The Real Reasons Why Composting on Campus is So Hard

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Abstract

Canadians generate an excessive amount of waste that is deposited in landfills, resulting in detrimental effects to the environment and human health. To effectively manage waste and decrease the amount that is sent to landfills, it is essential to divert waste through recycling and composting efforts. Reducing waste at the source is another essential component of waste reduction. The waste management practices at McMaster University possess the potential to positively impact Ontario's ecological footprint if effective programs are implemented. Enhancing composting initiatives by incorporating data-driven decisions can facilitate a more sustainable campus that aligns with the United Nations Sustainable Development Goals (SDGs). The purpose of this study was to analyze the current composting system on McMaster's campus via surveys and waste audit analysis, and to establish an improved composting system to increase diversion rates from the garbage stream. To examine variation in waste categories, including non-recyclable and organic waste, McMaster's Solid Non-Hazardous Waste Audits from 2019 and 2022 were analyzed and compared. The findings indicate that organic waste in the garbage stream decreased in 2022 compared to 2019. However, no changes to organic waste management have been implemented on campus within that period, indicating that the decrease may be due to alternative reasons such as the COVID-19 pandemic. To gauge the perception of students, faculty, and staff towards composting on campus, a survey was administered to many more, but 200 responded. The consensus among the respondents was that additional compost bins were required to improve composting on campus. Changes were implemented based on the findings from a first survey through collaboration with Facility Services and the McMaster Student Union. A second survey was given to the first pool of participants to evaluate the perception of

the changes. Approximately 30% of the returning participants notice changes, highlighting the logistical challenges of improving waste management in a large institution such as a university.

Introduction

The global community is currently grappling with the ongoing human disaster of climate change, which has been estimated to have started in the mid-20th century due to human activity on the planet (NASA, 2022). The industrial revolution, with its boundless growth and greenhouse gas emissions, is a major contributor to climate change. Greenhouse gases trap heat in the atmosphere due to their molecular structure (Kweku et al., 2018). As the use of fossil fuels for energy has increased, greenhouse gas emissions have also increased. These emissions contribute to a warming planet, which leads to extreme weather events such as hurricanes, floods, droughts, and forest fires (Francis, 1998). Canada has already experienced catastrophic events, such as forest fires in British Columbia and Hurricane Fiona in Eastern Canada, demonstrating the urgent need for action to address this global emergency.

Canada generates the most waste of any other country, producing an estimated 1,325,480,289 metric tons of waste annually (Sebastian, 2022). Much of this waste ends up in landfills, which can have negative environmental impacts and pose health risks. Even organic waste emits greenhouse gases when left in landfills, but it can be used as fertilizer for various purposes if properly composted (Kamyab, 2015). Organic waste placed in landfill produces methane gas (Havran , 2011), whereas the same organic waste placed in the compost significantly reduced these emissions. Therefore, it is essential to divert organic waste from landfills and utilize it in other ways.

McMaster University has had a consistent student population since 2019, with approximately 31,500 undergraduate students, 4,900 graduate students, 1,050 full-time

instructional faculty members, and other individuals regularly using the facilities on campus (Get to know McMaster, 2022). At the beginning of 2022, the campus has thirteen publicly facing compost bins, which may not be sufficient to support the thousands of individuals regularly on campus. The purpose of this study was to (1) determine trends in waste diversion rates since 2019, by comparing waste audits, (2) identify the key obstacles faced by McMaster students, faculty, and staff when composting on campus, (3) consider these obstacles into an improved composting system on campus, and (4) assess the effectiveness of the changes implemented and promote a discussion for future goals and initiatives.

Within peer-reviewed literature, there have been very few studies asking about barriers that University students face when composting on campus, and none specifically on McMaster University students. This study aims to fill this knowledge gap to inform waste management decision-makers at McMaster University. This study was done in collaboration with Facility Services and McMaster Student Union so that they could leverage the data, make change and assess the impacts. As such, this study aims to create real change and provide evidence for others to do so as well.

Methods

Two online surveys were carried out in conjunction with an analysis of the Solid Non-Hazardous Waste Audits conducted at McMaster University in 2019 and 2022 as well as some observational studies by the primary researcher. Before any survey data was collected an ethics application was sent to and reviewed by the McMaster University Research Ethics Board. The first and second surveys were not made available to participants until ethics clearance was given. Each participant was presented with a formal letter of information, the knowledge that the survey had been approved by the McMaster University Research Ethics Board and was asked to

consent to take the survey. If participants did not take the survey, they were directed to the end of the survey and thanked for their time.

