

Industrial, Commercial, Institutional (ICI), and Retail Mattress
Disposal Study in Nova Scotia

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Executive Summary

Approximately 95,000 mattresses end up in Nova Scotia landfills annually, causing many issues for waste management facilities overseen by municipalities. This paper presents new data on an under-researched area of mattress disposal by interviewing industrial, commercial, and institutional (ICI) generators and retailers in the province of Nova Scotia. This study finds the vast majority of mattresses being disposed of in Nova Scotia come not from businesses but rather from consumers. Furthermore, findings show that businesses and organizations are overwhelmingly in favour of a diversion program for mattress disposal in the province, and are willing to pay <more> for current disposal methods.

1. Introduction

Demand towards a greener future from the general public, politicians, and policy makers is resulting in a cultural shift allowing us to address key environmental issues. These issues, especially in waste reduction and diversion, are of critical importance if provincial stakeholders intend to reach their environmental goals in a sustainable way. One such issue involves the disposal of mattresses. Mattresses are problematic for Nova Scotia Landfills and with almost 100,000 disposed of annually, it is a problem that is not going away (Halifax C&D Recycling Ltd., 2009). In Nova Scotia, there are no regional facilities available to process and/or recycle mattresses, which means mattresses either continue to pile up in landfills or are shipped to Quebec for recycling (Dillon Consulting, 2019). The mattresses that do end up in landfills encumber facilities in the province since they are large items that are difficult to compact.

Furthermore, their material components frequently pose a risk in damaging heavy machinery within landfills (Russell, 2019). These qualities result in items that use large amounts of space that strain time and resources for waste facilities.

Although a mattress is comprised of approximately 95% recyclable material, the process of extraction is not cost-effective (Island Waste Management Corporation, 2018). Not only does this deter economic interest from recycling, but it also hinders the efficiency of recycling within the province. Attempts have been made in the private sector to remedy the situation, such as the case in 2015 when a Quebec entrepreneur started a business in the region which dismantled mattresses and sold the materials (K. Laskow-Pooley, personal communication, October 2019). After four months he closed the business and determined that it was not viable unless regulations were enacted to place a ban on mattresses being sent to landfills (K. Laskow-Pooley, personal communication, October 2019). Additionally, Dillon Consulting was approached by the municipality of Cumberland County to help address assess the situation in 2018. Their in-depth report provided valuable information; however, the scope of the study was to be exclusive to landfill sites in Nova Scotia (Dillon Consulting, 2019). As a result, this research will expand the scope of Dillon Consulting (2019) to new and relevant data.

The purpose of this research project is to identify all of the active businesses and organizations in the mattress market and estimate their impact on mattress disposal within Nova Scotia. This is achieved by taking a similar approach to the report by Dillon Consulting (2019) and expanding their scope beyond municipal

landfills. This new information will be used to provide insight to stakeholders and government officials in the mattress industry for potential policy efforts in the future. Whether that be a processing facility in Nova Scotia, a recycling program similar to other regions, new regulations, a stewardship program, other alternatives, or a combination of options; this project will be a crucial first step towards an optimal solution that is compatible with stakeholder interests.

In this paper, a survey will be conducted on a list of all identified businesses and organizations that are industrial, commercial, or institutional (ICI) generators or retailers of mattresses within Nova Scotia. With these survey results, data analysis will be done to learn about mattress disposal trends in Nova Scotia strictly with a business focus.

This paper will proceed as follows: first, there will be a literature review consisting primarily of consultant publications and annual reports across a diverse geography; next, the second chapter will involve the data sources and methodology of the research; the third chapter will cover results and data analysis followed by a conclusion.

2. Jurisdiction Review

This review examines a series of annual reports from institutions within jurisdictions responsible for mattress disposal. These reports indicate the overall summary of these entities in terms of waste management and, to some degree the level of involvement in mattress disposal. Consultant reports are another important source of information, with Dillon Consulting (2019) being the primary

source of this research. Since mattress recycling programs are relatively new in North America and have yet to be implemented on a wide scale, there is a lack of academic sources. Given this shortage, the literature selection presented here best represents the available information on the topic. Additionally, these sources are from a diverse selection of jurisdictions to show the implications of mattress disposal within Nova Scotia and abroad.

Canada

Giroux (2014) is a report prepared for the Canadian Council of Ministers of Environment and is the only literature supporting mattress disposal methods with a Canada-wide context. Their findings show that the majority of provinces deal with mattresses in the same way by disposal via landfill. However, they note that recycling facilities exist in British Columbia, Alberta, Ontario, and Quebec and estimate that only 7% of mattresses nationwide are being recycled. They find that pilot projects such as mattress recycling can be key opportunities for provinces for waste prevention and reduction. This report shows that there is room for growth and plenty of potential for mattresses to be recycled in Canada. However, they claim that it may be wise to wait until California's extended responsibility program for mattresses shows applicability to Canada (Giroux, 2014).

Nova Scotia

In March 2019, Dillon Consulting, in collaboration with Cumberland Joint Services Management Authority, published an in-depth study on mattress management for the province of Nova Scotia (Dillon Consulting, 2019). This study was conducted by doing questionnaires with seven regional waste management authorities/ or municipal units in Nova Scotia. They also assessed

the options that have been undertaken in regions outside the province such as Prince Edward Island, Rhode Island, and Connecticut. They concluded that a stewardship program was of particular interest for the province but could only be implemented if significant changes and regulatory action were taken Dillon Consulting (2019). This report is the primary source of this research and will be largely based upon its approach. However, as mentioned, the scope of Dillon Consulting (2018) is its downfall as it does not include ICI generators and retailers and by including this extra data in new research projects, a more accurate picture of mattress disposal within the province can be discovered.

Dillon Consulting also prepared a municipal financial impact review on the Town of Antigonish, Cape Breton Regional Municipality, Municipality of the District of Chester, Municipality of Colchester, and Pictou County Solid Waste Management in May of 2015 (Dillon Consulting, 2015). They collected information on the current disposal methods of mattresses for each municipality and proposed new methods based on an assessment of costs, assumptions, and forecasts. All municipalities were disposing of mattresses the same way, by using landfills within the regions. Dillon Consulting (2015) proposed that all municipalities instead use contractor removal via an extended producer responsibility (EPR) program from a set drop-off site and a final off-site for processing and disposal. Similar to Dillon Consulting (2018), Dillon Consulting (2015) has a thorough assessment but lacks in scope.

Halifax C&D Recycling Ltd. conducted a study on mattresses and box springs in Nova Scotia in May 2009 (Halifax C&D Recycling Ltd., 2009), where

they describe how landfills are currently the only method of disposal for mattresses in Nova Scotia. This work explains the concerns of this method, for example, that landfills and mattresses within them occupy a lot of space, and that mattress disposal can affect landfill machinery. They also compare the rules and procedures of each specific landfill to determine the feasibility of a mattress recycling facility in Nova Scotia. They conclude from input received from municipalities that a feasible recycling facility would require a large number of mattresses as well as a fee per mattress (Halifax C&D Recycling Ltd., 2009). The researchers show that this combination would be the best way for value generated from mattress components to make a viable business. The study is also over a decade old, having been published in 2009, meaning these results and other factors could have substantially changed by now. Additionally, this study does provide a focus beyond municipalities by including retailers but it still does not include all ICI generators (Halifax C&D Recycling Ltd., 2009). With a wider scope including all ICI generators, the number of mattresses in Nova Scotia may be enough to not require a fee per mattress and make a recycling business more viable.

Prince Edward Island

Island Waste Management Corporation (IWMC) indicates in their Annual Report for 2017 a launched pilot program to divert mattresses and box springs from landfills to Matt Canada in Montreal at no charge to residents (Russell, 2019). In 2016, they shipped 7,442 mattresses, or 167 tonnes, which saved an estimated 5,221 square metres of landfill space (IWMC Annual Report, 2017). In 2018, Island Waste Management (2018), they shipped 337 tonnes to Matt

Canada and saved an estimated 9,126 metres of landfill space (IWMC Annual Report, 2018). This shows that the program has grown in popularity and has proven to be effective, and it shows that the smallest province in Canada can achieve a successful recycling program for mattresses. This shows the potential for Nova Scotia to mimic that success. However, Prince Edward Island is under the authority of one Crown Corporation whereas Nova Scotia is split into seven regions around the province which means that there may be a lack of external validity due to a difference in structure (Island Waste Management Corporation, 2018).

British Columbia

In the city of Richmond, British Columbia, the vision of a “Circular Economy” drives their mattress recycling program. According to the city of Richmond, the Circular Economy model has a vision “to maximize the value of resources, by design, through responsible consumption, minimizing waste and reimagining how resources flow in a sustainable, equitable, low-carbon economy.” Part of this mission is mattress recycling and diverting these recyclable materials from mattresses and box springs from landfill (City of Richmond Recycling and Solid Waste Management, 2021).

For some consumers in Richmond, BC, mattresses can be put curbside; wrapped in plastic, sealed with tape, dry, and free of bugs; for recycling via the city’s Large Item Pick Up program available with the regular garbage service. Residents are able to have six large items picked up per year with this program and can schedule the pick-up online with Sierra Waste Services, the city’s waste

service provider, at the City of Richmond website. This free program is only available to residents in single-family homes and townhomes with City garbage collection, or other multi-family complexes with City garbage services.

Consumers in large complexes may not qualify for this free pick-up program, and may need to purchase garbage disposal vouchers to have their discarded mattresses taken to landfill (not recycled) (City of Richmond Recycling and Solid Waste Management, 2021).

In the Metro Vancouver and surrounding areas, Canadian Mattress Recycling has been recycling mattresses for 10 years, diverting more than 42 million pounds of mattresses and other furniture combined from landfill (Canadian Mattress Recycling, 2021). In 2020, their Zero Waste Centre facility recycled approximately 260 metric tonnes of mattresses. (City of Vancouver, Engineer Services, Transfer and Landfill Operations, 2021)

Canadian Mattress Recycling charges consumers a fee for recycling: mattresses or box springs if dry cost \$20 to be recycled, while mattresses or box springs that are wet, though not soaked, are \$25. Crib-sized mattresses are just \$5, and they also offer recycling for other components such as mattress toppers, headboards, and bed frames for various prices. Residents may either drop-off their items for the listed prices (with GST included), or book a pick-up for their items. The cost of pick-up for residents starts at \$85 plus tax for 1-2 items, and rises to at least \$105 plus tax for five or more items. Additionally, fuel surcharges may be added for pick-ups, depending on the distance needed for Canadian

Mattress Recycling to travel, from \$0 to \$25. Pick-up appointments can be booked by residents online (Canadian Mattress Recycling, 2021).

