box per row:	**0 portions**	**1**	**2**	**3**	**4**	**5**	**6**	**7+ portions**
Bread and Baked Goods	☐	☐	☐	☐	☐	☐	☐	☐
Meat and Fish	☐	☐	☐	☐	☐	☐	☐	☐
Dairy (e.g. milk, cheese, yoghurt)	☐	☐	☐	☐	☐	☐	☐	☐
Fruit and Vegetables	☐	☐	☐	☐	☐	☐	☐	☐
Dried Food (e.g. cereal)	☐	☐	☐	☐	☐	☐	☐	☐
Other food	☐	☐	☐	☐	☐	☐	☐	☐

SECTION 2:

Changing Food Habits Since the COVID-19 Crisis Started

2.1 The following table relates to the edible foods you discarded since the COVID-19 crisis started. Please provide an answer, per food type – one response per row. Please indicate if you think your household discarded less, just as much, or more of the following edible food products since the COVID-19 crisis started, compared to a typical time before the crisis.

Please fill/check ONE box per row:	Much less	Less	A bit less	Just as much	A bit more	More	Much more	We never eat this
Bread and Baked Goods	☐	☐	☐	☐	☐	☐	☐	☐
Meat and Fish	☐	☐	☐	☐	☐	☐	☐	☐
Dairy (e.g. milk, cheese, yoghurt)	☐	☐	☐	☐	☐	☐	☐	☐
Fruit and Vegetables	☐	☐	☐	☐	☐	☐	☐	☐
Dried Food (e.g. cereal)	☐	☐	☐	☐	☐	☐	☐	☐
Other food	☐	☐	☐	☐	☐	☐	☐	☐

2.2 Please indicate if your household experiences the following less often, the same, or more often since the COVID-19 crisis started, compared to a typical time before the crisis.

Please fill/check ONE box per row:	Much less	Less	A bit less	Just as much	A bit more	More	Much more
Do you have less/more leftovers now, compared to before COVID-19	☐	☐	☐	☐	☐	☐	☐
Do you less/more frequently cook at home now, than before COVID-19	☐	☐	☐	☐	☐	☐	☐
Do you have less/more foods in stock now, compared to before COVID-19	☐	☐	☐	☐	☐	☐	☐

SECTION 3:

TPB Personal Norms

Please answer the following questions thinking about the near future (e.g. next one/two weeks) and your household. There are no right or wrong answers.							
	DISAGREE				AGREE		
Please fill/check ONE box per row:	Strongly disagree						Strongly agree
3.1 I feel bad when I throw food away.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
3.2 I feel it is immoral to waste any food.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐

SECTION 4:

Good Provider Identity

Please answer the following questions thinking about the near future (e.g. next one/two weeks) and your household. There are no right or wrong answers.							
	DISAGREE				AGREE		
Please fill/check ONE box per row:	Strongly disagree						Strongly agree
4.1 It would be embarrassing to me if my guests ate all the food I had prepared for them, they would probably have liked to eat more.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
4.2 I regularly buy many fresh products although I know that not all of them will be eaten.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
4.3 I like to provide a large variety of foods at shared mealtimes so that everyone can have something they like.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
4.4 I always have fresh products available to be prepared for unexpected guests or events (e.g. illness).	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
4.5 When I am expecting guests, I like to buy more food than is necessary because I am a generous host.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐

SECTION 5:

Household Planning Habits

Please answer the following questions thinking about the near future (e.g. next one/two weeks) and your household. There are no right or wrong answers.							
	DISAGREE				AGREE		
Please fill/check ONE box per row:	Strongly disagree						Strongly agree
5.1 When I have made a shopping list, I always keep strictly to it.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
5.2 Before I prepare food, I always consider precisely how much I need to prepare and what I will do with the leftovers.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
5.3 I always plan the meals in my household ahead and I keep to this plan.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
5.4 I would buy less if I lived within a more convenient distance to a grocery store.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
5.5 My household communicates closely about food purchases prior to purchasing food (e.g., to avoid duplicate purchases when stopping at the store on the way home).	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐

PART B: Food Waste Diversion

Definitions:

Green Bin: is the curbside collection of food and organic waste from households.