Survey Methods

The first survey aimed to shed light on the primary obstacles experienced by students, faculty, and staff of McMaster University when it comes to composting on campus. The survey was made available to all undergraduate, graduate, and Ph.D. students as well as faculty and staff members at the university. The first survey consisted of two scale questions that gauged participants' frequency of composting at home and on campus, two ranking questions that asked respondents to rank the main challenges they encountered when composting on campus and to rank the possible locations for new compost bins, and an open-ended question that invited participants to share any feedback or suggestions regarding compost management on campus.

As an effort to increase engagement, an incentive was provided for participants, whereby after completing the survey they would be eligible to win a free McMaster hoodie of their choice. The survey was also designed to be as short as possible while still providing essential information to increase participation. The first survey was available for the month of November 2022 and was promoted through social media, verbal recruitment, promotion in a McMaster Daily News article, and professor sharing.

The second survey was sent to willing participants from the first sample which consisted of sixty-one participants. The second survey had the same hoodie incentive and short length to increase participation. This survey was delivered after changes were implemented on campus based on the first survey. The purpose of this survey was to determine the perception of the changes. Participants were asked if they noticed any changes, which changes they noticed, and

were given an open-ended question asking them to share any comments or suggestions for composting on campus moving forward.

Percentile analysis was used for both survey results to determine percentages of participants who compost at home versus on campus, for the first survey, and which proportion of the sample noticed changes in the second survey. For the two ranking questions in the first survey, the mean average was calculated to determine the primary barriers and which locations participants most recommended. For the two open-ended questions at the end of each survey, an NVivo analysis was performed, whereby responses were coded and grouped together based on their contents to create categories of similar ideas/content (Edwards-Jones, 2014). For example, any response which suggested more visible compost bins or more education would have been grouped together or coded to quantify the qualitative data.

The choice to not collect descriptive data on the participants provided the project with a simplistic outlook and it also fosters increased participant engagement. Having a short simple questionnaire increases the number of willing participants as well as increases the completion rate of the survey. Some limitations of not collecting descriptive data however are not being able to categorize the data by sample democratic. Another potential limitation of the survey data is response bias. A portion of the participant recruitment effort was targeted toward students in environmental sciences and sustainability courses therefore it is likely that this bias would have skewed the data. This sampling effort also would have caused a sampling bias as the participant demographic will not accurately represent the McMaster community as an entirety. Another potential limiting agent is social desirability bias (Krosnick, Narayan, & Smith, 1996). This phenomenon occurs when participants answer in a way that they believe to be socially acceptable

and or desirable. Another limitation of the survey sample size is that it can be contested to not be a representative sample of the population, being the McMaster community.

Waste Audit Methods

The Solid Non-Hazardous Waste Audit was conducted by the Waste Reduction Group Incorporated (WRG) for McMaster in 2019 and again in 2022. For this waste audit, auditors came to the university's campus and audit their garbage stream. A select number of buildings are determined prior to the audit to ensure a sample is collected from each significant building type such as library, residence building and administrative buildings, etc. for a representative simple. When the 2019 waste audit was performed for McMaster, the John Hodgins Engineering Building, the Burke Science Building, Hamilton Hall, Les Prince Residence North and South side, Mills Library, and McMaster University Student Center were the buildings that were audited. For the 2022 waste audit, the John Hodgins Engineering Building, the Burke Science Building, the General Science Building, Hedden Hall, Woodstock Hall, Mills Library, and McMaster University Student Center. To maintain consistency the WRG sampled the same building as 2019 in 2022 when possible. On the day of the 2022 audit, waste from the garbage stream is weighed and sorted into the following categories: mixed papers, non-recyclable, paper towels, mixed containers, cardboard, coffee cups, cold beverage cups, low-density polyethylene LDPE plastic films, organic waste, PPE and other. Each category is weighed, and the percentage is proportional to its weight.

Some limitations to this sampling method are a human error as well as the potential for inaccurate representative data. When the Waste Reduction auditors weigh, count, and sort waste, human error can occur at varying levels at each of these steps. Another potential limitation of the waste audit sampling methods is that there is the potential that external factors may result in a

sample not being representative of the entire school's waste, however taking representative samples is a common practice that is more time and cost-efficient and is widely accepted within the scientific community (Sharma, 2017).