In the city of Vancouver, mattresses and box springs can be recycled by residents via the landfill, for a fee. Items may be dropped off at the Vancouver Transfer Station, and the fee for recycling is \$15. Both clean mattresses and mattresses with bedbugs (with proper preparation) can be dropped for recycling here, up to 4 pieces (mattress and box spring each count as one piece) per day. To recycle more than 8 mattresses at a time, the city of Vancouver requires that a private recycling company must be used (City of Vancouver, Waste and Recycling, 2021). Around Vancouver, Yellow Pages lists four private companies: Dash Recycle4u Ltd., Canadian Mattress Recycling Inc, Rick's Rubbish Removal, and Mattress Recycling (YellowPages.ca, 2021).

Quebec

In Montreal, the company MattCanada offers mattress recycling programs for its clients. MattCanada recycles mattresses and box springs, along with other items, mostly for retail stores and similar clients to have their mattress disposals dealt with in an environmentally-friendly way. This company has recycled 650,000 mattresses and box springs since they began in 2004. Clients must have their items delivered to MattCanada, and the option exists for a transportation company to deliver the discarded items at a cost of \$70. The cost of disposal for clients is \$10 per mattress, to be paid upon delivery (MattCanada, 2021).

Further, another Montreal-based company Recyc-Mattress recycles mattresses and box springs, and operates in both Ontario and Quebec in

Canada. Recyc-Mattress has their own facilities to break down all components of a mattress (foam, metal, wood, fabric) to properly recycle each component. In Ontario and Quebec, more than 400,000 mattresses and box springs are recycled each year. Further, Recyc-Mattress operates a mattress donation program, where some mattresses in good condition are reused rather than recycled by families in need (Recyc-Mattress Canada, 2021).

In some municipalities in Quebec, there are organizations that will collect bulky items like mattresses and appliances in an attempt to either reuse or repair the items for other use. These are not recycling programs, but an attempt to divert items from landfill if possible, if the items are in condition to be reused or repaired (Recyc-Quebec, 2009).

In 2003, an attempt was made by Recyc-Quebec to implement an EPR program, such that producers of mattresses would be required to finance the costs of recycling their materials, but that has not been implemented.

Saskatoon

The Utilities & Environment Department for the City of Saskatoon released an Integrated Waste Management Report for 2018. This report lists plans for a project titled “Recovery Park” with construction planning to begin in the third quarter of 2020. This project will bring a new one-stop location for disposal and recovery of waste. They estimate that Saskatoon receives over 17,000 mattresses and box springs and this facility will provide recycling services for these materials and are looking at exploring future opportunities for other bulky furniture (City of Saskatoon Utilities & Environment Department, 2018). This

report shows an example of how Nova Scotia could develop a one-stop facility for waste needs, and this could prove to be viable given its small geography given there are short distances needed to travel to dispose of waste. However, this report is specifically for one municipality and not for a province containing multiple municipalities. Moreover, the development of this facility would surely be delayed for 2021 due to COVID-19, meaning they could already be considering other alternatives.

United States

Approximately 38 million mattresses are sold in the United States annually and only four states in the country have a recycling program for mattresses and they are, Rhode Island, Connecticut, California and Massachusetts (Geyer and Kuczenski, 2012).

Rhode Island and Connecticut: Bye Bye Mattress

Both Rhode Island and Connecticut have passed mattress stewardship legislation and have introduced the “Bye Bye Mattress” Program based on Mattress Recycling Council (MRC) guidelines. The program is operated by the MRC, a non-profit organization created by the mattress industry to address problems related to mattress disposal. It involves a statewide fee charged upon the sale of mattresses which is used to fund program expenses such as: transporting to processing facilities, program management, and public outreach. For Connecticut this fee is \$11.75, and \$16 for Rhode Island for each new

mattress or box spring sold (Mattress Recycling Council, 2021). This program operates in California as well.

For consumers, their old mattress can be picked up or discarded to Bye Bye Mattress in a number of ways depending on the store they visit for a new mattress and their specific town. Some retailers will pick-up old units when delivering new items, while others will direct consumers to the Bye Bye Mattress website to find a drop-off location (Mattress Recycling Council, 2019). Additionally, some towns will collect mattresses and box springs via curbside trash service to be taken for recycling, while others require consumers to drop-off used items at public works yards or transfer stations (Merton, 2021).

In Connecticut, the 2019-2020 Connecticut Annual Report reports that 189,492 mattresses were diverted from landfills and 3,403 tonnes of material were recycled in that state. Just as in Rhode Island, retailers collect a recycling fee on all new mattresses and box springs sold to fund the Bye Bye Mattress program. However, Connecticut also offers a financial incentive for consumers to drop off old mattresses and box springs at one location in the state where residents will receive \$2 per unit recycled, up to four per household per visit or eight per year. Statewide, Connecticut had 122 permanent mattress collection sites recycle 3,320 tonnes of mattresses averaging 27 tonnes per site. Furthermore, there are two recycling facilities serving all CT residents, and six towns host mattress collection events each year. The program cost a total of approximately \$3.8 million USD in 2020 (Mattress Recycling Council Connecticut, 2020).

The 2019-2020 Rhode Island Annual Report revealed that during the fourth year of the Bye Bye Mattress program, there were 82,529 mattresses collected and 1,271 tonnes of material recycled, diverting those mattress materials from landfills in that state. From the funding collected by retailers from new units, consumers can freely dispose of their mattresses in a number of ways, including having the mattress picked up curbside, dropping off the mattress at a waste or recycling facility for transport to a MRC recycler, or through collection events. There are 35 collection sites available in the state and one recycling facility. Some of these collection sites are available only to a specific town's residents, and typically accept a maximum of 3 units. In addition to residents being able to freely discard their mattresses to MRC directly, there are also 169 other entities in Rhode Island such as retailers, lodgings, etc., that have large volumes of mattresses recycled by MRC. Rhode Island is very similar to Nova Scotia in population and geography with its small size and coastal landscape, making it more comparable than other regions of interest (Mattress Recycling Council Rhode Island, 2020).

California

Similar to Rhode Island and Connecticut, California also has a statewide mattress stewardship program run by the Mattress Recycling Council California (MRCC), a non-profit organization. The organization started the program in 2015 under the brand "Bye Bye Mattress" after the Used Mattress Recovery and Recycling Act being passed in 2014 (California Department of Resources Recycling and Recovery, 2021). The state charges a \$10.50 fee and received

\$44.5 million in revenues from the purchases of 4.2 million mattresses in 2020. This was a 7% increase in revenues compared to a year earlier even with the impact of the COVID-19 pandemic. Total expenses for the program in 2020 were just over \$49.9 million with the majority of expenses from operational costs totaling \$38.1 million (76%). The state had a total of 227 permanent collection sites in 2020 to receive mattresses and in that year almost 99% of residents lived within 15 miles of a collection site. In 2020, 1.5 million mattresses were collected, a yearly increase of 4.4% or 63,269 mattresses resulting in diverting approximately 65 million pounds of material from landfills. This diverted material was instead purposed for reuse, recycling, and biomass and representing just over 77% of the volume managed by MRCC contractors (Mattress Recycling Council California, 2021). As per the Used Mattress Recovery and Recycling Act, manufacturing's, renovators, and distributors are required to be registered with MRCC or be banned from selling mattresses. The state recycling authority, CalRecycle, is required to establish a list of compliant businesses who are registered and authorized to sell mattresses within the state (California Department of Resources Recycling and Recovery, 2021). California has demonstrated the effectiveness of their program with continual annual growth in volume of collected mattresses and with fee revenues covering almost 90% of total program expenses. However, given the large population of California and its density, the scale of its program may be difficult to apply to the jurisdiction of Nova Scotia.

Maine

A study by the Maine Department of Environmental Protection was completed in December 2019 to evaluate the feasibility of implementing a mattress stewardship program in Maine similar to other New England states. The report evaluates current waste practices for mattresses and compares current policy efforts in other American states and Canadian provinces. The report confirms that Maine currently has adequate recycling markets for steel recovered from springs, however, for other materials, recycling markets are either absent, distant, or niche. The study reached the conclusion that further research is needed to address further questions related to mattress waste management and recommends the pursuit of field trials and a pilot study (Maine Department of Environmental Protection, 2019).

In July 2021, Maine passed new legislation, LD 1541, starting an Extender Producer Responsibility (EPR) program, requiring producers of large packaging to pay fees to cover the cost of recycling packaging or end-of-life products (Sellers, 2021).

Producers must pay into the stewardship fund to cover the cost of running the recycling program in the state, or the cost of the fees may be offset if the producers implement their own means of recycling material (Maine Legislature, 2021). The payments received into the stewardship fund are then used to reimburse municipalities for the cost of operating recycling facilities and for recycling materials. This is the only EPR program in the United States for

packaging and shows potential for new recycling legislation for Maine. This new policy is expected to be fully-funded by 2024 (Nichols, 2021).

Massachusetts

The state of Massachusetts has four companies under contract to recycle mattresses, three in MA and one in Rhode Island. In the state, municipalities can apply for a grant to cover the cost of having a disposal unit delivered and filled by residents. Residents and commercial businesses in the state currently dispose of an estimated 600,000 mattresses on an annual basis. Since the program began in 2016, more than 103,000 mattresses and box springs, or 2,835 tons has been recycled with the participation of 110 municipalities. Fees to process the mattresses for recycling range from \$10 to \$16 USD while incurring a \$19.55 per mattress cost to the state government. Mattresses are transferred using large shipping containers, either sea containers or trailer containers ranging in size from 20-feet to 52-feet, holding between 40-50+ mattresses and box springs to 125-180+ items. Municipal staff are required to ensure that items are efficiently stacked in order to optimize the space in the containers (Massachusetts Department of Environmental Protection, 2021).

Municipalities can offer drop-off services only where residents must drop off their mattress, or they can offer curbside pickup. Both services require the resident to pay a fee to have the mattress accepted and it is recommended that the fee for curbside pick-up be higher and operate via appointment-only.

While the goal is to recycle mattresses through the program, the municipalities should accept all mattresses at drop-off, and there is a separate container for mattresses that cannot be recycled due to damage, infestations, or being the wrong type of mattress (such as a mattress pad or air or water bed). The Massachusetts Department of Environmental Protection has spent just over \$2 million USD on the program with \$400,000 towards purchasing shipping containers, and the remaining funds towards transportation and processing of mattresses (Massachusetts Department of Environmental Protection, 2021).

United Kingdom

A paper on mattress recycling by the Institution of Civil Engineers (ICE) examines the material and composition of mattresses, as well as the process of recycling them specifically in the United Kingdom. They argue that to improve end market viability, manufacturers need to consider mattress destruction to ease the extraction of materials (Griffiths et al., 2013). Such considerations could include total redesigns for mattresses but current manufacturing procedures still dominate the market.