For this Part, please identify the degree to which you agree with each of the following statements on green bins and food waste based on your anticipated actions/experience. As with the questions above, there are no right or wrong answers.

SECTION 6:

Food Waste Diversion

Based on your anticipated actions/experience, please identify the degree to which you agree with each of the following statements on green bins and food waste. There are no right or wrong answers.

	DISAGREE				AGREE		
Please fill/check ONE box per row:	Strongly disagree						Strongly agree
6.1 I am in favour of having a green bin program in my city.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
6.2 I am looking forward to the implementation of London's upcoming green bin program.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
6.3 An extra average of $25 per year per household in taxes is not too much to fund a green bin program.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
6.4 Food waste that can go in a green bin will always end up in my household garbage whether or not my household has a green bin.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐

SECTION 7:

Convenience

Based on your anticipated actions/experience, please identify the degree to which you agree with each of the following statements on green bins and food waste. There are no right or wrong answers.							
	DISAGREE				AGREE		
Please fill/check ONE box per row:	Strongly disagree						Strongly agree
7.1 I have enough time to sort my food waste and put it into a green bin.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
7.2 I have enough space in my kitchen to separately store food waste, prior to taking it to a green bin.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
7.3 I would be concerned about storing separated food waste in my kitchen because I am concerned that the odour might be annoying.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
7.4 I would be concerned about storing separated food waste in my household because I am concerned that the pests and insects might be annoying.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
7.5 I have enough space in my garage or beside my house to store a green bin.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐

SECTION 8:

Green Bin Norms

Based on your anticipated actions/experience, please identify the degree to which you agree with each of the following statements on green bins and food waste. There are no right or wrong answers.							
	DISAGREE				AGREE		
Please fill/check ONE box per row:	Strongly disagree						Strongly agree
8.1 I feel green bins have no direct benefit to people.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
8.2 I feel that having a green bin causes people to discard more food.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
8.3 I feel that using the green bin is the right thing to do.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
8.4 Through their actions or words, people close to me suggest I should use the green bin.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
8.5 People should not feel guilty when they throw out food waste that is or was edible (as opposed to inedible food such as vegetable peelings, eggshells, coffee grounds etc.) into a green bin.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
8.6 People should not feel guilty when they throw out food waste that is or was edible (as opposed to inedible food such as vegetable peelings, eggshells, coffee grounds etc.) into the garbage.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐

SECTION 9:

Environmental Impact

Based on your anticipated actions/experience, please identify the degree to which you agree with each of the following statements on green bins and food waste. There are no right or wrong answers.							
	DISAGREE				AGREE		
Please fill/check ONE box per row:	Strongly disagree						Strongly agree
9.1 Food waste should be banned from Ontario landfills	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
9.2 Food waste is a serious environmental issue we must solve.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
9.3 Green bin is good for the environment.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
9.4 Green bin diverts food waste from the landfill.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
9.5 Green bin reduces greenhouse gas emissions (e.g. methane and carbon dioxide) from the landfill.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐

SECTION 10:

Home/backyard composting

Based on your actual or anticipated actions/experience, please identify the degree to which you agree with each of the following statements on home composting and food waste, remembering that you can home compost things such as leftovers and fruit & vegetable waste but not meats, dairy and fats.		
Please fill/check ONE box per row:	Yes	No
10.1 I have a home composter into which I put food waste (e.g., fruit and vegetable trimmings)	☐	☐

Based on your actual or anticipated actions/experience, please identify the degree to which you agree with each of the following statements on home composting and food waste, remembering that you can home compost things such as leftovers and fruit & vegetable waste but not meats, dairy and fats.							
	DISAGREE				AGREE		
Please fill/check ONE box per row:	Strongly disagree						Strongly agree
10.2 People should home compost their food waste (e.g., fruit and vegetable trimmings) if there is an option to.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
10.3 If I had access to both a home composter and a green bin, I would put all my food waste in the green bin.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐

SECTION 11:

Knowledge

Based on your anticipated actions/experience, please identify the degree to which you agree with each of the following statements on green bins and food waste. There are no right or wrong answers.