Results

First Survey

The first survey was based on a sample size of 200 participants. It was found that 23% of participants composted at home and 73% of participants composted on campus. Participants ranked the main barriers to composting in the following order in order of importance:

1. There aren't enough compost bins
2. I don't know where the compost bins are located
3. I didn't know there were compost bins
4. I don't know what can and can't go in the compost bin
5. I don't care to compost

Average rankings from each response:

1.866	There aren't enough compost bins
2.275	I don't know where the compost bins are located
2.435	I didn't know there were compost bins
3.237	I don't know what can and can't go in the compost bin
4.556	I don't care to compost

Table 1. Average ranking barriers from survey #1

Participants also ranked the ideal locations of a new compost bin as follows, in order of importance,

1. dining area
2. residence buildings
3. outdoor bins

4. Library
5. classrooms,
6. Other
7. we don’t need more compost bins

Average ranking from each response:

1.723	Dining Area
2.81	Residence buildings
3.175	Outdoor bins
4.012	Library
4.089	Classrooms
5.563	Other
6.373	We don't need more

Table 2. Average ranking of locations from survey #1

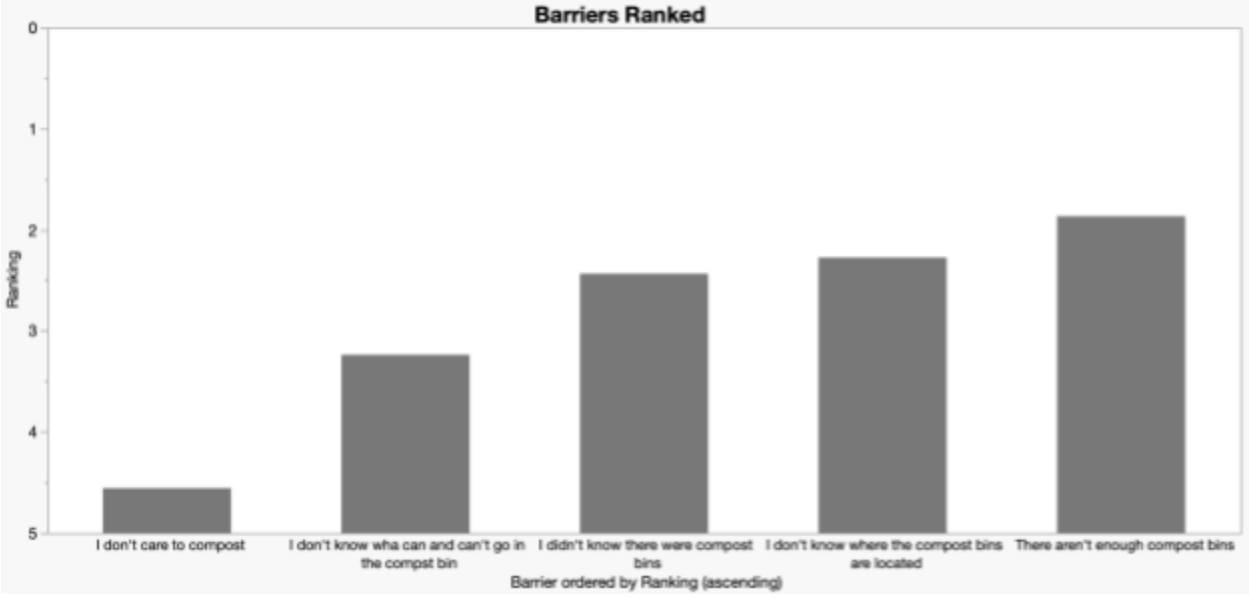

Figure 1. Results of ranking barriers survey question on an inverse Y axis for improved interpretation