Oakdene Hollins prepared the “End of Life Mattress Report 2019” based on surveys of manufacturers and retailers of mattresses and current trends in the recycling sector in the United Kingdom (Bell et al., 2019). They find that over 7 million mattresses or 181,500 tonnes, were disposed of in 2017 by households and ICI generators and only 14,728 tonnes being recycled (Bell et al., 2019). This disposal costs residents, and ICI generators an estimated £20 million in 2017 not accounting for transport and handling costs (Bell et al., 2019). The recycling rate

of mattresses for the UK has grown from 10% in 2012 to 19% in 2019. They find that local authority (LA) sent the majority of mattresses to recyclers equating to 46% of the total in 2017 (Bell et al., 2019). Even though they sent the most, LA claim cost is the primary reason why they chose not to send mattresses to recyclers due to the fees costing double compared to other disposal methods (Bell et al., 2019). The authors found that they expect the number of mattresses to grow by the year 2020 and that there is optimism for the industry as recyclers continue to innovate and expand their capacities. They also found that there has been a 14% decrease in mattress recycling carried out by local authorities but find that the 19% recycling countrywide is enough for commercial viability (Bell et al., 2019). Similar to the previous paper, these authors recommend a redesign of mattresses incorporating eco-designs that make deconstruction easier. They also recommend an EPR scheme, as well as targeting research and development to improve the overall sustainability of mattresses. Further, they emphasize that the UK needs to improve trust and transparency with stakeholders (Bell et al., 2019). This paper is a great source due to its similar scope of capturing ICI generators.

3. Data Sources & Methodology

As previously mentioned, this research focuses on identifying all ICI generators and retailers in Nova Scotia and collecting vital information from them via questionnaire. Upon completion of data collection, data analysis was conducted using the responses from the questionnaire to establish stylized facts to represent the current state of ICI generators in terms of mattress disposal in

Nova Scotia. These findings will assist in determining the best direction when it comes to disposing of mattresses.

Data Sources

Identifying all ICI generators and retailers in Nova Scotia was achieved by extensive research through multiple online sources. The first step was to define what a mattress generator is. In this case, a “mattress generator” is the following: “a business or organization that is active in the mattress market.” From this definition, a wide scope of industries active in Nova Scotia was to be established that fit the definition to include as many potential mattress generators in the province as possible. The final scope consisted of the following industries/sectors:

- Hotels & Accommodations (hotels, inns, bed & breakfasts, etc.)
- Retailers
- Health Facilities (hospitals, rehabilitation, nursing, etc.)
- Educational Facilities (post-secondary, schools with room & boarding)
- Correctional Facilities
- Defense (military bases with barracks/accommodations)
- Camping Facilities for Children & Youth
- Shelters & Community Housing

With industries established, the next step involved searching for contact information for the businesses and organizations within these industries. Finding this information was done by using three methods. The first method involved

getting official information from provincial and federal government websites (Tourism Nova Scotia, 2020; Nova Scotia Department of Health and Wellness, 2013; Nova Scotia Health Authority, 2020; Department of Justice Correctional Services, 2013a; Department of Justice Correctional Services, 2013b; Correctional Service Canada, 2019; Department of National Defence, 2020; Maritime Provinces Higher Educational Commission (MPHEC), 2019; Nova Scotia Office of Immigration, 2020). The second involved searching areas based on population across Nova Scotia using Google Maps for specific industries. Lastly, business information was found using Google’s search engine to find businesses listed by Google and also to find business websites and social media pages.

Industry	Businesses	Market Representation
Hotels & Accommodations	623	58.1%
Retailers	128	11.9%
Health Facilities	232	21.6%
Educational Facilities	18	1.8%
Correctional Facilities	7	0.65%
Defense/Military	5	0.47%
Camping Facilities for Children & Youth	28	2.6%
Shelters & Community Housing	32	3%
Total:	1073	100%

Table 1, total number of businesses and organizations by industry and percentages

Using these methods of online research, a comprehensive list identifying 1,074¹ businesses and organizations active in the Nova Scotia mattress market was established as shown in Table 1.

¹ There are 1074 businesses in total. Table 1 has 1073 businesses due to the removal of one business for confidentiality reasons.

Methodology

Upon establishing a list of potential respondents by identifying all businesses and organizations in Nova Scotia who were active in the mattress market, a questionnaire was created. Constructing the questionnaire was a collaborative process between the research funder, Divert Nova Scotia, and consultancy from Nova Scotia Environment.

The questionnaire contained the following criteria:

- Contact & Geographic Information
- Volume of Mattresses Disposed
- Method of Mattress Disposal
- Costs of Disposal
- Input Towards a Diversion Program
- Frequency of mattress disposal?

Note: A full version of the questionnaire can be found in the appendix

The distribution of the questionnaire could not commence until there was an approval from the Saint Mary's University Research Ethics Board (REB). Approval was granted on June 1st, 2020 and the distribution and contact phase began with respondents being contacted from the list of businesses and organizations established from the data sources described.

Attempts to reach respondents began exclusively by telephone inviting them to participate in the study with a deadline of July 10th, 2020. If contact was made with the initial call, respondents were introduced to the project by the researcher, informed of the purpose of the study, and invited to participate. If

interested, the respondents were given the choice of either completing the survey by phone interview or to be sent an electronic questionnaire via email. If the phone interview was preferred, the interview would either begin immediately or be arranged to be conducted at another time which was convenient for the respondent. Before starting the questionnaire, respondents were read the informed consent agreement and once understood and agreed, the survey would begin. This informed consent agreement can be viewed in the Appendix at the beginning of the questionnaire. Alternatively, if the respondents preferred to do the questionnaire online, they provided an email address to be added to the mailing list which would receive the survey by the end of the day. An additional email follow-up was sent to respondents one week before the deadline of June 10th, 2020 as a reminder to complete the survey. Due to time constraints, REB approved a bulk email invitation that was sent to publicly-available email addresses for the business and organizations selected for the study. Follow-up calls were provided for businesses who attempted the survey but had yet to fully complete it by the time of the call.

Determining whether a business was in scope was another critical step before proceeding with survey participation. Within Nova Scotia, only a fraction of the retailers have a company policy in which they take back mattresses from their customers for disposal. Any retailer who was contacted and said they do not take back mattresses were declared out-of-scope for the survey. Businesses who permanently closed were also deemed out-of-scope for the survey. Small businesses who did not dispose of mattresses on an annual basis or donated

their mattresses were still eligible for the survey. They were included since they will dispose of mattresses in the future and can provide feedback for a diversion program.

Conducting interviews and calling businesses and organizations was done strategically. For instance, certain businesses and organizations were given priority to be called during business hours of 8:00 am – 5:00 pm Atlantic time to reach the best contacts at the best possible time. For example, these considerations were taken for government institutions, larger businesses requiring personnel at the management level, and sites with maintenance staff since they are rarely available during evening hours. In the evening hours, smaller businesses and retailers who are open later hours were only called during this time. Additionally, priority calls and email invitations were made specifically for regions and industries where completed questionnaires were lacking or the best contact was yet to be found.

During the collection phase, the survey responses were collected either electronically or through a telephone interview and were electronically stored in PDF format. Once the collection phase was completed, the survey responses were then inputted onto a spreadsheet linked to demographic information such as postal code, waste collection region, respondent and business name, and unique identifier. It is very important to link the responses with location data as the findings from this study will be highly valued by waste management within municipalities as they can observe trends within the region they service. After the data was collected and compiled, data analysis to establish stylized facts, trends,

and estimates was conducted on the collected responses and will be presented in the following chapter.

4. Data

Location

Using the above data sources and methodology, 104 surveys were received for this study representing 130 business and organization locations across Nova Scotia active in the mattress market.

Industry	Surveys	Locations
Hotels & Accommodations	54	56
Retailers	7	7
Health Facilities	20	28
Educational Facilities	6	6
Correctional Facilities	-	-
Defense/Military	-	-
Camping Facilities for Children & Youth	9	9
Shelters & Community Housing	7	20
Total:	104	130

Table 2, number of surveys submitted and locations of participating businesses by industry. Note: Correctional facilities and defense/military have been suppressed due to confidentiality issues.

As shown above, in Table 2, some surveys were done by one respondent for multiple operating locations. Due to confidentiality reasons, and to protect the identity of the participants, the number of surveys and locations for defense/military installations and correctional facilities has been suppressed.

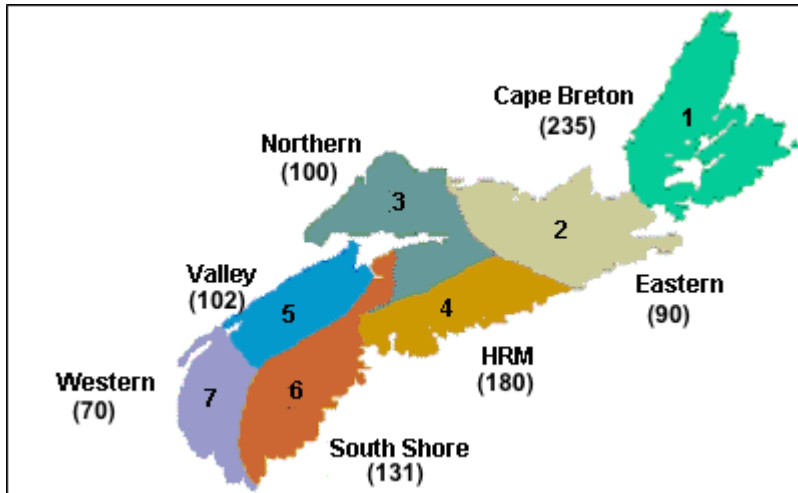


Figure 1, map of municipal waste management regions in Nova Scotia.

Source: Municipal Collection Information, Environment Nova Scotia, edited to include the number of active businesses in the NS mattress market in brackets below the name of each region

All businesses and organizations that were surveyed within the specified industries in the province were divided into the seven provincial waste management regions and they are:

1. Cape Breton (Cape Breton)
2. Antigonish, Guysborough, Pictou (Eastern)
3. East Hants, Cumberland, Colchester (Northern)
4. Halifax Regional Municipality (HRM)
5. Annapolis Kings (Valley)
6. South Shore, West Hants (South Shore)
7. Yarmouth, Digby (Western)

As shown below in Figure 2, we see that Cape Breton and Halifax Regional Municipality have the highest representation, this is reflective that these are the two highest populated regions in Nova Scotia and the two regions with the largest amount of businesses active in the Nova Scotia mattress market at 235 and 180 respectively. The Eastern and Northern regions are the third and fourth highest

represented at 15 and 18 businesses respectively. However, according to the map above in Figure 1, the South Shore region has the third-highest number of active businesses while the Eastern region is 6th out of 7th. This means there is less representation from the regions that rank higher in the number of active businesses.