	DISAGREE				AGREE		
Please fill/check ONE box per row:	Strongly disagree						Strongly agree
11.1 My city can do a better job of educating people about reducing food waste	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
11.2 Being educated on food waste reduction before implementing a green bin program is useful.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
11.3 Knowing that each London household throws out $450-$600/year of food waste, with a city-wide value of $80-$100 million/year would help motivate our household to reduce their food waste.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐

Please fill/check ONE box per row:	Text/SMS	Newspaper/radio ad	Email/ newsletter	Online/ website	Community events/open house	I do not need any information
11.4 I would prefer to receive information on food waste reduction and the green bin program via:	☐	☐	☐	☐	☐	☐

SECTION 12:

Contextual Questions

Please tell us a little about your food purchase and preparation responsibilities as well as your waste management responsibilities:					
Please fill/check ONE box per row:	Never	Seldom	About 50/50	Often	Always
12.1 To what extent are you responsible for the food shopping in your household?	☐	☐	☐	☐	☐
12.2 To what extent are you responsible for the cooking and preparation of food in your household?	☐	☐	☐	☐	☐
12.3 To what extent are you responsible for taking out the waste and placing it at the curb for your households?	☐	☐	☐	☐	☐

Please tell us a little about your food purchase and preparation responsibilities as well as your waste management responsibilities:							
Please fill/check ONE box per row:	0%	1-20%	21-40%	41-60%	61-80%	81-100%	Not applicable
12.4 Currently in your household, what % of food waste goes into your garbage	☐	☐	☐	☐	☐	☐	☐
12.5 In your household, what % of food waste currently goes into your composter	☐	☐	☐	☐	☐	☐	☐

SECTION 13:

Socio-Demographic

Please fill/check ONE box per row:

What is your sex?

Male	Female	Other
☐	☐	☐ _____

What is your age

18-24	25-34	35-44	45-54	55-64	65+
☐	☐	☐	☐	☐	☐

What is your postal code (e.g. A1A 1A1)?

_____

In what type of housing do you live?

Detached/Semi Detached House	Townhouse	Other – Please specify
☐	☐	☐ _____

What is your housing status?

Own home outright	Live with family or friends rent free	Pay mortgage	Pay rent	Other – Please specify
☐	☐	☐	☐	☐ _____

How many people live in your household?

1	2	3	4	5	6+
☐	☐	☐	☐	☐	☐

What is your highest degree or level of education?

High school certificate	College diploma	Bachelor's degree	Master's degree	Doctorate degree	Other – Please specify
☐	☐	☐	☐	☐	☐ _____

Please select one category that best describes your employment status?					
Unemployed	Student	Stay at home parent	Work part-time	Work full-time	Retired
☐	☐	☐	☐	☐	☐
What is your before tax annual household income					
Under $40,000	$40,001-$60,000	$60,001-80,000	$80,001-$100,000	$100,001-$120,000	$120,001 or greater
☐	☐	☐	☐	☐	☐

What is your ethnic group do you identify with?							
White	Latino or Hispanic	Black	East Asian	South Asian	Indigenous	Middle Eastern	Prefer not to say
☐	☐	☐	☐	☐	☐	☐	☐

End of Block

Thanks for completing the survey! Please provide your name and email address to contact you if you are prize winner.

Name (print clearly):

***Email address (print clearly)**:*

Once you have finished all the questions, please place the completed questionnaire in the enclosed postage-paid envelope and drop it off at the nearest Canada Post pick-up location at your convenience.