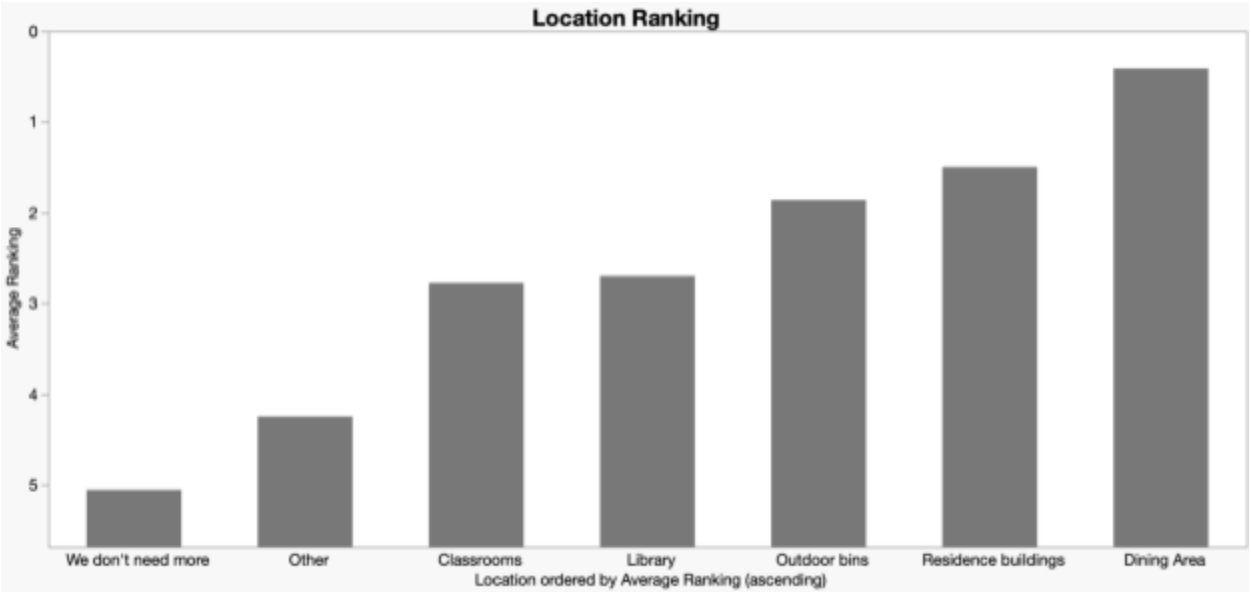

Figure 2. Results from location survey question on the inverse y-axis for improved visual interpretation

Open Ended Question

For the open ended question, 48 participants mentioned suggested locations, 17 of which mentioned a further emphasis on compost bins in the dining area, 10 participants mentioned increased and improved signage would be useful, 8 participants suggested improved visibility of compost bins would be beneficial, 5 participants suggested increased awareness of compost bins and composting practices across campus would help, 6 participants suggested an interactive map would be useful, and 13 participants further emphasized the importance of more compost bins on campus. Based on these findings, a collaborative effort between this project, Mcmaster's Facility Services, and McMaster's Student Union completed an interactive map of the compost bins on campus, implemented clearer more eye-catching and visible signs (Figure 4), and implemented a pilot project of compost bins in the washrooms in the Michael G. DeGroote Centre for Learning and Discovery (MDCL) building washrooms for paper towels.

Second Survey

The second survey had a sample size of sixty-one participants, which was a subset of the first survey sample size. 69% of the participants said that they did not see any changes made to composting practices on campus and 31% of participants said that they did see changes to composting on campus. Some of the perceived changes were more visible and clear compost bins and the recognition of the new compost bins in the MDCL washrooms. The responses to the open-ended question suggested that participants still did not see sufficient compost bins on campus. Some participants also mentioned the importance of waste reduction efforts which will be further discussed in the discussion portion of this paper.

Waste Audit Analysis

The primary focus of the analysis for the waste audit was to consider the percentage of organic matter (compost) ending up in the garbage stream. In 2019, based on the Solid Non-Hazardous Waste Audit, 21.5% of waste in the garbage stream was found to be organic waste. In 2022, based on the Solid Non-Hazardous Waste Audit, 3.5% of the waste found in the garbage stream was the organic matter and 11% of waste was paper towels which is also compostable material. The total waste audit measured 2,396 metric tonnes of waste and 1,295 metric tons of waste in 2019 and 2022 respectively.

Discussion

The study's goal was to determine the main barriers facing the McMaster community's ability to compost on campus. Through survey data, it was found that participants' perception of the problem was that there were not enough publicly facing compost bins on campus in high-traffic areas such as residence buildings and eateries. Through collaborative efforts with Facility Services and the Student Union, it was made clear that implementing change is complex

and requires considerable financial and logistic considerations. Another challenge that was highlighted in this project was the challenges that come with decentralized authority. Having consistency across campus is key for improving engagement however, as with many large institutions, different departments manage different buildings. At McMaster, the hospital, the residence buildings, the student center, IAHS and the rest of the buildings' waste is managed by different agents, therefore implementing consistent change proved to be difficult if even possible. Based on the portion of participants who compost at home compared to on campus, the perception is that campus is a more accessible environment to compost than at the participants' residency. The reduction in the amount of organic waste going into the landfill from 2019 to 2022 is promising, however, it is important to keep in mind, the waste audit categorized paper towels in a separate category from organic waste. This is compostable matter as well and had these categorize been combined, it would have been found that approximately 14.5% of matter in the garbage stream was organic matter.

Based on the second survey findings, the implemented changes were not widely recognized, highlighting either the need for more promotion of the changes, a lack of magnitude of the changes, or a lack of awareness from the McMaster community. Although the results of this study suggest that more compost bins might be required to improve composting engagement, this does not address the issue of contamination. Ongoing concerns over contamination in recycling and compost streams are being faced by many institutions (Hottle et al.,2015). Despite waste facility corporations having established thresholds for contamination, exceeding them can result in the unfortunate practice of discarding otherwise recyclable or compostable materials in the garbage stream, which is not sustainable. It was observed that after the implementation of changes based on the first survey that contamination remained a prevailing challenge to

composting. (Figure 3). Based on the first survey data, this challenge is not widely recognized by participants, which further complicates the dilemma. If the perception is that the main barrier is the number of compost bins on campus, but the true problems go far beyond this, perhaps a different approach is required to address them.

Following the first survey, efforts were made to collaborate with Facility Services and the Student Union to put more compost bins on campus. There was some pushback from Facility Services seeing as a key challenge for them is the contamination in the compost bins and putting more bins will not solve this issue and will likely only exacerbate it.

Figure. 3 Contamination of plastic in a compost bin on McMaster campus.

Based on this realization, efforts were then made in collaboration with Facility Services to try to address contamination issues by improving signage clarity, uniformity, and visibility. The creation of these signs proved to be a challenge as well. Existing compost signage had

outdated and incorrect information, which was a primary focus of the amendments to the new signage. A simplistic sign that demonstrated what could go in the compost bins and that shared a map of where the compost bins are all located was the desired outcome. This task however proved to be challenging as well due to the inconsistencies of products across campus. Hospitality Services introduced compostable utensils, food containers, and coffee cups; however, this is not uniform across campus with other non-hospitality services vendors such as Tim Hortons, Second Cup, Starbucks, Paramount, Chopped Leaf, Booster Juice, The Grind, Williams Cafe and Pizza Pizza. There were also coffee cups that looked compostable and very similar to Hospitality services coffee cups but that were lined in very thin plastic making them garbage as well. This made it challenging to introduce signage that was clear to the McMaster community seeing as only some containers, utensils, and coffee cups are compostable while the others are garbage. Ultimately, a decision was made to make the signage as simple as possible to only include food scraps, napkins and paper towels, and paper takeout containers (Figure 4).

Figure 4. Implemented compost bin signage after the first survey

Only incorporating three basic compostable materials on the compost signage was a difficult decision to make because it discredits all of the compostable items that Hospitality Services have provided to the McMaster community. To open the signage effort to become more dynamic and better reflect changes on campus, signs were made from recyclable paper, rather than thick plastic signage, to make for easy changes in the signs' contents. While this might not seem sustainable in theory, by having planned obsolescence, this complex issue requires the system to remain flexible and open to change to reflect an improving campus community and waste management system.

After the challenges of the lack of uniform compostable items on campus were realized, efforts were made in collaboration with the Student Union to introduce compostable options at the Grind. This does not address the issue regarding non-compostable or recyclable coffee cups from Tim Hortons or Starbucks, however, it is a first step towards a more uniform and simple waste system. Suggestions were provided to The Grind to reach out to Hospitality Services' coffee cup providers to piggyback on their existing orders, obtain compostable coffee cups, and potentially cut costs. This proved to be a complicated task seeing as The Grind has a large stock of existing non-compostable, plastic, and styrofoam coffee cups collected over the years that should not go to waste. Those in the positions of power to introduce compostable coffee cups in The Grind were also limited temporally, which highlights the challenge with sustainable efforts in relation to short office terms. While the MSU president was a collaborator on the project, the limitation of his power for effecting long-term changes became apparent due to the impending end of his office term.

It is clear that improving diversion rates from the garbage stream into the compost stream is a highly complex issue. Addressing the multi-scaled challenges that composting on the McMaster campus faces is far more elaborate than what was originally foreseen by this project. There is a clear disconnect between participants' perceptions of the issues and back-of-house issues that persist. Some of the obstacles faced by this project are listed but are not limited to, supply chain issues, and different supplies which lead to inconsistencies of compostable materials across campus, limited power timelines with student government, decentralization of waste management on campus, and contamination. These are all factors that the first survey did not account for or foresee. Moving forward, in future studies to address this complex issue, survey questions should reflect these obstacles. Additionally, efforts might also be better places in addressing the issues back-of-house seeing as the perception of the issues by the average student, faculty member, or staff member does not and cannot grasp the true complexities.

This research project aimed to close the knowledge gap of what limits the McMaster communities' ability to compost on campus. The findings of this project seem to have broadened the issues and make the knowledge gap even larger. Although this might seem like an unsuccessful project, it is the contrary. Due to this project, new challenges and obstacles that must be addressed have been brought to light. This project has brought these challenges to the conversation and is a critical component of sustainable development. The path toward a sustainable future is nonlinear and dynamic. Bold decisions need to be made to address the climate crisis and projects such as these only help to foster new developments and bring forward courageous voices at the decision-making table.

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