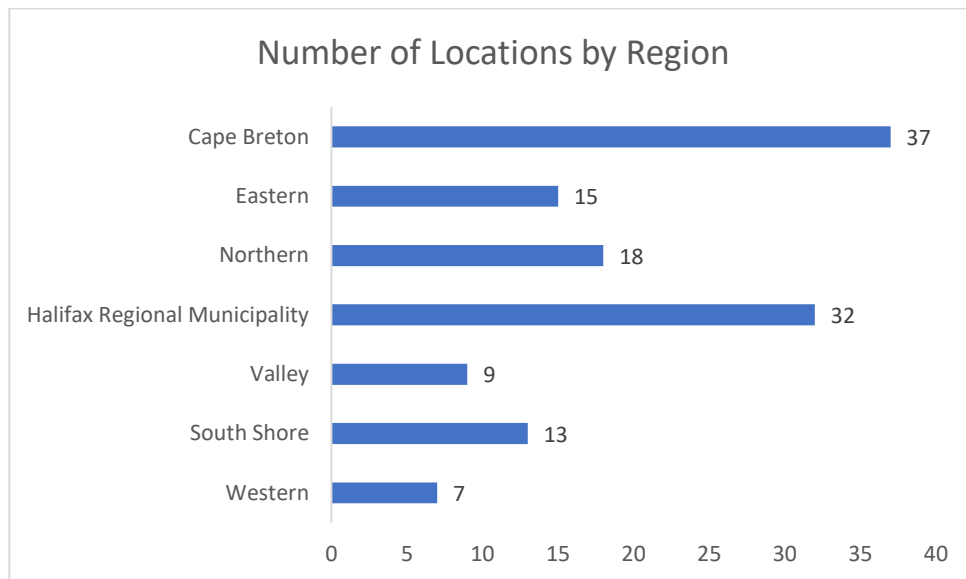


Figure 2, Total number of participating locations active in the NS mattress market by region

Representation by industry can be shown below in Figure 3. Hotels and accommodations have the largest representation for the province while educational facilities have the lowest. This partially reflects the researched list of businesses showing that since hotels and accommodations are the vast majority at 58.1% market representation and educational facilities are the third lowest industry at 1.8% as shown in Table 1. As mentioned previously, only a fraction of retailers were eligible for this survey which could explain the lower representation. Additionally, representation from educational facilities was relatively low compared to other industries with 6 out of 18 participating in the study.

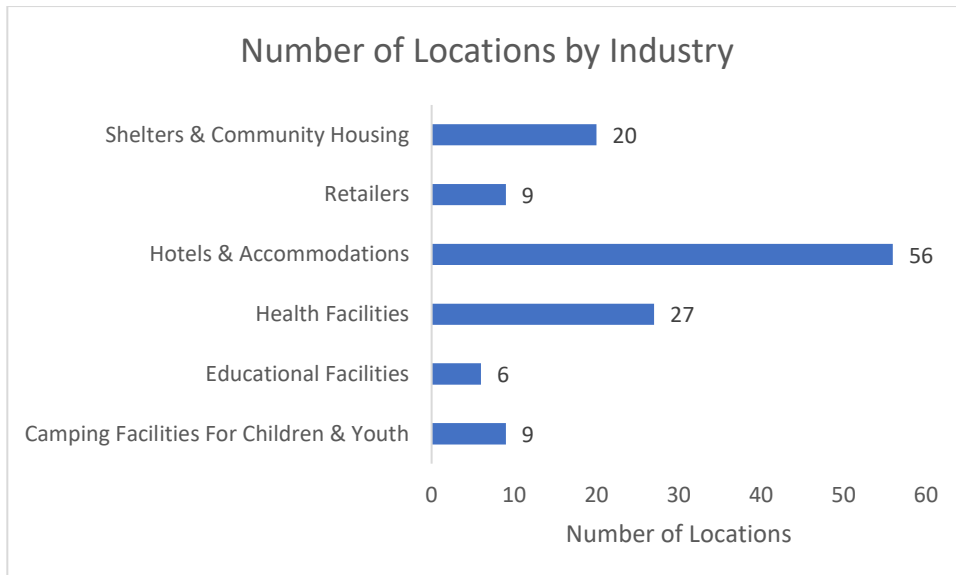


Figure 3, number of locations active in the NS mattress market by industry

Response Rate

From the researched list of 1,074 active businesses and organizations within the mattress market in Nova Scotia, 164 were determined to be out of scope through contacting the business which left a total of 910 businesses in scope as summarized in Table 3.

Total Number of Businesses and Organizations		
Initial Businesses	Out of Scope	Total Businesses
1,074	164	910

Table 3, total number of initial businesses and organizations researched, determined out of scope, and final count of active businesses in the NS mattress market

The response rate for completed surveys was 11.43%, with 104 of 910 respondents participating. When comparing response rates across industries as shown in Figure 4, we see that correctional facilities had the largest response rate with 66.67% followed by camping facilities for children and youth at 33.33%. Although hotels and accommodations have the largest number of surveys submitted, it has the second-lowest response rate at 9.05%.

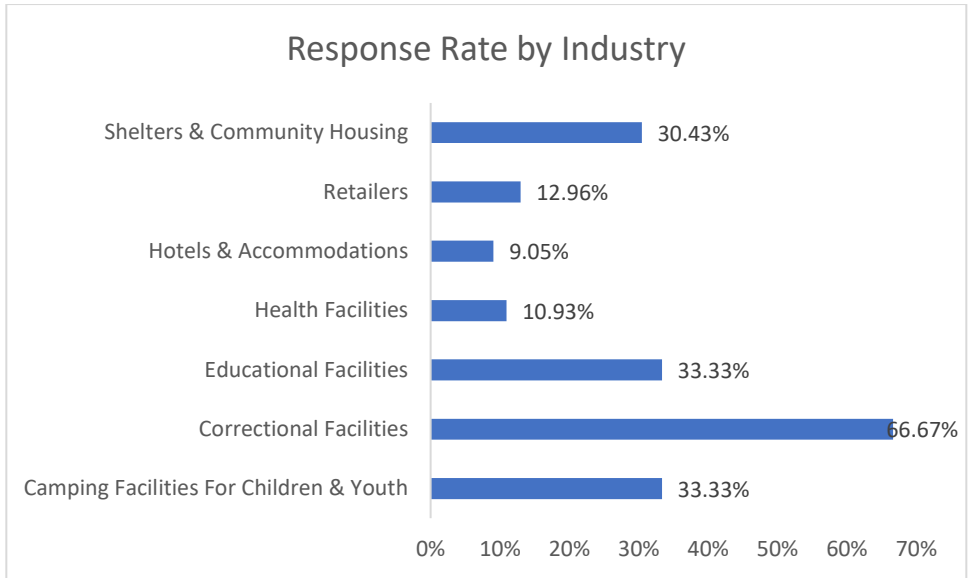


Figure 4, response rate by industry

In regards to response rate by region, we see in Figure 5 that Region 2, Eastern has the largest at 14.44% with Region 3, Northern close behind at 14%. Region 7, Western has the lowest response rate at 8.57%.

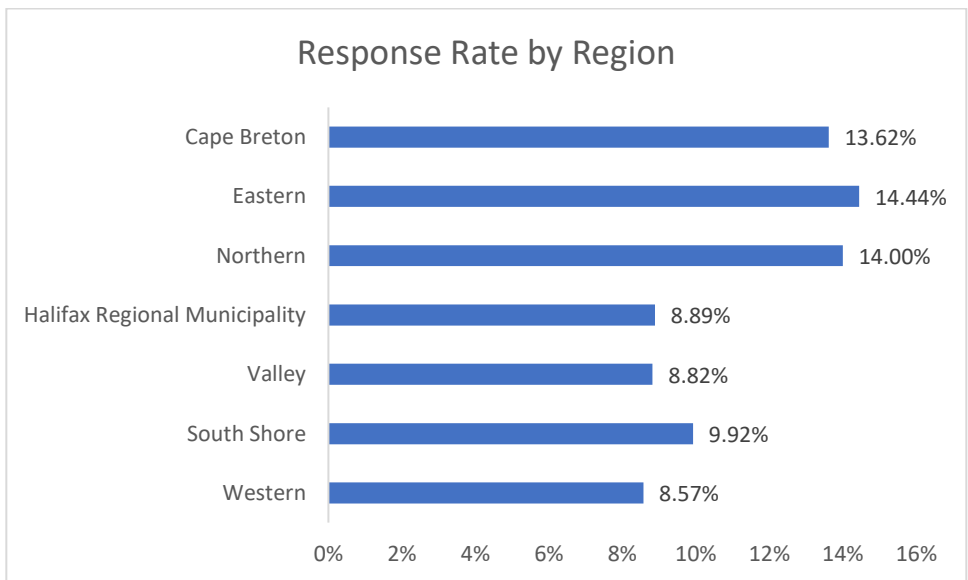


Figure 5, response rate by region

The highest amount of surveys received was from the Cape Breton region but similarly to hotels and accommodations within industries it does not have the highest response rate.

Summary Statistics

In terms of the volume of end-of-life mattresses disposed of annually, 93 of the 104 businesses surveyed were able to provide a figure or estimate. Within the 93 businesses, there was a total of 3,420 mattresses disposed of within Nova Scotia, giving an average of 36.77 mattresses disposed of per business annually. Additionally, the maximum amount disposed of by a business or organization was 800 on an annual basis and the minimum was 0 as shown in Table 4.

When it comes to the reuse of mattresses, we see that 36 mattresses in total were donated among seven businesses in Nova Scotia on an annual basis. This is an average of 5.14 mattresses among the seven businesses engaged in donating their mattresses. Within these seven businesses, the maximum donated on an annual basis is 20 and the minimum is 0 as shown in Table 4.

Summary Statistics – ICI Generators & Retailers

Variable	Obs	Mean	Total	Std.Dev.	Min	Max
Mattresses Disposed	93	36.77	3,420	107.85	0	800
Mattresses Donated	7	5.14	36	7.03	0	20
Disposal Cost per Mattress	51	\$10.95	-	\$21.97	\$0	\$100
Total Annual Disposal Cost	51	\$311.01	\$15,868	\$1,290.01	\$0	\$7,000
Maximum Price Willing to Pay*	80	\$20.85	-	\$21.09	\$0	\$100

Table 4, summary statistics for ICI generators and retailers. Obs = number of observations/businesses, mean = average, total = total mattresses or dollar amount, std dev = standard deviation, min = minimum number of mattresses or dollar amount, max = maximum number of mattresses or dollar amount
 Note: *Maximum price willing to pay per mattress to participate in a diversion program.

To landfill their mattresses, it cost 51 Nova Scotia businesses and organizations a total of \$15,868 annually or an average annual cost of \$1,290 per business. The average cost per mattress to landfill mattresses was \$10.95. Some businesses paid a maximum of \$100 per mattress while others had no expense for landfilling. The maximum annual cost for one business was \$7,000.

Within the Nova Scotia mattress market, 80 businesses and organizations would be willing to pay an average of \$20.85 per mattress to have their mattresses recycled in Nova Scotia. The maximum price to recycle mattresses in Nova Scotia for some businesses was \$100 per mattress while on the opposite end, others thought it should be free and are not willing to pay anything.