APPENDIX B

Sociodemographic Data

Sociodemographic variables of all survey respondents (s) and provincial (Ontario) data (p)

Gender	S	P	People in household	S	P	Income*	S	P	Housing Type	S	P
Female	69.8	51.2	1	14.4	25.9	<$40,000	10.9	24.8	Detached/semi-detached	81.4	59.9
Male	30.2	48.8	2	43.9	32.8	$40-60,000	14.7	15.4	Townhouse	12.2	10.1
Other	-	-	3	16.9	16.1	$60-80,000	15.2	13.5	Other	6.4	30.0
			4	16.9	15.4	$80-100,00	18.4	11.5			
			5	5.4	9.7	$100-120,000	10.3	10.8			
			6+	2.5	-	>$120,001	30.5	24			
Age			**Ethnicity**			**Employment status**			**Housing tenure**		
18-24	2.0	9.2	White	83.9	-	Unemployed	1.5	-	Live rent free	1.5	-
25-34	10.0	12.9	Latino	0.5	-	Student	1.5	-	Pay rent	7.8	-
35-44	14.6	12.7	Black	0.8	-	Stay at home parent	2.5	-	Pay mortgage	35.2	-
45-54	18.0	14.8	East Asian	3.5	-	Work part-time	8.5	-	Own home outright	54.8	-
55-64	23.6	13.6	South Asian	2.3	-	Work full-time	50.4	-	Other	0.7	-
65+	31.8	16.7	Indigenous	0.5	-	Retired	35.6	-			
			Middle Eastern	0.3	-						
			Prefer not to say	8.3	-						

***** Stats Canada group break was $100,000-$124,999 and >$125,000

Sociodemographic variables of London respondents (s) and city population data (p)

Gender	S	P	People in household	S	P	Income*	S	P	Housing Type	S	P
Female	69.4	51.6	1	13.8	32.0	<$40,000	12.2	30.7	Detached/semi-detached	77.2	53.3
Male	30.6	48.4	2	42.2	33.9	$40-60,000	17.3	17.7	Townhouse	14.8	10.3
Other	-	-	3	17.8	14.7	$60-80,000	15.7	14.0	Other	8.0	36.4
			4	17.3	12.5	$80-100,00	16.2	10.8			
			5	6.7	6.9	$100-120,000	8.1	9.4			
			6+	2.2		>$120,001	30.5	17.4			
Age			**Ethnicity**			**Employment status**			**Housing tenure**		
18-24	2.3		White	86.4	-	Unemployed	2.3	-	Live rent free	1.8	-
25-34	9.0	14.2	Latino	0.9	-	Student	0.9	-	Pay rent	5.4	-
35-44	14.0	12.2	Black	0.4	-	Stay at home parent	2.7	-	Pay mortgage	34.8	-
45-54	16.2	14.5	East Asian	0.5	-	Work part-time	7.7	-	Own home outright	57.6	-
55-64	23.4	13.2	South Asian	0.9	-	Work full-time	49.5	-	Other	0.4	-
65+	35.1	16.6	Indigenous	0.4	-	Retired	36.9	-			
			Middle Eastern	0.5							
			Prefer not to say	10.0							

* Stats Canada group break was $100,000-$124,999 and >$125,000

Sociodemographic variables of Kitchener-Waterloo respondents (s) and city population data (p)