Volume of Mattresses in Nova Scotia

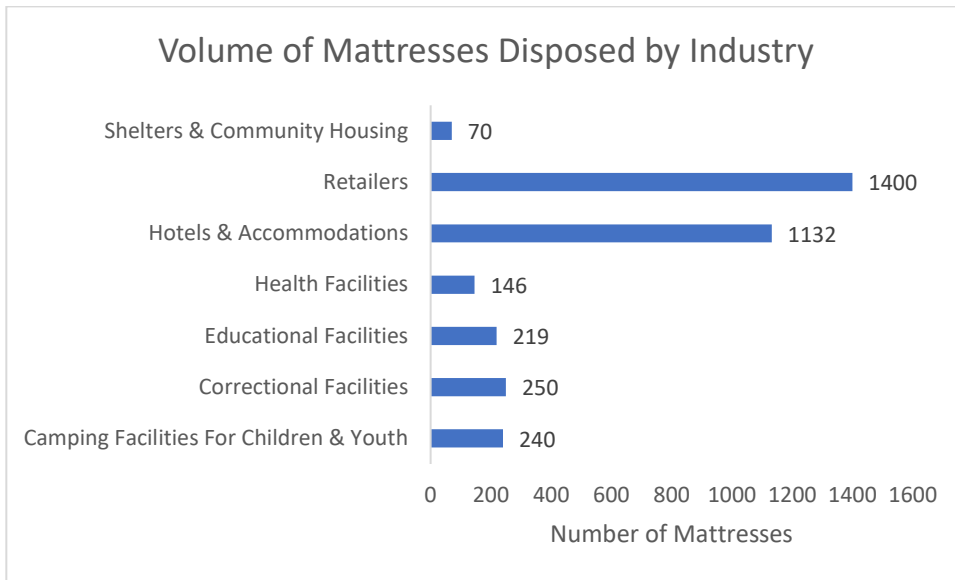


Figure 6, Volume of mattresses by industry

As shown in Figure 6, we see that the volume of mattresses disposed of by businesses in Nova Scotia comes predominantly from hotels and accommodation as well as retailers. Among all participants, these two industries dispose of 2,532 mattresses annually or approximately 74% of all mattresses from businesses sampled. Furthermore, shelters and community housing disposed of the least number of mattresses while the remaining four industries were almost identical in mattress output.

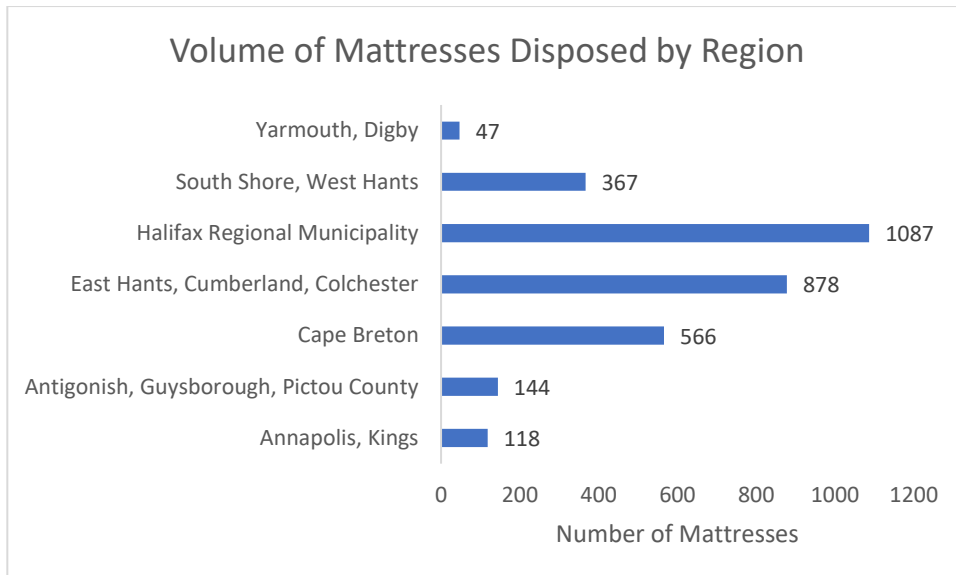


Figure 7, Volume of mattresses disposed of, total values (right of bars) by region

When it comes to the volume of mattresses disposed of, Regions 4, 3, 1, or Halifax Regional Municipality, East Hants, Cumberland Colchester, and Cape Breton respectively, are the three largest generators of mattresses disposed of in the province as shown in Figure 7. Together among these four regions, 2,531 mattresses were disposed or almost 75% of the sample surveyed in this study. Region 7, Yarmouth, Digby is a distant last with only 47 mattresses disposed of annually.

Volume of Mattresses Disposed of – Largest Three Regions & Largest Two Industries			
	Region 4 (HRM)	Region 3 (EH, CMB, COL)	Region 1 (CB)
Retailers	0	850	300
Hotels & Accommodations	849	10	208

Table 5, volume of mattresses disposed of, total number of mattresses by industry and region
HRM = Halifax Regional Municipality, EH = East Hants, CMB = Cumberland, COL = Colchester, CB = Cape Breton

Table 5 shows us that the two largest disposing industries operating in the two largest disposing regions generate 2,217 mattresses annually or approximately 65% of the sample surveyed. Within this sub-sample, hotels and accommodations within Region 4, Halifax Regional Municipality, and retailers within Region 3, East Hants, Cumberland, and Colchester together represent over 26% of all mattresses disposed annually within the surveyed businesses, or 52.4% when combined.

Methods of Mattress Disposal

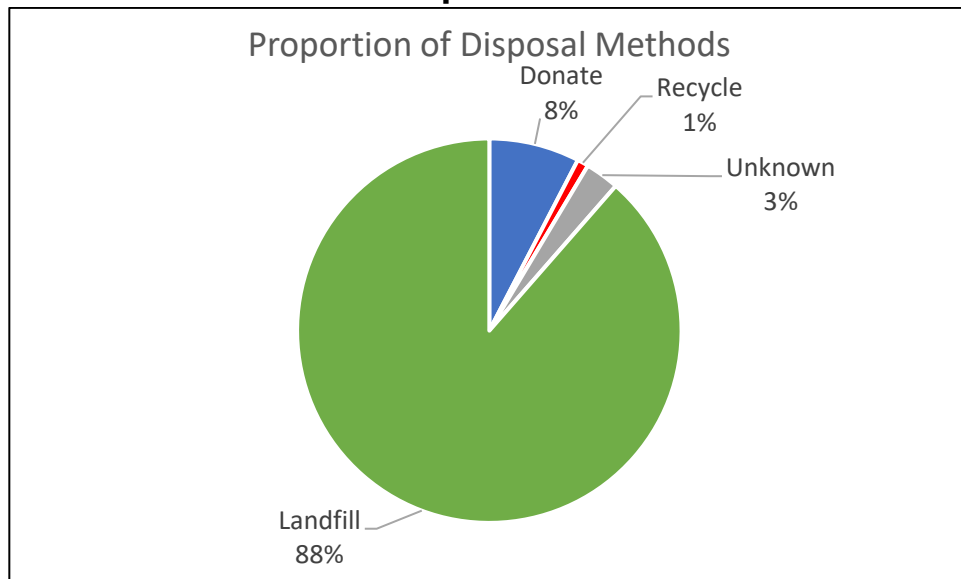


Figure 8, disposal methods, percentage of businesses

For disposal methods amongst all 104 respondents, 88% choose to landfill, 8% donate their mattresses, 3% provided no answer, and 1% recycled as shown in Figure 8. This is accurate of the current situation of mattress disposal in Nova Scotia as there are very limited alternatives to landfilling mattresses.

Disposal Methods - Industries				
	Landfill	Recycle	Donate	Unknown
Camping Facilities for Children & Youth	8 (88.8%)	-	1 (11.1%)	-
Educational Facilities	6 (100%)	-	-	-
Health Facilities	20 (100%)	-	-	-
Hotels & Accommodations	45 (83.3%)	-	6 (11.1%)	3 (5.6%)
Retailers	7 (87.5%)	1 (12.5%)	-	-
Shelters & Community Housing	7 (100%)	-	-	-
Total	93	1	7	3

Table 6, Disposal methods, number of businesses and percentages by industry, total number of businesses and percentages

According to Table 6, the composition of business disposal methods equates to 93 businesses landfilling, one recycling, seven donating, and three who are not sure what method they use.

Among businesses that were interviewed, educational facilities, as well as shelters, and community housing, dispose of 100% of their mattresses to landfills. Hotels and accommodations dispose of 83.3% of their mattresses to landfills, donate 11.1% and 5.6% are unknown. Throughout the entirety of the data collected only one business, a retailer, participated in recycling to dispose of their mattresses. Responses that were labeled unknown may be due to leaving the question blank or not completing the rest of the questionnaire. Another possibility may be businesses are unaware of their method of disposal due to never having to dispose of mattresses which can be the case for if they are relatively new to the market. Additionally, for all of the businesses interviewed that did not landfill their mattresses, 80% did so for environmental reasons.

Most Important Factors

Of the 104 businesses that participated, 87 responded as to what their priorities were for managing end-of-life mattresses. When choosing between cost, environment, convenience of location, and other, 34 businesses of the 86, or approximately 40%, chose cost as the most important factor. The next largest was 30 out of 86 businesses, or approximately 35%, choosing the environment as most important. The third-largest was 19 out of 86 businesses, or 22% choosing convenience of location. Finally, three out of 86 businesses, or 3.4% chose other. Some of the reasons specified in the other option were health standards, availability of options, and mattresses to be taken back to vendors.

Most Important Factor for Mattress Management*				
Region	Cost	Convenience	Environment	Other
Cape Breton	13 (44.8%)	4 (13.8%)	12 (41.4%)	-
Eastern	5 (50%)	2 (20%)	3 (30%)	-
Northern	7 (50%)	4 (28.6%)	2 (14.3%)	1 (7.1%)
Halifax Regional Municipality	4 (36.3%)	1 (9%)	5 (45.4%)	1 (9%)
Valley	1 (14.3%)	3 (42.9%)	3 (42.9%)	-
South Shore	4 (36.3%)	3 (13.3%)	4 (36.3%)	-
Western	0 (0%)	2 (50%)	1 (25%)	1 (25%)
Industry				
Camping Facilities for Children & Youth	2 (25%)	2 (25%)	3 (37.5%)	1 (12.5%)
Educational Facilities	1 (20%)	1 (20%)	3 (60%)	-
Health Facilities	7 (43.8%)	4 (25%)	5 (31.3%)	-
Hotels & Accommodations	20 (43.5%)	11 (23.9%)	13 (28.3%)	2 (4.3%)
Retailers	2 (33.3%)	-	4 (66.6%)	-
Shelters & Community Housing	2 (40%)	1 (20%)	2 (40%)	-
Total	34 (39.5%)	19 (22.1%)	30 (34.9%)	3 (3.4%)

Table 7, most important factors for mattresses management, number of businesses and percentages by region and industry, total number of businesses and percentages.

Note: *Respondents were asked to order the four options in terms of importance, this chart shows which option was chosen as first priority

Table 7 above shows distributions of each region and industry for their most important factors for mattress management: cost, convenience, environment, or other. In terms of choosing cost as the top priority, the East Hants, Cumberland, Colchester region had the highest percentage prioritizing cost at 50% or seven out of 14 businesses who answered from the region. This was followed by Cape Breton at 44.8% or 13 out of 19 businesses surveyed declaring it the most important. Yarmouth, Digby region on the other hand had no businesses claiming cost is the most important factor for mattress management among the four who answered.

The health facilities industry had the highest percentage of businesses that placed cost at the most important for mattress management, at 43.8% or seven out of 16 businesses surveyed in this industry. The hotels and accommodations industry were nearly identical with 20 out of 46 or 43.5% of businesses surveyed in this industry prioritizing cost over all other options. Other industries remained relatively the same ranging from 20% to 33.3% of businesses surveyed.

When it comes to having convenience as the most important factor in end-of-life mattress management, participants within the Yarmouth region had the highest percentage at 50%, or two out of four businesses. Alternatively, the Halifax Regional Municipal had the least with only one business among the 11 surveyed in the region who put convenience has the highest priority.

Industries that set convenience as their top priority for end-of-life mattress disposal had relatively the same percentage of surveyed businesses ranging from 20% to 25%.

For surveyed businesses where the environment was the most important factor, the Halifax Regional Municipality had the highest percentage within its region at 45.4% or five out of 11 businesses. Both Annapolis, Kings, and the Cape Breton regions were also close at 42.9%, and 41.1% of businesses surveyed within their regions respectively. The East Hants, Cumberland, Colchester region had the lowest percentage prioritizing environment first at 14.3% or two out of 11 of businesses surveyed in the region.

Within the retailer industry, 66.6% or four out of six businesses surveyed answered the environment as their most important factor for end-of-life mattress management. Educational facilities were almost the same at 60% or three out of five businesses surveyed within the industry. The remaining industries were relatively the same ranging from a percentage of 28.3% to 37.5% of surveyed businesses within their industry prioritizing environment.

Diversion Program Participation

Willingness to Participate - Diversion Program					
Region	VL	SL	IND	SUL	VUL
Annapolis, Kings	75%	25%	-	-	-
Antigonish, Guysborough, Pictou County	30%	50%	-	10%	10%
Cape Breton	59.3%	25%	6.3%	-	9.4%
East Hants, Cumberland, Colchester	57.1%	28.6%	7.1%	-	7.1%
Halifax Regional Municipality	33.3%	40%	26.7%	-	-
South Shore, West Hants	41.7%	25%	16.7%	-	16.7%
Yarmouth, Digby	60%	20%	-	-	20%
Industry					
Camping Facilities for Children & Youth	55.6%	22.2%	22.2%	-	-
Educational Facilities	60%	20%	20%	-	-
Health Facilities	61.1%	27.8%	11.1%	-	-
Hotels & Accommodations	44%	34%	2%	4%	16%
Retailers	71.4%	28.6%	-	-	-
Shelters & Community Housing	42.8%	28.6%	28.6%	-	-
Total	49 (51%)	29 (27.1%)	9 (9.4%)	1 (1%)	8 (8.3%)

Table 8, Willingness to participate in a diversion program, percentage of businesses by region and industry, total number of businesses and percentages. VL = very likely, SL = somewhat likely, IND = indifferent, SUL = somewhat unlikely, VUL = very unlikely

Table 8 shows the willingness of businesses and organizations to participate in a diversion program by region and industry. In total, 96 out of the 104 businesses participating responded to this question. For the entirety of the 96 businesses, 51% were very likely, 27.1% were somewhat likely, 9.4% were indifferent, 1% were somewhat unlikely, and 8.3% were very unlikely. This shows that 78.1% of the sample surveyed was, at a minimum, likely to participate in a cost-effective diversion program given all factors are favourable.

When comparing regions in terms of willingness to participate in a diversion program, the Annapolis, Kings had the highest percentage. 75% of the businesses surveyed within that region were very likely to participate and the

remaining 25% were somewhat likely. 60% of businesses surveyed in Yarmouth, Digby were very likely to participate and 20% were likely to participate. However, 20% of the businesses in that region were very unlikely to participate in a diversion program. Similarly, the South Shore, West Hants region had 16.7% of businesses surveyed within the region who were very unlikely to participate but 41.7% and 25% who were very likely and likely to participate respectively. At least 66% of all businesses within any region were likely or very likely to participate.

Comparing industries shows us that retailers are most willing to participate due to 71.4% of the surveyed businesses in this industry claiming they are very likely to participate in a diversion program. The remaining 28.6% of businesses surveyed in this industry said they were somewhat likely to participate. The only opposition to participating came exclusively from the hotels and accommodations industry with 20% of businesses surveyed saying they are somewhat or very unlikely to participate. However, this industry has 44% and 34% who are very likely and somewhat likely to participate as well. According to the data, at least 71% of all businesses within any industry are likely or very likely to participate in a diversion program.

Special Requirements

In terms of special requirements for a diversion program in Nova Scotia, 95 out of the 104 businesses surveyed provided an answer. 67 out of the 95, or just over 70%, said they did not have any special requirements. 28 out of the 95 or approximately 30% said they had a special requirement. Among the 28, over 50% claimed a pick-up arrangement for the mattresses would be a necessary

special requirement. Other responses included storage and transportation solutions.

Special Requirements – Mattress Disposal		
Region	Yes	No
Annapolis, Kings	3 (37.5%)	5 (62.5%)
Antigonish, Guysborough, Pictou County	1 (9%)	10 (91%)
Cape Breton	9 (29%)	22 (71%)
East Hants, Cumberland, Colchester	3 (21.4%)	11 (78.6%)
Halifax Regional Municipality	5 (35.7%)	9 (64.3%)
South Shore, West Hants	4 (33.3%)	8 (66.7%)
Yarmouth, Digby	3 (60%)	2 (40%)
Industry		
Camping Facilities for Children & Youth	3 (33.3%)	6 (66.7%)
Educational Facilities	3 (60%)	2 (40%)
Health Facilities	5 (31.2%)	11 (68.8%)
Hotels & Accommodations	14 (27.5%)	37 (72.5%)
Retailers	1 (14.3%)	6 (85.7%)
Shelters & Community Housing	2 (28.6%)	5 (71.4%)
Total	28 (29.5%)	67 (70.5%)

Table 9. Need for special requirements, number of businesses and percentages by region and industry, total number of businesses and percentages

When examining specific regions in terms of needs for special requirements, Table 9 shows the regions of Annapolis, Kings, Halifax Regional Municipality, and South Shore, West Hants have almost the same percentage of surveyed businesses within their regions needing special requirements, ranging from 33.3% to 37.5%. The Yarmouth, Digby region had the highest percentage at 60% or three out of five businesses needing special requirements within the region - this was the only region with a majority of businesses needing special requirements. Among the other six regions who have a majority not needing special requirements, the Antigonish, Guysborough, Pictou County region had

the highest response for no with 91% or 10 out of 11 businesses surveyed within this region not needing special requirements. The remaining five regions with a majority not requiring special arrangements all ranged between 62.5% and 78.6% of businesses within their regions not needing any special arrangements.

Within industries requiring special requirements for disposal, only educational facilities had a majority of businesses surveyed within their industry who needed such arrangements at 60% or three out of five. Retailers had the least amount of businesses requiring special arrangements at 14.3% or one out of seven participating businesses. The remaining four industries with a majority not requiring special arrangements fell within the range of 66.7% and 71.4% of businesses within their industries not needing any special arrangements.

COVID-19 Impact

Table 10 shows the impact of mattress contamination on businesses by industry and region. Out of the 94 respondents who answered this question, a vast majority of 80.2% respondents representing 75 businesses saw no impact on mattress contamination due to COVID-19². Furthermore, thirteen businesses had a large or small decrease, while six had a small or large increase in mattress contaminations.

² This would be mattresses that would need to be disposed of due to COVID. This would have been before we knew about contact transmission being minimal.

COVID-19 Impact for Mattress Contaminations					
Region	LD	SD	NI	SI	LI
Annapolis, Kings	28.6%	14.7%	57.1%	-	-
Antigonish, Guysborough, Pictou County	20%	10%	70%	-	-
Cape Breton	9.4%	6.25%	78.1%	3.1%	3.1%
East Hants, Cumberland, Colchester	-	-	91.7%	8.3%	-
Halifax Regional Municipality	-	-	85.7%	-	14.3%
South Shore, West Hants	-	-	12.2%	-	25%
Yarmouth, Digby	-	-	91.7%	-	8.3%
Industry					
Camping Facilities for Children & Youth	22.2%	-	66.7%	-	11.1%
Educational Facilities	-	-	100%	-	-
Health Facilities	-	-	83.3%	11.1%	5.6%
Hotels & Accommodations	14.6%	2.1%	83.3%	-	-
Retailers	-	42.9%	57.1%	-	-
Shelters & Community Housing	-	-	66.7%	-	33.3%
Total	9 (9.6%)	4 (4.3%)	75 (79.8%)	2 (2.1%)	4 (4.3%)

Table 10, COVID-19 impact on mattress contaminations, percentage of businesses by region and industry, total number of businesses and percentages. LD = Large decrease, SD = Small decrease, NI = no impact, SI = small increase, LI = large increase

Only the regions of Annapolis, Kings, Cape Breton, Antigonish
Guysborough, Pictou County saw a decrease of contaminations within their
region due to COVID-19. The largest number of surveyed businesses claiming
large decreases in contaminations occurred due to COVID-19 in the region of
Annapolis, Kings and Antigonish, Guysborough, Pictou County with 28.6%, and
20% respectively. The regions of Cape Breton, East Hants, Cumberland,
Colchester, Halifax Regional Municipality, South Shore, West Hants, and
Yarmouth, Digby, saw an increase in contaminations within their region due to

COVID-19. Halifax Regional Municipality and South Shore, West Hants had the largest amount of businesses surveyed claiming they had large increases in contaminations in their regions at 14.3% and 25% respectively. One common trend among regions is that they all have some businesses that claim no impact of the number of mattress contaminations due to COVID-19.

When looking at individual industries, three industries: camping facilities for children and youth, retailers, and hotels and accommodations had any number of businesses that saw a decrease in mattress contaminations due to COVID-19. Camping facilities for children and youth had 22.2% of businesses surveyed in their industry claim there was a large decrease in contaminations due to COVID-19, whereas, retailers claimed 42.9% of businesses surveyed within their industry saw a small decrease. Hotels and accommodations had 16.7% of participating businesses in its industry claim at least a small decrease in contaminations. Only the industries of camping facilities for children and youth, shelters, and community housing and health facilities saw an increase in contaminations due to COVID-19. Shelters and community housing had 33.3% of surveyed businesses within its industry claim they saw a large increase in contaminations, while for camping facilities for children and youth, 11.1% surveyed claimed a large increase and for health facilities, 16.7% of businesses surveyed saw at least a small increase in contaminations. All industries had some businesses which saw no impact with a minimum of 57.1% of their businesses reporting no impact. Lastly, 100% of businesses within educational facilities reported no impact from COVID-19 on mattress contaminations.