Gender	**S**	**P**	**People in household**	**S**	**P**	**Income***	**S**	**P**	**Housing Type**	**S**	**P**
Female	70.2	50.6	1	15.2	24.5	<$40,000	9.3	22.2	Detached/semi-detached	86.7	61.3
Male	29.8	49.4	2	46.1	33.3	$40-60,000	11.3	15.6	Townhouse	8.9	13.1
Other	-	-	3	15.7	16.6	$60-80,000	14.6	14.0	Other	4.4	25.6
			4	16.3	16.3	$80-100,00	21.2	12.3			
			5	3.9	9.3	$100-120,000	13.2	11.9			
			6+	2.8	-	>$120,001	30.5	24.0			
Age			**Ethnicity**			**Employment status**			**Housing tenure**		
18-24	1.7	10.1	White	80.9	-	Unemployed	0.6	-	Live rent free	1.2	-
25-34	11.3	14.0	Latino	0	-	Student	2.3	-	Pay rent	10.8	-
35-44	15.3	13.3	Black	1.1	-	Stay at home parent	2.3	-	Pay mortgage	35.8	-
45-54	20.3	14.5	East Asian	7.3	-	Work part-time	9.6	-	Own home outright	51.1	-
55-64	23.7	12.5	South Asian	3.9	-	Work full-time	51.3	-	Other	1.1	-
65+	27.7	14.5	Indigenous	0.6	-	Retired	33.9	-			
			Middle Eastern	0							
			Prefer not to say	6.2							

* Stats Canada group break was $100,000-$124,999 and >$125,000

APPENDIX C

Data Analyses

Pearson correlation analysis with green bin support and predictor variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Green bin support	1														
2. Frequency of food wasting per household	.174***	1													
3. Portions of food wasting per household	.155***	.793***	1												
4. Personal norms[2i]	.167***	-.105*	-.081	1											
5. Good provider identity[5i]	.197***	.172***	.173***	.136**	1										
6. Household planning habits[5i]	.098*	-.079	-.098*	.189***	.008	1									
7. Convenience[5i]	.610***	.022	-.033	.123**	.004	.110*	1								
8. Green bins norms[4i]	.639***	.002	.018	.280***	.160***	.105*	.595***	1							
9. Environmental impact[5i]	.628***	.001	.010	.282***	.122**	.117**	.495***	.569***	1						
10. I feel people waste more when there is a green bin	-.364***	-.058	-.095	-.027	.046	.004	-.451***	-.366***	-.314***	1					
11. Prefer green bin to garbage	.506***	.021	.051	.081	-.036	.112*	.533***	.488***	.461***	-.334***	1				
12. People should compost when possible	.014	.045	.089*	.056	.065	.045	-.052	.022	.086	.049	.064	1			
13. Prefer composter to green bin	-.313**	-.028	-.009	-.086	-.112*	-.070	-.199***	-.191***	-.286***	.226***	-.139**	.314***	1		
14. Better education from city	.182***	.177***	.195***	.114*	.101*	.107*	.029	.178***	.268***	-.060	.079	.234***	-.057	1	
15. Food waste education is useful for green bin	.339***	.010	.011	.162***	.115*	.086	.284***	.336***	.326***	-.122**	.176***	.057	-.147**	.335***	1

*p<0.05, **p<0.01, ***p<0.001

Pearson correlation analysis of green bin support and socio-demographic variables

	1	2	3	4	5	6	7	8	9
1. Green bin support	1								
2. Age	-.208***	1							
3. Housing type	-.032	.073	1						
4. Housing tenure	.129**	-.478***	.154***	1					
5. Household number	.156***	-.347***	-.184***	.139**	1				
6. Education	.048	-.187***	-.063	.060	.122**	1			
7. Employment	.200***	-.559***	-.144**	.179***	.249***	.170***	1		
8. Income	.146**	-.289***	-.311***	-.100*	.258***	.286***	.434***	1	
9. Ethnicity	-.107*	.011	.008	.064	.041	.035	-.014	-.012	1

*p<0.05, **p<0.01, ***p<0.001

Linear regression model for green bin support

	B	SE	β
(Constant)	0.993	1.207	
Self-reported food wasting frequency	0.070	0.026	0.087**
Personal norms	-0.123	0.055	-0.075*
Good provider identity	0.062	0.028	0.059
Convenience	0.170	0.026	0.311***
Norms favouring green bin use	0.212	0.037	0.274***
Concern for environmental impact	0.181	0.031	0.263***
Prefer composter to green bin	-0.226	0.068	-0.104**
Food waste education is useful for green bin program	0.300	0.119	0.078*

Age	-0.268	0.102	-0.076**
Model statistics	$R^2 = 0.64$, F (9,624.356) =78.429, p<0.001		

*p<0.05, **p<0.01, ***p<0.001

Linear regression model for green bin support in London

	B	SE	β
(Constant)	-2.740	1.431	
Self-reported food wasting portions	0.095	0.036	0.094
Personal norms	-0.274	0.073	-0.144**
Good provider identity	0.158	0.040	0.146**
Convenience	0.183	0.038	0.244**
Norms favouring green bin use	0.240	0.038	0.244**
Environmental impact	0.294	0.042	0.366**
Prefer green bin to composter	-0.182	0.094	-0.075
Food waste education is useful for green bin program	0.348	0.150	0.088*
Model statistics	$R^2 = 0.71$, F (8,612.899)=71.663, p<0.001		

*p<0.05, **p<0.01, ***p<0.001

Linear regression model for green bin support in Kitchener-Waterloo

	B	SE	β
(Constant)	4.961	1.184	
Convenience	0.201	0.029	0.395**
Norms favouring green bin use	0.138	0.045	0.180**
Concern for environmental impact	0.154	0.034	0.258**
Model statistics	$R^2 = 0.43$, F (3,394.731)=51.315, p<0.001		

*p<0.05, **p<0.01, ***p<0.001

APPENDIX D

Ethics approval form

Western Research

Date: 21 April 2020

To: Dr. Jason Gilliland

Project ID: 108899

Study Title: Determining current household food wasting intentions and its impact on self-reported household food wasting behaviour.

Application Type: NMREB Amendment Form

Review Type: Delegated

Full Board Reporting Date: June 5 2020

Date Approval Issued: 21/Apr/2020

REB Approval Expiry Date: 27/Mar/2021

Dear Dr. Jason Gilliland,

The Western University Non-Medical Research Ethics Board (NMREB) has reviewed and approved the WREM application form for the amendment, as of the date noted above.

Documents Approved:

Document Name	Document Type	Document Date	Document Version
Green Bin NM 10015639 Protocol 13022020 clean	Protocol		
GreenBin_Survey_DraftV13	Paper Survey	05/Mar/2020	1
GreenBin_Survey_KW_DraftV3	Paper Survey	05/Mar/2020	1
LOI_Ethics_Clean_Version2	Implied Consent/Assent	23/Mar/2020	2

REB members involved in the research project do not participate in the review, discussion or decision.

The Western University NMREB operates in compliance with the Tri-Council Policy Statement Ethical Conduct for Research Involving Humans (TCPS2), the Ontario Personal Health Information Protection Act (PHIPA, 2004), and the applicable laws and regulations of Ontario. Members of the NMREB who are named as Investigators in research studies do not participate in discussions related to, nor vote on such studies when they are presented to the REB. The NMREB is registered with the U.S. Department of Health & Human Services under the IRB registration number IRB 00000941.

Please do not hesitate to contact us if you have any questions.

Sincerely,

Kelly Patterson, Research Ethics Officer on behalf of Dr. Randal Graham, NMREB Chair

Note: This correspondence includes an electronic signature (validation and approval via an online system that is compliant with all regulations).

APPENDIX E

Curriculum Vitae

Ladele Tomi

Education

Western University, London

MSc, Geography 2018 - 2020

Western University, London

Honours Specialization in Environmental Science 2016 - 2018

Centennial College, Toronto

Advanced Diploma in Environmental Science 2013 - 2016

Work Experience

Western University – Teaching Assistant 2018 – 2020

- Courses TAed: Geo 1400, Geo 2011, Geo 2152 and Geo 3432

Volunteer Experience

Go Wild Grow Wild Green Expo April 2017 – April 2019

Thames Region Ecological Association (TREA) July 2017 – August 2018