96 businesses were able to provide responses determining the impact of COVID-19 on their purchases and/or sales of mattresses. As shown in Table 11, among the 96, approximately 54% did not see any impact on mattress purchases or sales. Additionally, 38.6% of businesses overall saw a large decrease or small decrease while only 7.3% saw a small increase or large increase in purchases or sales of mattresses due to COVID-19.

COVID-19 Impact for Mattress Sales/Purchases					
Region	LD	SD	NI	SI	LI
Annapolis, Kings	25%	37.5%	37.5%	-	-
Antigonish, Guysborough, Pictou County	11.1%	11.1%	77.8%	-	-
Cape Breton	25%	15.6%	50%	6.25%	3.1%
East Hants, Cumberland, Colchester	50%	7.1%	35.7%	7.1%	-
Halifax Regional Municipality	20%	6.7%	60%	-	13.3%
South Shore, West Hants	33.3%	-	66.7%	-	-
Yarmouth, Digby	20%	-	60%	-	20%
Industry					
Camping Facilities for Children & Youth	33.3%	-	55.6%	-	11.1%
Educational Facilities	40%	-	60%	-	-
Health Facilities	5.3%	5.3%	78.9%	-	10.5%
Hotels & Accommodations	37.5%	12.5%	47.9%	-	2.1%
Retailers	14.3%	57.1%	-	28.6%	-
Shelters & Community Housing	14.3%	-	71.4%	14.3%	-
Total	26 (27.1%)	11 (11.5%)	52 (54.1%)	3 (3.1%)	4 (4.2%)

Table 11, COVID-19 impact for mattress sales and purchases, percentage of businesses by region and industry, total number of businesses and percentages. LD = Large decrease, SD = Small decrease, NI = no impact, SI = small increase, LI = large increase

In terms of the impact of mattress sales or purchases for regions, only Cape Breton, East Hants, Cumberland, Colchester, and Yarmouth, Digby have any businesses claiming an increase whereas, every region has some businesses reporting a decrease in sales or purchases due to COVID-19. East Hants, Cumberland, Colchester had 50% of businesses within its region reporting a

large decrease in sales or purchases which is the largest among all regions. All regions reported had at least 20% of surveyed businesses reporting that there was a small or large decrease within their region. Five out of seven regions had at least 50% of surveyed businesses reporting no impact on sales or purchases.

For industries, all except educational facilities had businesses reporting an increase in sales or purchases due to COVID-19. Every business that was surveyed in retail felt some impact from COVID-19 on sales and this industry saw the largest percentage of business reporting a decrease with 71.4% of businesses surveyed reporting at least a small decrease in sales and purchases due to COVID-19. However, retailers also saw the largest increases when comparing individual industries. 28.6% of businesses surveyed in the retail industry said there was a small increase in sales or purchases of mattresses. The remaining five industries had a minimum of 47.9% of participating businesses within their industry report no impact on sales and purchases due to COVID-19.

5. Data Validity & Challenges

Upon looking at the entirety of the data gathered from respondents there are clear questions on the validity of the data. This is mostly due to the small response rate of 11.43% or 104 responses out of 910 who were selected for the study. The small response rate from this sample may inaccurately represent the population of businesses and organizations due to inadequate sample size. The cause of the small sample size is due to many factors and challenges encountered during the collection phase. For instance, COVID-19 delayed

research phases and limited the time permitted for the collection phase, resulting in some respondents only being contacted once and/or by email. Additionally, the ongoing pandemic made finding the best contact for businesses and organizations challenging for the research team due to work-at-home arrangements and business closures. This is especially true when seeking the best contacts for underrepresented groups such as educational facilities and retailers. The absence of retailers is especially problematic since they are the only industry within the province that are engaged with recycling mattresses. This makes their data unique and lacking data from retailers may offer a poor representation of the trends for the mattress market as a whole. The inability and struggle to find the best contact cost valuable time which was already strained due to delays. This lack of contact also prevented the research team from clarifying whether certain businesses were in scope or not. Determining whether a business is in scope was done either by investigation through the company website or by reaching a contact. If neither option was possible, there could still be businesses within the 910 selected who are not in scope. This means that our sample size may lower than 910 and our response rate could potentially be higher than the 11.43% calculated.

Another issue that was present was the questions asked for respondents and their inability to answer some of them. This problem was a combination of not accommodating all aspects of the mattress industry and their different circumstances, as well as businesses themselves either not recording the information requested or not knowing of an individual who possessed said

information. Not accommodating different business practices resulted in fewer optional answers within the questionnaire which made it difficult to record alternative answers. For example, in terms of disposal methods, there were only two options recycle and landfill; however, many businesses and organizations do neither but still dispose of mattresses through donations. Fortunately, this was identified either through phone interviews or the comments section and the data was recorded. However, it is reasonable to assume that many businesses that use alternative disposal methods who did not see the option that applied to them may have decided the study was not for them and decided to not participate.

Even with a small response rate, the data collected is still relatively diverse, meaning there is decent representation from regions, as well as from industries. For instance, regions tend to have a small number of hospitals, and as a result, one hospital could represent an entire region for that industry. Similarly, the size of businesses is also important as we tend to assume the size of the business would have a positive relationship on the volume of mattresses disposed of. With the data acquired from the study, there is some representation from businesses of different sizes within each industry but is still lacking in some areas. For example, it is established that the only industry that is actively recycling mattresses to be sent out of province are retailers. Within the data acquired, there is only one retailer who recycles mattresses who participated in the study. This lack of participants who actively recycle mattresses (1 versus 103) negatively affects the diversity of the data.

Overall, the data acquired has some validity in which stylized facts can be established and some insight on mattresses in Nova Scotia can be obtained. However, with the small response rate and the less than desirable diverse sample, there are still issues in which the sample data can be applied to the population.

6. Results

With a survey response rate of 11.43%, we have a small sample size representing mattress disposal in Nova Scotia. These responses indicate there is strong support for change when it comes to recycling mattresses in the provinces.

These results are similar to the majority of the literature we have reviewed. It shows that there is optimism similar to the United Kingdom, and general approval for a new method of handling mattresses. Respondents are not in favour of new methods for landfills and are instead looking for recycling options. There may also be a possibility that municipalities may hesitate and wait for new data from current programs in Rhode Island & Connecticut in addition to this research before taking action as a sign of caution (Giroux, 2014).

Additionally, due to the 11.43% of participation from businesses selected for the study and a total number of 3,420 mattresses disposed of from these businesses, we can provide a rough estimate of the impact from ICI generators and retailers in Nova Scotia on Nova Scotia landfills due to mattress disposal. This rough estimate shows that businesses and organizations in the mattress

market in Nova Scotia in total dispose of 29,925 mattresses on an annual basis. When compared with Dillon Consulting (2019)'s estimate that approximately 95,000 mattresses end up in landfills we can see that not even one-third of that amount is from ICI generators and retailers. Therefore, we can assume with confidence that consumers are the largest generators of mattresses that end up in landfills and speculate they contribute an estimated 70%.

Further, not only is there a positive sentiment towards a diversion program within the business community, but overall, they are willing to pay for it. According to the data, we see the overall average cost of disposing mattresses is \$10.95 per mattress. Whereas, the maximum average price for a business willing to participate in a diversion program is \$20.85 per mattress. This means that businesses are willing to almost double the cost of disposing of mattresses to enroll in a new diversion program for the province. Therefore, either businesses in the mattress market are not price-sensitive when it comes to disposing of their mattresses, or mattress disposal is potentially a small cost when it comes to the entirety of their operations. Considering many of the businesses, 39%, claimed cost as the most important factor in mattress disposal, the latter option is most likely.

Another consideration regarding the maximum price of participation is that 10 out of the 80 responses indicated they would not be interested in paying anything, meaning 12.5% of the respondents thought that this should be a free service at no charge. Additionally, 65% of the businesses were willing to pay above the average cost per mattress of \$10.95 to participate. As a result, the

businesses that are willing to pay for a program are willing to pay a considerable amount relative to current mattress disposal costs, and the ones that are below the average cost want no charge.

Anecdotally, during the interviews and collection phase, many comments were made by respondents on the topic of mattress disposal. An overwhelming majority of contacts across industries such as shelters and community housing, camping facilities for children and youth, health facilities, and hotels and accommodations claim that they keep their mattresses for many years, and disposal is not a common occurrence, especially among smaller businesses.

Camping facilities for children and youth tend to be comprised mostly of summer camps which are only open seasonally and, as a result, their mattresses get very little use and last quite a while. Many shelters and community housing commonly give their mattresses to the occupant who has used their mattress when they move out of the residence. A common practice for some health facilities such as nursing homes is that their mattresses are given away to staff who have a high demand for mattresses for their cottages and other uses.

Many businesses within the hotel and accommodations industry donate their mattresses since they are not yet at the end-of-life stage. The primary reason being is that they are dependent on their star rating which is determined by inspections. To get a positive inspection their mattresses need to be a higher than normal standard to maintain their star rating. Furthermore, some larger establishments in the hotel and accommodation industry only replace mattresses at a minimum of seven years. In addition to infrequent disposal across industries,

many respondents also mention that mattresses themselves have improved over the years and the innovations towards protecting them have also helped extend mattress life. Overall, these comments from respondents across industries reinforce the previous conclusion that businesses and organizations are the minority when it comes to mattress disposal for landfills and that consumers are the primary disposers in Nova Scotia.

Overall, these results show inconsistency across many factors within ICI generators and retailers, but it is clear that the overwhelming majority of stakeholders want a transition from landfill disposal and that businesses are small contributors to mattress disposal.

7. Conclusion

The purpose of this research project was to identify ICI generators and retailers active in the Nova Scotia mattress market and gather important data from them regarding mattress disposal. The acquired data was then to be used to determine the optimal policy of handling mattress disposal within Nova Scotia by expanding the scope of the Mattress Management Options Evaluation report by Dillon Consulting. By expanding the scope, we have an up-to-date examination which in addition to municipal landfill sites, now includes all ICI generators and retailers. This inclusion, unlike previous literature, provides more representation of mattress disposal preferences in Nova Scotia. Furthermore, the results of this examination show that stakeholders within the province want new methods that divert mattresses from landfills and are willing to pay for them.

Furthermore, the majority of literature available is mostly through municipal annual reviews, consultant reports, and is overwhelmingly not peer-reviewed. This means that this study provides data on a topic which currently is lacking in available research.

The global pandemic of COVID-19 has presented challenges for researching with respondents. Some respondents may not even be able to work at their positions given the current crisis and could be unavailable for contact. The results of the survey may lack some external validity for other developed nations and regions showing interest in diversion programs due to the unique nature of Nova Scotia's population, economy, and geography.

It is worth interviewing stakeholders involved in the programs mentioned in the literature review to better understand their unique challenges and strengths undergoing policy implementation. Furthermore, it may be useful to seek and request data from government institutions such as Statistics Canada, Environment Canada, and Nova Scotia Department of Environment to get more supporting information to the research. Additionally, involvement from academic departments of engineering, waste management, and environmental studies would prove valuable as they have been associated with numerous studies and could have further insight into mattress disposal.

Due to the number of businesses and organizations that were unable to participate in the study, there needs to be more research done before policies can be implemented. To optimize the effectiveness of future research, survey participation rates must be maximized. It is especially important to increase

representation for retailers as their data is unique due to their exclusivity of mattress recycling within the province. To succeed in this goal, the questionnaire needs to be revised to best accommodate all the different industries within scope.

Additionally, it is crucial to conduct any further research once businesses and the province return to normalcy in a post-COVID-19 period. Lastly, to fully understand the impact of mattress disposal and the viability of a diversion program in Nova Scotia, research must be done on consumers who have been identified as the primary disposers of mattresses. To properly engage with the public and obtain the research participation required, outreach programs combined with effective communication within the municipalities are paramount.

To conclude, due to a combination of COVID-19 circumstances causing collection issues, there is not enough evidence from the data provided to recommend the best option for policy around the management of mattresses. However, several important findings are now established, and a significant first step towards sufficient research on this topic has been made.

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9. Appendix

Questionnaire

Nova Scotia Mattress Disposal Study

Start of Block: Informed Consent



SMU REB File #20-101- Mattress Disposal in Nova Scotia: A Study Involving Industrial, Commercial, and Industrial Generators & Municipalities

My name is Blair Davis and as part of the graduate requirements for my masters in applied economics, I am conducting research under the supervision of Dr. Mark Raymond.

We invite you to participate in the Nova Scotia Mattress Disposal Study. This study is being conducted to estimate the volume of mattresses and recommend the best option for a potential mattress diversion

program within the province. This option will be one that both addresses the factors involved for municipal governments and as well as businesses and organizations within the mattress industry.

There are no foreseeable risks involved with participating in this study and involvement allows participants to provide valuable input towards important research in their industry. This research could have potential impact towards future policies regarding mattresses in the province.

In order to be eligible, you must currently be situated in Nova Scotia and fall under at least **ONE** of the following:

1. A municipal facility involved with mattress management
2. A business/organization active in the mattress market
3. An institution or government entity active in the mattress market

This study is funded by Divert NS, a not-for-profit organization leading the waste diversion efforts for Nova Scotia.

Completion of the study can be done through this electronic questionnaire or by appointment via telephone interview by dialing 902-210-5132. Your participation is important to ensure there is input from all aspects of the mattress industry. If you do not

record exact figures, please provide your best estimates. If you are unable to answer and need to skip a question simply leave it blank and proceed.

Additionally, if you wish to withdraw from participating from the survey simply close your browser. Depending on your answers, the survey itself can take an estimated **5 to 10 minutes**.

Upon completion of the study you will be given the option to receive the results and provide feedback.

The Saint Mary's University Research Ethics Board has reviewed this research with the guidance of the TCPS 2 based on three core principles: Respect for Persons, Concern for Welfare and Justice. If you have any questions or concerns at any time about ethical matters or would like to discuss your rights as a research participant, please contact ethics@smu.ca or 902-420-5728.

Your contact information and survey responses will be stored securely on the Qualtrics survey platform and then properly disposed of after a maximum of 5 years in case of any needed revisions. This information will be kept confidential by remaining only with the research team consisting of myself and my supervisor. Any results released publicly in the final report will be unable to identify participating persons, businesses, or organizations. If you choose to be contacted for further information (will be asked near the end of the survey), any gathered data will remain confidential but will of course be no longer anonymous.

If you have any questions you can contact either researcher at:

Blair Davis, Masters of Applied Economics Candidate, Principal Student Researcher, divertmae@gmail.com, 902-210-5132

Mark Raymond, Saint Mary's University Department of Economics Chair, research supervisor, 902-440-5339, mark.raymond@smu.ca

I understand and agree (4)

End of Block: Informed Consent

Start of Block: Contact Info



Contact Information

For confirmation, please enter the following:

Business/Organization

Name _____

Position/Title _____

Email _____

Postal code _____

End of Block: Contact Info

Start of Block: ICI Generator Information Questions



Q1 Describe the main business activity or type

Retailer

Correctional Facility

Health Facility (hospitals, rehabilitation, nursing)

Educational Facilities (post-secondary, schools with room and boarding)

Hotels & Accommodation (hotels, inns, motels etc.)

Defense (military bases)

Other, please specify:

Q2 How many end of life mattresses does your business/organization generate annually? (mattresses to be disposed, if unsure please provide best estimates)

Total number of mattresses

Total metric tonnes (if known)

Q3 How do you manage your end of life mattresses? (mattresses to be disposed)

Recycle

Landfill

Skip To: Q5 If How do you manage your end of life mattresses? (mattresses to be disposed) = Recycle

Display This Question:

If How do you manage your end of life mattresses? (mattresses to be disposed) = Landfill

Q4 What are the reasons or barriers preventing you from recycling mattresses?
Select all that apply:

Unaware of recycling options

Lack of available recycling options

No interest

Cost

Other, please specify:

Display This Question:

If How do you manage your end of life mattresses? (mattresses to be disposed) = Recycle

Q5 Where does your business/organization send mattresses to be recycled? (please be as specific as possible regarding location, company, etc.)

Display This Question:

If How do you manage your end of life mattresses? (mattresses to be disposed) = Recycle

Q6 What is the reason(s) for your business/organization to recycle end of life mattresses?

Select all that apply:

- Corporate policy requires recycling
 - Improve brand awareness (sustainability)
 - Environmental consciousness
 - To reduce environmental impact
 - Potential cost savings
 - All of the above
 - Other, please specify:
-

Display This Question:

If How do you manage your end of life mattresses? (mattresses to be disposed) = Landfill

Q7 How much does it cost you to dispose of your end of life mattresses in landfill annually?

Total annual costs (\$)

Average cost per mattress (\$)

Display This Question:

If How do you manage your end of life mattresses? (mattresses to be disposed) = Recycle

Q8 How much does it cost you to recycle your end of life mattresses annually?

Total annual costs (\$)

Average cost per mattress (\$)

Display This Question:

If How do you manage your end of life mattresses? (mattresses to be disposed) = Recycle

Q9 Describe the process of recycling your end of life mattresses? (please be as specific as possible regarding collection method, transportation arrangements, frequency of collection)

Display This Question:

If How do you manage your end of life mattresses? (mattresses to be disposed) = Landfill

Q10 Describe the process of disposing of your end of life mattresses in landfill? (please be as specific as possible regarding collection method, transportation arrangements, frequency of collection)

End of Block: ICI Generator Information Questions

Start of Block: Opinion Questions

Q11 What is most important to you when it comes to end of life management of mattresses? (Please drag and drop the options below with most preferred at the top)

- _____ Cost (1)
 - _____ Convenience of facility location (2)
 - _____ Environment (3)
 - _____ Other, please specify (4)
-

Q12 What is the maximum price per mattress (fee) this business/organization would be willing to pay to allow your mattresses to be recycled in Nova Scotia?



Q13 Are there any special requirements for your business/organization to participate in a diversion program? (collection and transportation arrangements)

- Yes, please specify _____
 - No
-

Q14 Are you aware of any end market recycling opportunities for materials extracted from end of life mattresses? (End markets are buyers for materials extracted from processed mattresses)

- Yes
 - No
-

Q15 Are you aware of products made from materials recovered from end of life mattresses?

- Yes
 - No
-

Q16 If all factors are favorable, how likely are you to participate with a cost effective recycling program within the province? (collection, drop off etc)

	Very Unlikely (1)	Somewhat Unlikely (2)	Indifferent (3)	Somewhat likely (4)	Very Likely (5)
A cost-effective diversion program within the province (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

End of Block: Opinion Questions

Start of Block: COVID-19

Q17 How severely has COVID-19 impacted your business/organization?

	Large decrease (1)	Small decrease (2)	No impact (3)	Small increase (4)	Large increase (5)
Mattress sales and/or purchases (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mattress contaminations (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>How do you manage your end of life mattresses? (mattresses to be disposed) = Recycle</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Created barrier for recycling (4)					

End of Block: COVID-19

Start of Block: Feedback & Results

Please put any questions or comments below:

Q18 Are you willing to be contacted to obtain further information? (Your information will remain confidential but no longer anonymous)

Yes

No

Q19 Are you interested in receiving an executive summary along with a copy of the report via email? (A link to where the completed study will be provided at the end of the survey)

Yes

No

End of Block: Feedback & Results

Email Invitations

Initial Batch Email

SMU REB File #20-101- Mattress Disposal in Nova Scotia: A Study Involving Industrial, Commercial, and Industrial Generators & Municipalities

Dear respondent,

My name is Blair Davis and as part of my Masters of Applied Economics program at Saint Mary's University, I am conducting a study on mattress disposal within Nova Scotia on behalf of Divert NS with the supervision of Dr. Mark Raymond.

Approximately 100,000 mattresses end up in Nova Scotia landfills on an annual basis which presents many issues for municipalities due to their size and interference with machinery. In response, we are seeking the participation of businesses and organizations involved with mattresses to provide vital statistics that can help determine the interest and viability of a diversion program within Nova Scotia.

The survey takes an estimated **5-10 minutes** depending on responses. Please find the link below to complete the survey online. If you are not the best contact but do know the appropriate person, please either forward this email to that person or have them call the number below.

Follow this link to the Survey & informed consent:

Or copy and paste the URL below into your internet browser:

If you prefer to complete the survey over the phone or have any questions you can dial 902-XXX-XXX.

Due to research time constraints, responses must be submitted by the end of this **Friday, July 10th, 2020**.

Apologies for the short notice and thanks again,

Research team

Follow the link to opt out of future emails:

Follow-up Email

SMU REB File #20-101- Mattress Disposal in Nova Scotia: A Study Involving Industrial, Commercial, and Industrial Generators & Municipalities

Dear respondent,

This is a reminder that the deadline for this study is only one week from now on **July 10th, 2020**. If you are still interested in participating, please either follow the survey link below or contact me at 902-XXX-XXXX to complete the questionnaire in **5-10 minutes**.

Follow this link to the Survey:

Or copy and paste the URL below into your internet browser:

The data to be collected is important information that could impact policies for waste diversion in the province. For further details, please read the initial email or click the link above.

On behalf of the research team here at Saint Mary's University, thank you for your time and participation,

Blair Davis, Student Researcher

Follow the link to opt out of future emails: