Transport packaging waste management in E-commerce industry: Opportunities and risks

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A thesis
presented to the University of Waterloo
in fulfillment of the
thesis requirement for the degree of
Master of Environmental Studies
in
Sustainability Management

Waterloo, Ontario, Canada, 2022

Author's Declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.
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Abstract

Free and easy returns cause more packaging waste in online purchases. With a growing number of waste import bans in Asian countries, waste exports are now a less viable option. The high quality and low market value of post-consumer packaging increase the difficulties of packaging waste recycling. Current research often focuses on the design and material choices of packaging, the broad perspective of considering the factors leading to sustainability in E-commerce packaging has yet to be explored empirically. This study has two primary objectives: a) to explore the role and responsibilities of the E-commerce business in post-consumer packaging waste management under the Extended Producer Responsibility (EPR) regulations and b) to identify the barriers and drivers to improve packaging waste management across the E-commerce industry. As part of the first objective, the study adopted a systematic review method to review 34 papers about the best practices of packaging waste management across the retail sector over ten years (2011-2020). The results reveal that the best practices in packaging waste management are primarily based on five objectives of packaging sustainability guidelines, including optimizing resources, responsible sourcing, resource recovery, material health, and consumer engagement. Of these, consumer engagement is highlighted as a strong effort on packaging waste recycling with low cost and high efficiency. In pursuit of the second objective, the study employed a case study method to assess the current E-commerce package waste program with the best practices. The results show that best practices in the retailing industry are applied to the E-commerce business, and improvements are needed. The author undertook a content analysis to assess each e-commerce firm's packaging sustainability. This analysis confirms that firms in the E-commerce industry become similar to meet the needs of legitimacy, and institutional pressures affect green practices. Barriers have been explored and scopes of improving the packaging waste management framework identified. E-commerce businesses are aware of packaging issues and take green practices, but the packaging sustainability strategies vary across business models. The hybrid firms, which have both Business to Consumer (B2C) and Consumer to Consumer (C2C) models, perform better in packaging sustainability than B2C and C2C businesses. For a shift towards a full EPR in packaging waste, harmonized identification of the packaging producer in the E-commerce industry is also needed, a fundamental requirement for EPR regulation implementation. The role and responsibilities of the online platform should be recognized in transport packaging sustainability, especially for C2C online retailing. Besides the government's outcome-results requirements, design and operation guidelines for sustainable packaging would be required in the E-commerce industry. Overall, this work is the first attempt to evaluate online platforms' current packaging waste sustainability and the potential for complete producer control in the E-commerce industry. Furthermore, the study offers insight into how institutional theory might be adopted in corporate green strategies analysis across the industry.

Keywords: Packaging waste, E-commerce retailing, Extended Producer Responsibility, Institutional theory, Reverse logistic

Acknowledgements

I would like to sincerely thank my supervisor, Dr. Michael Wood, for his invaluable contribution shaping this thesis with valuable literature, case choices, and feedback. This would not have been possible without his support. I am also grateful to my committee member, Dr. Komal Habib, for her valuable suggestions and helpful comments. I am also thankful to Dr. Jeffery Wilson for agreeing to be my thesis reader.

Many thanks to the School of Sustainability Management and all its member staff for the thoughtful guidance, especially Dragana Kostic, for her commitment to students.

Finally, a very special word of thanks goes to my family for their constant understanding and support throughout this journey.

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Chapter 1: Introduction

E-commerce has greatly disrupted the retail sector. According to February's Retail Sales report (2019) released by the Commerce Department, the total market share of online U.S. retail sales exceeded in-store retail sales for the first time. Compared with 11.807 percent for in-store retail sales, online retail sales accounted for 11.813 percent of the total in February (Kate, 2019), growing to 15.1 percent at the end of the year. Under the restrictions on physical retail imposed by COVID-19, consumers migrate to online shopping (CNBC, 2021). In 2020, U.S. online sales nearly trebled to 44 percent of total retail sales, contributing to $861.12 billion in retail sales (Digital Commerce 360, 2021). Similarly, Canadian E-commerce retail trade sales reached a record-high of 4.82 billion Canadian dollars at the end of 2020, up 20.7 percent from the previous year. (Statistics Canada, 2020).

Due to free and easy returns, E-commerce continuously causes more packaging waste that is likely sent to landfills due to its low value. The National Retail Federation and Appriss Retail's report (2021) stated that customers return about 20.8 percent of online purchases, which is much higher than the 10.6 to 16.6 percent return rate in traditional in-store retail. Online retailers are not typically producers but repack and resell products all over the country or even the globe. When customers order online and return items, many returned products, especially in the fashion industry, end up in landfill due to the high cost of shipping items, let alone packaging (Harriet, 2021). The thin and low-quality plastics used in packaging are rarely recycled.

Due to the low benefit of recycling such plastic packaging materials, there is little incentive to do so (1421 Consulting Group, 2019). PVC and other low-quality polymers generate a lot of waste and pollution. Once returned products are shipped back to online retailers, the packaging is likely to be contaminated, damaged, or lost, increasing the difficulty for retailers and consumers to recycle transport packaging. As public awareness focusing on climate change and corporate environmental responsibility grow, businesses are considering adopting green practices in waste management (Sarkis, 2003). The increasing popularity of online shopping and high return rates require more attention to post-consumer packaging waste in the E-commerce industry.

Both developing and developed countries play essential roles in packaging waste management issues in the E-commerce industry. Developing countries have been the biggest importers of global recyclable waste, including electronic and packaging waste. This international trade of waste provides an easy and cheap way for developed countries to avoid their liabilities against dumping rubbish under stricter environmental regulations emended in 1980, such as the London Convention in the United States. However, this practice is now a less viable option with a growing number of waste import bans in Asian countries. China's ban on importing waste closed its doors to recyclables from the U.S. and other countries and forced them to seek alternatives (Brooks, Wang & Jambeck, 2018). Recently, the 14th conference of Parties to the Basel Convention adopted the Basel Amendment on plastic waste as regulated wastes and subject to prior informed consent procedure (TES,2019). With the

increasing requirements for recyclable quality, contaminated materials such as post-consumer packaging are losing their market value.

Extended Producer Responsibility (EPR) is a practical policy approach to enhancing end-of-life products and materials by adding environmental costs. It aims to shift waste treatment costs onto producers as the government has limited ability to affect waste generation. Producers refer to "brand owners, first importers, and manufactures of products and packaging" that can change packaging design (Government of Canada, 2020). Over the last few decades, producers have started to improve product design and recycle used products under the requirements of the EPR principle. Canada has had a national EPR strategy, but it is implemented from province to province. It is only implemented for packaging in five provinces in Canada (e.g., British Columbia, Saskatchewan, Manitoba, Ontario, and Québec) (Diggle&Walker, 2020). Nonetheless, packaging waste usually relies on local government services in curbside recycling (Cruz et al., 2014). For example, the Ontario government pays half of waste recycling fees. It is working on the transition of blue box collection to a 100% industry-funded waste recycling system that allows producers the flexibility to collect some packaging through other methods (Ontario, 2021). This leads to the need to determine the barriers to transforming post-consumer packaging waste management systems to full producer control in the E-commerce industry.

Institutional environments are important in shaping organizational actions, and institutional pressures affect green practices directly (Ball & Craig, 2010; Glover et al., 2014;

Juárez-Luis et al., 2018; Scott, 2013). This research aims to understand online retailers' institutional barriers and incentives to enhance transport packaging waste management.

Research on the barriers and drivers to engaging online retailers in better packaging waste management strategies is vital for several reasons. First, waste reduction is one of the requirements under Sustainable Development Goal 11: *Sustainable Cities and Communities* and associated with Goal 12: *Responsible Consumption and Production* (United Nations, 2019). It is also essential to transform the current linear economy into a circular economy. Second, it is an opportunity to identify the responsibility of E-commerce retailers for waste reduction. China's ban on importing waste closed its doors to recyclables from developed countries and forced them to seek alternatives (Brooks, Wang & Jambeck, 2018). Since communities have limited waste generation capacity, E-commerce is more likely to take adequate measures to reduce packaging waste. Third, packaging waste reduction is an effective measure to deal with climate change (Bogner et al., 2008). The current linear retail supply chain leads to low resource use efficiency and sends waste to landfills, which creates significant volumes of waste and is a primary source of CO2 emissions. In Canada, people produce about 3.3 million tons of plastic waste annually while only recycling 9 percent of it (Lewis, 2019; Statistics Canada, 2019). This study will identify specific pressures for online retailers to manage transport packaging waste under the regulatory, cognitive, and normative institutional forces in the case of Ontario. It provides managerial experience for businesses to apply EPR-based packaging waste management measures at sector levels. By asking producers to take

responsibility for the post-consumer and production and distribution stages of products, online retailers are likely to adopt sustainable initiatives to increase the product recovery rate and promote eco-design, thus mitigating pollution and packaging waste.

This study used a mixed-method approach to identify barriers and incentives to improve post-consumer packaging waste management in the E-commerce industry, integrating systematic literature reviews and case studies. Mixed methods can help "address more complicated research questions than case study alone" (Yin, 2018, p. 101). First, a systematic literature review is conducted on best practices of packaging waste management. In the case study section, five E-commerce companies are selected and divided into three groups as comparative cases according to 2020 estimated monthly traffic in Canada. DiMaggio and Powell (1983, p148) argued that "firms become more similar due to isomorphic pressures and pressures for legitimacy." It means firms in the same industry will take similar actions and learn from the leaders to be competitive. Compared with the best practices identified in Chapter 4.1, five firms' current measures will be summarized and analyzed to find the opportunities and risks of integrating returned packaging waste management in future improvement. Based on the evaluation, this study will provide suggestions for policymakers and online retailers to address the risks and increase their innovativeness and risk-taking in packaging waste management.

The remainder of the study is organized as follows. Chapter 2 reviews the literature on institutional theory, post-consumer packaging waste, and EPR regulations. Chapter 3 presents the main aspects of the systematic review methodology and case study. Chapter 4

provides the main research findings, and Chapter 5 discusses the two RQs. Chapter 6 details the research implications and proposes an agenda for future research. Chapter 7 presents research limitations.

Chapter 2：Literature Review

The literature review will first engage with Institutional Theory in corporate sustainability to build a theoretical apparatus upon this study. Then a review of post-consumer packaging issues in the E-commerce industry will narrow corporate sustainability into waste management. Finally, the state of knowledge on EPR is introduced as practical policy tools for packaging waste management.

2.1 Institutional Theory and Corporate Sustainability

The literature on the use of institutional theory in corporate sustainability is vast and has been reviewed extensively in examining the adoption of one corporate strategy and corporate social responsibility studies (e.g., Campbell, 2007; Gauthier, 2013; Grob & Benn, 2014). In this literature, the institutional theory is defined as a tool to analyze organizational choice and "emphasize certain supply chain practices because they observe other firms doing so" to respond to external pressures (Giunipero, & Ketchen, 2004, p. 530). Scott's (2013) study on institutional theory states that external corporate forces are mainly from regulative, normative, and cultural-cognitive institutions. Those institutions can be reflected in the regulation basis, societal acceptance, and support for corporate environment initiatives (Manolova, Eunni, & Gyoshev, 2008; Peng, 2003). Most provide suggestions on how businesses might develop an institutionally focused approach for corporates. For example, Grob and Benn (2014) found through institutional pressure analysis that the proliferation of sustainable procurement across organizations was associated with the isomorphism forces which engage organizations to

mimic each other and bolster their legitimacy. They indicated that shaping transformation at the industrial level might work better than stabilizing the isomorphism forces during the dynamic processes of responsible consumption, a point also supported by van Wijk et al. (2013) in a management study.

Moreover, empirical studies have shown that cultural-cognitive and normative institutions influence innovation by affecting behaviour and attitudes (Shane et al.,1995). As an integral part of the sustainable supply chain, the institutional theory may also be used to understand the increasing concern and green practices on waste management in the E-commerce industry. In this research, the institutional theory helps explain the similar rules adopted by online retailers to build a post-consumer waste framework and identify the common barriers to increasing the efficiency and effectiveness of material recovery and disposal.

2.1.1 Institutional Environments

Institutional environments are essential in shaping organizational actions (Ball & Craig, 2010; Glover et al., 2014; Scott, 2013). Juárez-Luis et al.'s (2018) found that institutional pressures affect green practices. Organizations not only seek reasonable goals of efficiency but also focus on changes in social values and regulations (Gibbs & Kraemer, 2004). The regulatory force plays a significant role in determining an industry's environmental initiatives (Campbell, 2007; Pfahl, 2005; Ortas et al., 2015). Additionally, the instructional theory points out those isomorphic pressures make firms in the same industry similar to meet legitimacy needs (DiMaggio &Powell, 1983). It means firms in the same sector will take similar actions

and learn from the leaders to be competitive and meet stakeholders' needs. For example, online retailers are likely to be induced to reduce their waste by the isomorphic pressures from competitors, partners, and the government (Ye, Zhao, Prahinski, &Li,2013).

2.1.2 Three Pillars of Institutions

Scott (2013)'s study on the three pillars of institutions provides the principal dimensions of institutions. These three pillars were built on the three mechanisms identified by DiMaggio and Powell's research (1983) on institutional isomorphism. The three key constructs are:

1. *Coercive isomorphism* is described as a type of isomorphism that comes from political influence and the legitimacy dilemma.

2. *Normative isomorphism* relates to professionalization.

3. *Mimetic isomorphism* is a result of the natural reactions to uncertainty.

Table 1 summarizes the three pillars of institutions with mechanisms and indictors described by Scott (2013, p. 60).

Table 1Three Pillars of Institutions and Indicators

	Regulative	Normative	Cultural-Cognitive
Basis of compliance	Expedience	Social obligation	Shared understanding
Mechanisms	Coercive	Normative	Mimetic
Indictors	Rules Law Sanctions	Certification Accreditation	Common beliefs Shared logics of action Isomorphism

Source from Scott (2013)

2.1.3 Regulative institutions

The term "coercive isomorphism" refers to the formal and informal pressures exerted by other institutions and the cultural expectations of the society (DiMaggio & Powell, 1983). Based on this mechanism, Scott defined the regulatory process as rules that "setting, monitoring, and sanctioning activities" (p59). In this concept, sanctions refer to rewards or punishments that try to influence future behaviours. Similarly, Campbell (2007) argues that regulatory force is not the presence of regulations but also the capacity of the government to monitor and enforce these environmental regulations. The indictors of the regulative institution are rules, laws, and sanctions. The logic underlying the regulative pillar is that individuals or organizations set rules based on their interests while they conform to regulations and rules to seek rewards or avoid punishments.

To make a sustainable planet possible, the World Business Council for Sustainable Development set up the Vison 2050 objective that ensures 9 billion people live within the resource limits of planets (WBCSD, 2010). As the Canadian Council of Ministers of the Environment (CCME) report noted, Canada is far from achieving the above 2050 resource use and waste management objective. According to the Conference Board of Canada report (2013), Canada has the worst track record for waste management among the OECD countries. In 2012, Canadians produced over 34 million tons of waste annually, and three-quarters of that ended up in landfills or incinerators (The Conference Board of Canada, 2012). This waste is expensive to manage ($2.9 billion in 2010, increased by 12% from 2008) and brought enormous challenges to municipal budgets (Statistics Canada,2013). Although there

is a positive relationship between the expenditures for local governments and the final waste diversion rate, the growing volume of waste and the costs of managing the environmental impacts require Canada to adopt new approaches to waste management. Table 2 shows the principles of waste reduction under the related regulation and initiatives in Canada. Packaging waste management approaches mainly target the first three aspects- Reduce, Reuse, and Recycle.

Table 2 Overview of Waste Reduction Regulations and Initiatives in Canada

Document	Focus	Principles	Targeted waste management stages
Canada-wide Action Plan for Extended Producer Responsibility,2009	Extended Producer Responsibility	It's the producer's duty to address the post-consumer waste problem	Recycle (Diversion)
National Zero Waste Council 2013 Discussion Paper	Multi-stakeholder initiative	1) creating a baseline by current data and quantitative targets on reducing the environmental footprint of packaging, 2) tracking the number of packaging remaining in the marketplace 3) engaging business on packaging optimization	Waste prevention and reduction
Waste-Free Ontario Act,2016	1.Upstream waste prevention at the manufacturing level 2. Reducing or preventing waste from a consumer or commercial and institutional level	1)Design changes on products and packaging 2) Behavior changes among all stakeholders and sectors of society	Waste prevention and reduction
Canada-wide Action Plan on Zero Plastic Waste, 2019&2020	Shifting to a Circular Economy	1)Add "plastic manufactured items" to the Canadian Environmental Protection Act, 1999 2) Create economic opportunities to recover the value of used plastics	Recycle (Diversion)

2.1.4 Normative institutions

"Isomorphic changes" can also be achieved through "normative pressure." These pressures come from educational institutions that have established expert norms and networks. For example, in packaging waste management, packaging production associations can support the promotion of sustainable packaging through normative pressure. Scott (2013,

p.66) believed "social beliefs and norms are both internalized and imposed by others," and they can be indicated by certification and accreditation. Professionalism creates normative pressure, which is generally connected to external stakeholders' expectations, norms, and standards (DiMaggio and Powell, 1983; Lai, Wong, & Cheng, 2006). Under this pressure, firms stick to the certifications of sustainable practices, which gain the trust and reputation of customers to be more competitive in the same industry (Scott, 2013).

According to the Australian Packaging Covenant Organization (APCO, 2019), 'Sustainable packaging' is defined as packaging that performs this primary function but has a lower environmental impact than existing or conventional packaging. This concept considers economic and social factors as well as the environment. (For detailed criteria, see Appendix 1)

The CCME had adapted EPR to promote sustainable packaging in Canada (CCME, 2009). However, the action plan under EPR was non-binding. It provided the consensus on "what should be tackled, when, and how," without any quantity targets or monitoring mechanisms. There was no widely accepted packaging waste management framework, especially in the E-commerce industry. As the CCME's report (2008) on sustainable packaging inventory suggested, the CCME should consider several high-quality guidelines and tools already exist rather than create new approaches for sustainable packaging, such as the Design Guidelines Stainable Packaging established by Sustainable Packaging Coalition. The Design Guidelines for Sustainable Packaging (2006) provided some good directions for the product or packaging Designers in packaging waste reduction and recycling according to the quality of packaging, including "optimizing resources," "responsible sourcing," "material

health," and "resources recovery." Recently, a new updated sustainable packaging guideline (2020) published by the Australian Packaging Covenant Organization (APCO) created a co-regulatory framework based on the National Environment Protection (Used Packaging Materials) Measure 2011 (the NEPM) and the Australian Packaging Covenant. It summarizes ten sustainable packaging principles which provide greater detail to the 2006 guidelines (see Appendix 1)

2.1.5 Cultural-cognitive institutions

When organizations imitate other organizations under uncertain circumstances, including inadequate understanding, unclear goals, and so on, “mimetic isomorphism” will occur. An organization may have top performance in the field and provide a convenient source of practice without any desire to be copied (DiMaggio & Powell 1983). Scott (2014) considers the cultural-cognitive institution as common beliefs. Individuals and organizations in one field might adopt isomorphic action due to shared logic. It is also the culture-specific beliefs about socially appropriate behaviour, which are acquired through socialization by living or growing up in a community or society (Hirsch and Lounsbury, 1997). For example, as the 2019 to 2022 Federal Sustainable Development Strategy (2018) mentioned, Canada should divert at least 75% (by weight) of plastic waste from landfills by 2030. To achieve this objective, the shared belief of Canadians is to adopt sustainable lifestyles and choose sustainable products.

The 2030 Agenda and the SDGs have included tackling plastic pollution as a core component (UN, 2015). SDG 12's implementation, which focuses on sustainable consumption and production patterns, is crucial for reducing plastic waste.

SDG 12 offers a set of quantifiable goals to direct government and business action by 2030. The objectives related to the waste problem are as follows:

1. Substantially reduce waste through prevention, recycling, and reuse.

2. Encourage companies, substantial and transnational companies to adopt sustainable practices and to integrate sustainability information into their reporting cycle.

3. Ensure that people everywhere have relevant information and awareness for sustainable development and lifestyles in harmony with nature.

4. Support developing countries to strengthen their scientific and technological capacity to move towards more sustainable consumption and production patterns.

Those four targets force businesses and customers to take action on packaging improvements and innovations in material design, recycling technologies, and infrastructure. The role of the state is vital in institutional environments, as the condition can shape organizational practices, set goals without specified methods, and promote public awareness (Chuang, Church, & Ophir, 2011; Scott,2013; Grob & Benn, 2014). Different countries might have other institutional factors shaping sustainable corporate practices (Kolk, 2005). In developing countries, the regulatory institution has a substantial impact on promoting sustainability-related initiatives in developing countries. However, normative pressures are weak (Amran & Haniffa, 2011). In this study, the institutional theory provides a lens through

which to explore the barriers and drivers to E-commerce packaging waste management in the context of Canada.

2.2 Packaging Issues in the E-commerce Industry

In 2020, COVID-19 promoted the roll-out of digital services and e-commerce. The transformation into E-commerce increases massive production and consumption of packaging materials, which are one-time-use items that are quickly discarded upon reaching the consumer. Although recycling rates for some packing materials, such as corrugated cardboard, are high, they are still too low for many other materials. According to a 2019 study on the Canadian plastic industry, markets and waste generate more than 3 million tonnes of plastic each year, and 47 percent of it is packaging (Environment and Climate Change Canada, 2019). Only 9 percent of plastic is recycled. Similarly, China generated about 60 million tons of plastic waste, of which about 16 million tons will be recycled in 2020 (China Material Recycling Association,2021), which translates into a recycling rate of 26.7 percent for plastic.

2.2.1 Transport Packaging and Environmental Impacts of Packaging Waste

The packaging used to protect the product during transport in retail systems is called transport packaging (Sustainable Packaging Coalition, 2018). There are three levels of packaging that are widely used in the logistic of the retail system (Saphire, 1994):

1. **Primary packaging** is the direct protection and containment of products. It often provides information on the brand, product functions and. Some of them are not necessarily for transport.

2. **Secondary packaging** is made to hold one or more items with primary packing. It aims to aggregate products into a large unit to improve efficiency and safety during transport and distribution. Additionally, it refers to the packing for direct customer shipments. Bags and boxes are common examples of secondary packing.

3. **Tertiary packing** is utilized for secondary group packaging to maximize loading efficiency. It is the traditional method of transporting bulk items.

Table 3 Transport Packaging Materials Used in the E-commerce Industry

Packaging materials	Primary packaging	Secondary packaging	Tertiary packaging
Cardboard and papers	boxes, labels	boxes, labels, envelopes	boxes, labels, slip sheets
Plastic	baling films, containers or bottles	Poly bags, blisters, tape, bubble wrap, woven bags	pallets and skids

Packaging can significantly contribute to GHG emissions, mainly when using cardboard packaging (Mangiaracina et al., 2015). According to the Analysis of Generation Characteristics and Management Situation in Chain Express Packaging Waste Report (2019), cardboard and plastic bags are the two primary materials for E-commerce packaging, accounting for 90.95 percent and 9.05 percent, respectively, Chinese packaging materials in 2018. China consumed 85.605 million tons of paper packaging materials in 2018, of which more than 96 percent was cardboard (Greenpeace, 2019). This report stated that 13.03 million tons of CO2 emissions were generated in the packaging waste production, use, and disposal processes in 2018, which required 710 million trees to mitigate the impact.

There are two views on the environmental impacts of online shopping-related packaging. Some researchers hold a negative impact of packaging used in online shopping (Williams &

Tagami, 2003; Borggren et al., 2011; Van Loon et al., 2014). On the one hand, customers often order individual items instead of consolidating due to discounts or unplanned purchase behaviours (Borggren et al., 2011; Hostler et al., 2011; Van Loon et al., 2014). Some convenient shopping and delivery options make this problem worse but at the same time increase customer satisfaction. For example, Amazon's free Same-Day and One-day delivery services reduce the costs of online shopping for the customer at the expense of the environment.

On the other hand, protective packaging is required in distribution processes (Matthews et al., 2002; Williams and Tagami, 2003). Suppliers always adopt secondary packaging outside the items to protect their products during delivery to consolidate or defend the plain packaging in long sorting and transportation processes. Compared to regular retail, ordered goods have four times more touchpoints that are likely to be damaged in online retail logistics, requiring more protective packaging in online shopping (Ameripen, 2017). As a result, conventional retail may have lower environmental impacts due to the limited shopping bags used (Van Loon et al., 2014).

However, Weideli & Cheikhrouhou's study (2013) on the environmental analysis of U.S. online shopping argued that online shopping tends to be more controllable in reducing GHG emissions through improvements in the design of packaging and return processes. Similarly, Van's research (2014) showed that some forms of packaging could have lower needs packaging in the online retail channel, such as no secondary packaging needed in the direct delivery of electronic products.

Finally, returns also significantly contribute to GHG emissions depending on the amount and methods of products sent from customers' homes to the distribution warehouse (Wang and Lalwani, 2007; Wiese et al., 2012). A 2010 study by Edwards et al. (2010) in the United Kingdom found that separate car returns generate 12 times more significant GHG emissions than consolidating returns. Customers return 20 to 30 percent of online purchases, which is much higher than the 8 to 10 percent return rate in traditional in-store retail (Table 4). A high return rate in online purchases brings a new challenge in tackling the packaging of returned goods.

2.2.2 The Traditional and E-commerce Retail Systems

Understanding online purchases' logistics to track packaging waste in E-commerce is the first step. The traditional retail logistic system is linear, according to a 2017 white paper by the American Institute for Packaging and the Environment (Kyla et al., 2017). Suppliers deliver goods to a warehouse or a store where they are inventoried until individual units are on the shelf for retail display. These goods are frequently unitized in large quantities for safe transportation and effective storage. The consumer is typically in charge of making their own purchases and does it on-site. In this model, consumers and retailers share the responsibility of recycling and disposal of product packaging when returning the product to the store without additional packaging.

However, online retail creates a new paradigm using a digital device. Online purchases reduce the need for a physical business to serve as the hub of the supply chain. The fulfillment center can replace it to receive individual orders and assign bulk products to

parcel delivery providers. Before customers receive the final products, the transaction can be completed in a virtual space. As a result, consumers are generally responsible for all packaging if they don't decide to return goods (Figure 1). The trend of miniaturization and lightweight leads to excessive secondary packaging needed in the E-commerce logistics systems (Wang and Guo, 2014). Unlike traditional retail, E-commerce businesses primarily sell goods in small pieces with long-distance transport. A third-party express company generally adopts a destructive packaging design to improve customer satisfaction. Consumers' preference for high privacy and protective packaging increases the difficulty of splitting and restoring packaging materials. Table 4 (below) compares the transportation packaging management of traditional and online retail systems.

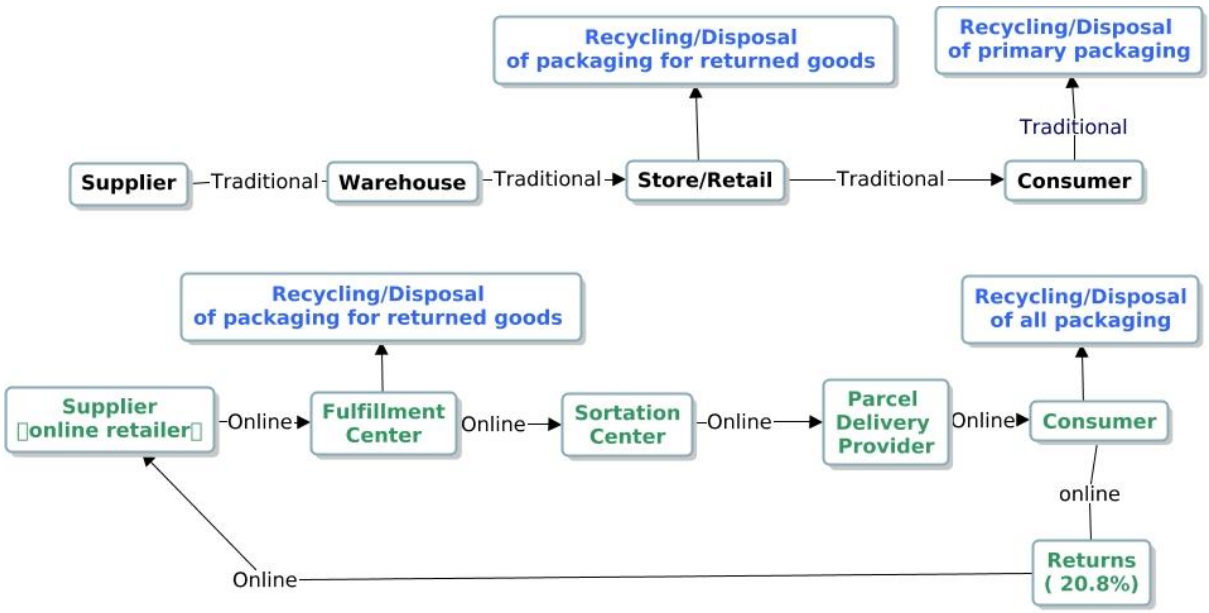

Figure 1 Simplified Traditional and E-commerce Retail System
Source: based on Ameripen. (2017)

Table 4 Transport Packaging Management in Traditional and E-commerce logistics Systems

	Traditional Retail Logistics System	**E-Commerce Logistics System**
Retail type	In-store retail	Online retail
Transportation packaging involved	Primary, secondary and tertiary packaging	Primary and secondary packaging
Post-consumer waste	Primary packaging	Primary and secondary packaging
The responsible for packaging waste disposal or recovery	Secondary and tertiary packaging is collected for disposal or recovery at the retail level. Consumers are responsible for the transport of primary package.	Consumers must handle disposal or recovery for all primary and secondary packaging.
Return rate	10.6-16.6%	20.8%

2.2.3 Four Stakeholders in the E-commerce Logistic and Post-consumer Packaging Waste

Four significant supply chain participants—product sellers, online marketplaces, logistics providers, and customers—manage the transport packing produced by online purchases (Wang, & Zhu, 2020). Each of them can affect the performance of packaging design and product return by requiring different levels of transport packaging in practice (Table 5). In the E-commerce industry, online platforms play an essential role in coordinating product sellers, shipping carriers, and customers by deciding whether and when additional packaging is needed. As the core hub in E-commerce logistics, online platforms should be responsible for pre-consumer and post-consumer packaging.

Table 5 The Role of Four Stakeholders in Packaging Sustainability

Stakeholders	Definition	Responsibility
Product Sellers	The first packaging provider, stakeholders that wrap product with designed packaging with brand name and firm image.	Material value, package footprints, packaging recovery and recycling, and effective and efficient for consumer packaging return or reuse.
Online Platforms	The online platforms of product sellers. Online platforms frequently repack or add additional packaging to the sellers' items.	Monitor their packaging sustainability in terms of product-to-packing ratio and incentive scheme for customer return and reuse.
Shipping Carriers	The deliverer of products to customers	Transportation footprints; extra packaging to original package ratio; additional packaging recovery value; and incentive schemes for consumer packaging return or reuse.
Customers	The ultimate packaging receivers.	Managing various types of end-of-life packaging.

The focus of this study is post-consumer packaging waste discarded after consumers receive the items. This packaging has served its protection, passed through the hands of a final consumer, and thrown out for disposal or recovery. Compared with pre-consumer packaging waste, which can reuse in product transportation, post-consumer packaging is sorted and collected differently in different regions. In Canada, post-consumer packaging is collected separately in the bring site collection or curbside recycling in the mixed municipal solid waste. Some provinces have launched garbage classification trials to provide residents with the convenience of sorting and discarding their packaging wastes close to home, such as the Ontario Blue Box program. Besides government and customers' efforts, online platforms also should act on packaging waste recycling. The following section introduces the major E-commerce business models and the role of the online platform in each model.

2.2.4 Major E-commerce Business Model Classifications

There are four main business models in E-commerce. This study mainly introduces three of them, including B2C, C2C, and Hybrid. Depending on the business model, an online platform's role varies.

Business to Consumer (B2C)

B2C sales are the classic retail model, in which a company sells to individuals but does it online rather than in a physical store (Gupta, 2014). They are direct sellers, such as manufacturers or small enterprises, or online department shops that sell items from various producers. Typical B2C E-commerce provides cross-brand products directly to online customers. The online platform controls the inventory and pricing of each good supplied by product sellers and is in charge of shipping to customers.

Consumer to Consumer (C2C)

C2C businesses allow customers to trade, buy, and sell items in exchange for a small commission paid to the site (Gupta, 2014). C2C online retailers provide private sellers platforms to promote second-hand resale goods. The online platform is an intermediary between product sellers and customers. Individual sellers post information about goods online and wait for customers to place an order.

Hybrid (B2C&C2C)

Some online retailers serve the B2C and C2C markets, allowing individuals and corporations to offer and display products for sale online (Gupta, 2014). This online platform accepts multiple sellers, including individuals and companies. The online platform offers a

marketplace for consumers to sell unwanted items. For example, Amazon Renewed allows individuals to sell three types of products:

- *Refurbished*: Products that have likely been used and returned by the consumer, either because they malfunction or they no longer desired it.
- *Pre-owned:* Products that were most likely used but were in better condition when returned than a reconditioned product.
- *Open-box:* Products whose packaging has been opened but the underlying product has not been used.

The following section introduces the challenges of post-consumer waste management.

2.2.5 The Increasing Difficulties on Post-consumer Waste Material Management

Although waste reduction can lead to financial and environmental benefits, the value of waste reduction varies between industries and business sizes (Hui, Chan and Pun, 2001; Redmond, Walker and Wang, 2008)**. "**It has become increasingly difficult to reduce further packaging cost and environmental impact" in the E-commerce industry (Escursell, 2021, p.1). According to Esursell's review on sustainability in E-commerce packaging (2021), current research often looks at the design and material choices of packaging. However, it has not taken the broad perspective of considering the pressures organizations are under to adopt green practices and sustainable packaging in the E-commerce industry.

Supply chain management allows the systemic and strategic design and management of flows of products, information, and financial resources to achieve efficiency and effectiveness in material and energy use (Chopra & Meindl, 2007). Waste is one of the typical examples of an ineffective supply chain. Subramanian et al.'s research (2009) investigated how better supply chain coordination can affect product design choice and cause

environmentally friendlier products. Online shopping tends to be more controllable in reducing GHG emissions by improving the design of packaging and return processes (Weideli & Cheikhrouhou, 2013).

The traditional supply chain model of "take, make, consume and throw away" only focuses on the forward channel of the entire supply chain and leads to the low efficiency of material use and waste generation (Amin & Zhang, 2012). In this open-loop and forward supply chain, the customer is the end of the process, and their requests are the main force of the production and operation processes (Masoudipour, Amirian, & Sahraeian, 2017). Besides the demand for products, Dowlatshahi (2000) identified several key factors that cause the one-way and downstream flow of products and services, including the costs of land, availability of materials, infrastructure, and warehouse capacity. Hence, there are few environmental concerns in developing the forward supply chain.

With the increasing awareness of environmental protection and the requirement of some environmental laws (e.g., extended producer responsibility), businesses try to close the supply chain loop by considering the post-consumer phase of product management (Masoudipour, Amirian, & Sahraeian, 2017, Amin, & Zhang, 2012, Blackburn et al., 2004). Therefore, integrating reverse logistics, an upstream product flow from consumers to producers, is an effective way to close the traditional linear supply chain.

Managing returns are the first step to building the closed-loop supply chain. Reverse logistics refers to all operations of the resource flow from early and end-of-life products to final treatment (Kokkinaki et al., 2001). A customer return is the first step in reverse logistics

(Rogers & Tibben, 2001). Once products are collected, they will be transported to a facility for "inspecting, sorting, and disposition" (Blackburn et al., 2004). In Blackburn's study (2004) on reverse logistics, there are three results of those products:

1. repaired and returned to customers (broken products);
2. reused and resale by retailers (new products); or
3. are disassembled for reconditioning, remanufacturing, or recycling to components and raw material suppliers (cannot be repaired).

Compared with forwarding logistics, reverse logistics provides new opportunities to increase material conservation and energy efficiency and minimize waste and costs in the supply chain.

However, it is challenging to practice reverse logistics in the retail industry. Lundin and Karlsson's research (2018) on the barriers to implementing a return system for industrial packaging found that a lack of time and location can also lead to the low efficiency of reverse logistics. Contributions assessing the impact of reverse logistics in packaging waste reduction are few and are mainly limited to the B2C area. Yang (2014) has ranked barriers to implementing reverse logistics in the B2C market. He identified three significant barriers: financial constraints, lack of awareness of the reverse logistics practice, and no legal requirements. Research on reverse logistics has not yet been carried out in the C2C market.

Different from the returned product, transport packaging is more likely to be excluded from reverse logistics, especially plastic packaging, due to its quality. Plastic bags are used in almost half of all e-commerce shipments in China (1421 Consulting Group, 2019). The thin

and low-quality plastics are too poor for reuse. As a result, the reward for recycling such plastic packaging materials is too low, implying that the motivation to recycle stays low.

Ongoing studies have identified three critical factors of successful waste material recycling: targets and priorities, quality control, and marketing (Baeyens et al., 2010). According to Baeyens's research (2010) on the recovery and recycling of post-consumer waste materials, a successful recycling system begins driving away from landfilling or incineration and ends with broad public involvement. Under the target setting, legislation must involve the public in waste reduction (Timlett & Williams, 2008; Xiao et al., 2017; Joseph, 2006). Quality control requires consistently keeping "high-quality and marketable end products" in the supply chain (Lund 1993; Wilson 1997, Fleischmann et al., 2002). The public should avoid dirty recyclables such as contaminated cardboard and uncleaned plastic bottles. Finally, the marketing of recyclables directly affects sustainable business initiatives on waste recycling due to profits (Agarwal et al., 2005; Hodge, Ochsendorf & Fernández, 2010). Those three factors provide possible standards to evaluate the current post-consumer packaging management frameworks. The following section introduces an effective policy tool to address the above packaging waste problems.

2.3 The Extended Producer Responsibility in Post-consumer Waste Management

This section introduces different EPR policy instruments and their implications on packaging waste management.

2.3.1 The Extended Producer Responsibility

Extended Producer Responsibility, or EPR, is considered a practical policy option to address the post-consumer waste problem by asking producers to take responsibility for the "post-consumer stage of a product's life cycle" as well as production and distribution stages (OECD, 2001). It assumes that collecting and recycling end-of-life materials have a net cost and might ends up in landfills without regulations. Some end-of-life materials are valuable, such as plastics, packaging, and paper. Under the EPR principle, several financial incentives are used to encourage manufacturers to design for the environment to reduce the cost of final disposal. The primary objective of EPR is to increase the resource recovery rate, thus mitigating the pollution and waste of end-of-life materials (Toffel, 2003). There are two important features of EPR policy. For starters, it pushes financial and management responsibilities upstream, away from the public sector. Second, it intends to encourage businesses to include environmental concerns in the design of their products and packaging (Smart Prosperity Institute, 2020).

2.3.2 Individual and Collective Responsibility

There are two practical forms of EPR regulations: a) Individual Producer Responsibility (IPR); and b) Collective Producer Responsibility (CPR). IPR requires individual producers to pay the recovery fees for their products, while CPR asks the whole sector to take responsibility for all end-of-life products in this industry (Toffel, 2008). Research shows manufacturers' preferences for IPR or CPR differ (Atasu & Subramanian, 2012; Toffel, 2008). First, CPR may cause lower incentives for producers to improve product design than

IPR due to the free-riding problem (Atasu, & Subramanian, 2012, Plambeck and Wang, 2009; Esenduran and Kemahlioglu-Ziya, 2011). Under CPR, producers with different recovery rates should share the recovery costs even if their actual return volumes are large. It is necessary to assign the average recovery costs to avoid free riders because they may be more competitive in product price because of the low cost of design and recovery fees (Atasu & Subramanian, 2012). However, Toffel (2003) argues that it is necessary to build collective recycling infrastructures because "individual responsibility can be achieved within and is compatible with collectively set up and operated take-back, treatment and recycling systems" (Pg.108). When imposing IPR, individuals must invest in logistics to support recycling and disposal by themselves, leading to high costs and low efficiency in economies of scale (Atasu, & Subramanian, 2012). Recyclers may be incentivized to improve product design and recovery rates for higher competitiveness and profits. Thus, take-back regulations are not only benefiting the environment but also based on the market. A well-established result from this literature is that the choice of IPR or CPR depends on the context of needs.

2.3.3 EPR Solutions in Packaging Waste Management: Applications on Post-consumer Waste Collection Systems in Canada

The first instance of EPR in packaging was the German Packaging Protocol, released in 1991. The German industry established a "dual system" for waste collection, taking up household packaging alongside municipal waste collections, per its requirements that manufacturers be responsible for the recycling or disposal of any packaging material they generate (Multi-Material Stewardship Western, 2022).

Now, the EPR strategy in packaging waste management is widely practiced in Canada. The CCME Canada-wide Action Plan for Extended Producer Responsibility identifies packaging waste as a Phase 1 material (CCME, 2009). Unlike the international EPR regulations, the concept of EPR in Canada has primarily targeted diversion rate increases because most producers add the recycling program cost to the price of products (EPR Canada, 2017). Three types of packaging are listed in Phase 1 materials: milk containers, beverage containers, and multi-packaging and printed paper (PPP). In this study, only the PPP is considered. In 2018, the CCME approved a Canada-wide strategy for zero plastic waste (CCME, 2018), aiming to take a circular economy approach to plastics and provide a framework for action in Canada. The discussion paper points out that "federal, provincial and territorial governments agree that extended producer responsibility is one of the most effective and efficient ways of increasing collection and recycling rates and is a cornerstone to achieving our Canada-wide objective of zero plastic waste"(Environment and Climate Change Canada, 2020, Page 14). All the above laws have emphasized the role of producers in packaging waste stewardship. Table 6 lists the national goals for packaging waste reduction in Canada.

Table 6 National Goals on Packaging Waste Reduction

Nation goals	Source
Canada should divert at least 75% (by weight) of plastic waste from landfills by 2030.	the 2019 to 2022 Federal Sustainable Development Strategy
By 2030, working with industry to make all plastics reusable, recyclable, or recoverable 1. Collaborating with industry to increase recycled content in plastic goods by at least 50% where applicable by 2030 2. Collaborating with business and other governmental levels to recover 100% of all plastics by 2040 and reuse or recycle at least 55% of plastic packaging by 2030.	G7 Ocean Plastics Charter Environment and Climate Change Canada, 2020

2.3.4 Implementation of EPR in Municipal Solid Waste Classification: Ontario

Following the guidelines of national goals, the government has published several laws and regulations for implementation. A centralized approach implies that the rules are provided nationally, whereas performance can vary across regions. Ontario has been selected as the pilot province to implement Canada's new MSW classification legislation. This study takes The Blue Box Program as a case to verify the risks and opportunities of current post-consumer waste management.

Ontario's Blue Box program

In Canada, waste management is generally governed at the provincial level. (Waste Reduction Week Canada, 2021). According to the CCME report (2015), BC is the only jurisdiction with the legislated EPR program requiring producers to have direct responsibilities for the funding and operation of packaging waste recycling. Most jurisdictions (SK, MB, ON, and QC) have established municipalities' collection and recycling centers to share the process and costs of the PPP program with producers. In 2021, Ontario will enhance the Blue Box program and transfers the financial and operational responsibility to producers of plastic and packaging.

The Blue Box program was a curbside recycling system in municipalities to collect source-separated household waste materials since the 1981s. It has been implemented as part of the Ontario MSW management since the 1994 Ontario Regulation 101/94 was issued (Government of Ontario, 2021). There are mainly five standard materials collected in the Blue Box systems, including "newspapers, glass bottles/jars, steel cans, aluminum cans,

plastic PET bottles as well as a minimum of two other materials, e.g., boxboard, cardboard, fine paper, the plastic film." According to Stewardship Ontario's survey (2013), nearly 90 percent of Ontarians believe the Blue Box program shaped their recycling habit.

In Waterloo, The Blue Box program is implemented as a two-box sorting system that requires sorting "containers" and "paper products and plastic bags" separately. Detailed materials accepted in two blue boxes are shown in Table 7. All the packages need to be empty and rinsed. Also, cardboard boxes full of garbage and recycling and mixed piles of unbundled garbage are not covered in curbside recycling (Region of Waterloo, 2021). This minimum collection list covered about a third of five percent of blue box materials in 2017(Government of Ontario, 2021). According to Chowdhury et al.'s investigation of Ontario's MSW diversion (2017), successful paper and organic recycling programs made significant progress in the waste diversion rate, increasing up to 85% from 1483 187 tonnes to 2 749 047 tonnes. It shows that Ontario's waste diversion rate was sensitive to policy and related diversion programs (Chowdhury et al., 2017).

Table 7 Materials Accepted Under the Two-Box Sorting System

Box	Containers Blue Box	Paper Products and Plastic Blue Box
Acceptable Materials	1. Cartons, such as drinking boxes, milk or juice cartons 2. Glass bottles and jars 3.Metal cans, including empty and dry paint cans, empty aerosol cans 4. Paper cups, such as take-out coffee cups 5. Plastic bottles, jars, and clamshells with plastic identification symbols 6. Aluminum foil wrap and pie plates/trays 	1. All household paper 2. Boxboard, paper tubes, paper egg cartons, paper take-out trays 3. Corrugated cardboard: Flatten and size no larger than 75 x 75 x 20 centimetres (30 x 30 x 8 inches), tie together with twine 4. Plastic bags, including bread, milk, and outer wrap from packages of toilet paper 
Disposal Ban	No containers with food, candy wrappers, cardboard cans, wooden orange crates.	No bags that contained meat or cheese, biodegradable bags, mesh bags, bubble wrap, diapers, foil or plastic wrapping paper.

Source: Region of Waterloo-Blue box (2021)
https://www.regionofwaterloo.ca/en/living-here/blue-box-recycling.aspx

However, with the rapid development of packaging materials and technology, the materials generated in household waste have changed and require higher recycling costs. The minimum collection list led to about 30 percent of listed materials ended up in landfills. Particularly, glass and plastic waste had a low diversion rate of less than 20 kg/capital from 1996 to 2010 (Chowdhury et al.,2017). New packaging materials, such as black plastic, plastic films, and laminates, are harder to sort and recycle by the traditional method. It requires increasing the content of blue box materials and transfer treatment costs.

The blue box system's change was completed in 2021 (Onatrio Federation of Agriculture, 2021). The new program will operate under the Resource Productivity and Recovery Authority and will use a producer responsibility approach. A producer is defined as a supplier that provides Blue Box materials (packaging, paper products, or packaging-like products) to consumers in Ontario. Table 8 shows the detailed materials under the enhanced Blue Box program. This regulation does not capture packaging materials not supplied to the consumer. For example, materials used to transport products to the store are not monitored. There are several important changes to the enhanced Blue Box program:

1. Encouraging collecting measures in all locations by 2026.
2. Standardizing what can be recycled across Ontario.
3. Accepting common single-use items and products that resemble packaging for domestic use, such as paper and plastic cups, foils, trays, bags, and boxes.
4. Collecting single-use items like stirrers, straws, cutlery, and plates that are offered or sold for use with food and drink products.
5. Increasing the number of service-delivery locations, such as apartment buildings, long-term care facilities, retirement communities run by municipalities or nonprofit organizations, and schools.

Table 8 The Define of Blue Box Packaging

Type of materials	Include	Exclude
Packaging	i) primary packaging, convenience packaging, or transport packaging that is provided with a product ii) disposable straws, cutlery or plates	Packaging that is not supplied directly to the consumer, such as materials used to transport products to store
Packaging-like products	aluminum foil, metal trays, plastic film, plastic wrap, wrapping paper, paper bags, plastic bags, cardboard boxes, and envelopes	N/**A**
Paper	printed and unprinted paper, such as newspapers, magazines, promotional materials, directories, catalogues	hard and soft cover books and hardcover periodicals.

2.3.5 Free Rider Problem

Although the EPR principle is currently being adopted as a sustainable waste management strategy in many countries, the monitoring and following-up steps are not enough. The waste generated in the city usually relies on curbside recycling, which the government supports. Packaging is considered products with limited durability that require importers, producers, or retailers to pay a fee in proportion to product weight.

Free riding is widely existent in online sales (OECD, 2014; Hilton et al., 2019). Online retailers are not typically producers but constantly repacking and reselling products that have a similar function to manufacturers in the supply chain. Moreover, express delivery service providers directly interact with consumers rather than the "producer" of packaging materials. Therefore, an EPR-like policy for packaging materials in express delivery needs to extend the responsibility of express delivery service providers—extended service-provider commitment—to incentivize them to explore ways to improve post-consumer recycling packaging materials (Duan, Song, Qu, Dong, & Xu, 2019). There are no existing operational requirements for cross-brands E-commerce enterprises and express service providers to comply with EPR regulations as they always come from various industries and sell different products.

Similarly, the three stages of EPR principles highlight the difficulties in operational practices in the E-commerce industry (Gui et al., 2013). First, a legislative framework associated with related policy instruments should be identified and developed (Gui et al., 2013). Second, understanding the detailed operational rules and monitoring processes at

industrial levels is important (Gui et al., 2013). Third, continuously modifying the regulations according to each stakeholder's interest (Gui et al., 2013). Without paying all or partial EPR fees, these sellers and delivery service providers have little understanding of the waste reduction obligations and pay less attention to end-of-life material management (Duan, Song, Qu, Dong, & Xu, 2019). As a result, online shopping causes a large amount of waste and negative environmental impacts.

2.4 Literature Gaps and Research Questions

Institutional environments are essential in shaping organizational actions, and institutional pressures affect green practices directly (Ball & Craig, 2010; Glover et al.,2014; Juárez-Luis et al., 2018; Scott, 2013). In this research, institutional theory helps to explain why online retailers adopt similar practices to build a post-consumer waste framework and identify the common barriers to increasing the efficiency and effectiveness of material recovery and disposal.

E-commerce development increases massive production and consumption of packaging materials and leads to environmental and financial impacts due to free and easy returns. The high quality (Baeyens et al., 2010) and low market value of post-consumer packaging (Agarwal et al., 2005; Hodge, Ochsendorf & Fernández, 2010) increase the difficulties of packaging waste recycling. Current research often places the focus on the design and material choices of packaging (e.g., Su, Duan, Wang, Song, Kang, & Chen, 2020; Lu, Yang, Liu, &Jia, 2020; Yen, & Wong, 2019), the broad perspective of considering the factors leading sustainability in E-commerce packaging has yet to be explored empirically (Escursell, 2021).

Extended Producer Responsibility (EPR) is considered an effective policy approach to enhance end-of-life products and materials by adding environmental costs (OECD, 2001). Many studies have evaluated EPR's role and effectiveness in packaging management (Rubio et al., 2019; Diggle & Walker,2020; Jang et al.,.2020), but very few articles have assessed the effect of the EPR policy approach on organizations' sustainable practices in the E-commerce industry, especially online platforms which are not defined as typical producer. The author considers the institutional barriers and incentives for online retailers to enhance transport packaging waste management. More specifically, this research will answer the following questions:

Q1. What are the best practices to address transport packaging waste associated with E-commerce?

Q2. How do institutional factors influence packaging waste management in the E-commerce industry in Canada?

Chapter 3: Method

This section presents the methodology used for conducting this research. The main objective of this study is to identify the barriers and drivers to improving packaging waste management across the E-commerce industry concerning stakeholders in E-commerce logistics (Product sellers, online platforms, logistics carriers, and consumers). Apart from determining these institutional environments, the research also intends to explore the role of E-commerce businesses in post-consumer packaging waste management under the EPR regulations.

This study will use a mixed methods approach for data collection and analysis to explore opportunities and risks in E-commerce post-consumer waste management. Systematic literature reviews and case studies are the two main methods used throughout the research. Mixed methods can help "address more complicated research questions than case study alone" (Yin, 2018, p. 101). The systematic literature review method aims to answer RQ1: "What are the best practices to address transport packaging waste associated with E-commerce?" and helps to identify several strategy measures for the case studies on selected online platforms. The case study will provide insight into the E-commerce industry's packaging waste strategies and differences in different business models.

The following section describes the steps for completing a systematic review (Tranfield et al., 2003).

3.1 Systematic Review

Ensuring capturing all the relevant data and coding them consistently and transparently, the author used a systematic approach, following Tranfield et al. (2003) and Denyer and Tranfield (2009) (Table 10). This method can help to answer the first research question as follow:

What are best practices to address packaging waste associated with E-commerce?

A systematic review is divided into three phases: planning, conducting, and reporting and dissemination. The first stage establishes the study's goals and scope. It aims to narrow the literature range and model the following research procedures (Tranfield et al., 2003). Table 9 shows the research protocols for best practices on transport packaging waste management in the E-commerce industry. Stage 2 begins with the identification of the study using relevant search strings (Table 9, below). In this stage, only the publications that met the full criteria in the research protocol were concerned. The detailed inclusion and exclusion criteria for different institutional factors are highlighted in Table 9. As recommended by Tranfield et al. (2003), research was quality assessed by peer-review journals and impact factor (cited by>0). Next, the data extraction phase used filters to minimize bias error and contribute to data synthesis. Bibliometrics Version 3.0, qualitative data analysis software, was used. Stage 3 presented the main findings and additional avenues for inquiry.

Table 9 Main Steps to Conduct Systematic Literature Reviews

Stage1-planning of the review				
Identifying the need for a review	Preparing a proposal for a review		Developing a review proposal	
Stage 2- conducting a review				
Identifying research	Select studies	Study quality assessment	Data extraction and monitoring progress	Data synthesis
Stage 3- reporting and dissemination				
Report and recommendation			Getting into practice	

Table 10 Research Protocol for Best Practices of Transport Packaging Waste Management

Research protocol	Detail description
Publication type	Various documents from Google scholar and Scopus (including journals, reports, conference papers, white papers, books etc.)
Language	English
Date range	Recent ten years（2011-2020）
Search fields	Titles, abstracts and keywords
Research terms	((TITLE-ABS-KEY (packaging waste) AND PUBYEAR > 2011 AND PUBYEAR < 2020) AND ((sustainable packaging)) AND (online shopping) AND (E-commerce) AND (EXCLUDE (EXACTKEYWORD,"Food Waste"))
Inclusion criteria	Only protentional practices for packaging waste management (including paper and plastic packaging) in online shopping and delivery were included. Only peer reviewed journals were included.
Exclusion criteria	Waste management methods on food waste were excluded. Journals with low impact (cited by=0) were excluded.
Data analysis and synthesis	The monitoring process was supported by the qualitative data analysis software bibliometrix 3.0, in which categorization of the previous studies was performed.

Table 10 lists the detailed research protocol and the inclusion and exclusion criteria adopted in this review. Figure 2 gives the flow chart of this process with the number of papers reviewed.

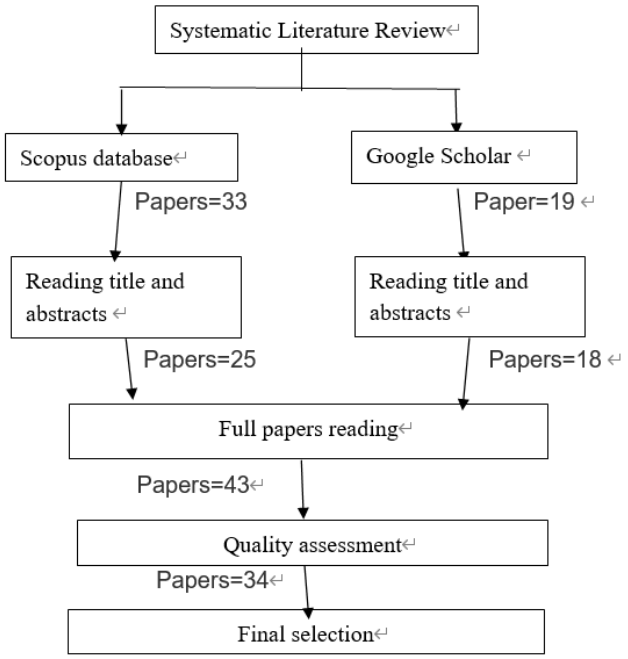

Figure 2 Schematic Representation of the Systematic Review Process on Best Practices

After screening, 34 papers were reviewed to find the best practices for sustainable packaging waste management in the E-commerce industry. Key findings are summarized in Section 4.1.

3.2 Case Study

A case study is defined as an empirical method that "investigates a contemporary phenomenon (the case) in depth and within its real-world context" (Yin, 2018, p.45). Research on institutional theory shows that institutional environments can influence organizational actions directly (Ball & Craig, 2010; Glover et al., 2014; Scott, 2013). To better understand this phenomenon, this study will conduct case studies on online retailers' current packaging waste management practices in Canada and investigate how institutional forces affect their decision-making in packaging design and post-consumer recycling processes. This case study will involve two parts: 1). explore specific packaging waste management programs of selected E-commerce firms under the potential institutional pressures in Canada; 2) compare them with best practices identified in systematic literature reviews to seek improvement.

3.2.1 Case Selection

This study will use qualitative analysis instead of statistical results to answer the above questions (Saunders et al., 2009, p. 237). The selection of cases aims to follow the proposition (Yin, 2018, p. 67) that understanding the connection between organizational packaging waste initiatives and the institutional environment. To examine the significance of the institutional environment on corporate actions at the industry level, this research selects a

multiple-case study that is more robust to represent the critical test of a significant theory (Yin, 2018, p91). According to institutional theory, firms become more similar under isomorphic pressures, and they will learn from leaders and take similar measures for competition (DiMaggio &Powell, 1983). This study selected the top 10 e-commerce sites in Canada by 2020 (according to estimated monthly traffic) as cases to look at the impacts of institutional pressures on the E-commerce industry and provide possible solutions for them to overcome the external factors listed in Table 11 below. (See Figure 3 for a schematic of the case selection process).

Table 11 Top 10 Leaders of E-commerce Platforms in Canada in 2020

Company	Geography (Global/national)	Business Area	Are there any annual sustainability reports?	Estimated monthly traffic (Million visits)
Amazon Canada	Global	a wide variety of goods and services	Yes	135.5
Walmart Canada	Global	a diversified range of products	Yes	37.7
eBay Canada	Global	a wide variety of goods and services	Yes	30.5
Canadian Tire	National	automotive, hardware, sports and leisure, home products, toys, and food products.	Yes	26.3
Best Buy Canada	Global	electronics and home appliances	Yes	21.4
Home Depot Canada	National	tools, construction products, home and garden equipment furniture, and associated services	Yes	21
Costco Canada	Global	electronics, computers, furniture, outdoor living, appliances, jewelry, and more.	Yes	20.3
Etsy Canada	Global	handmade or vintage items and craft supplies	Yes	13.5
Hudson's Bay	Global	high-end fashion apparel, accessories, and home goods	Yes	5.75
Newegg Canada	National	computer hardware and software, consumer and professional electronics	No	3.45

Source from: https://disfold.com/top-e-commerce-sites-canada/.

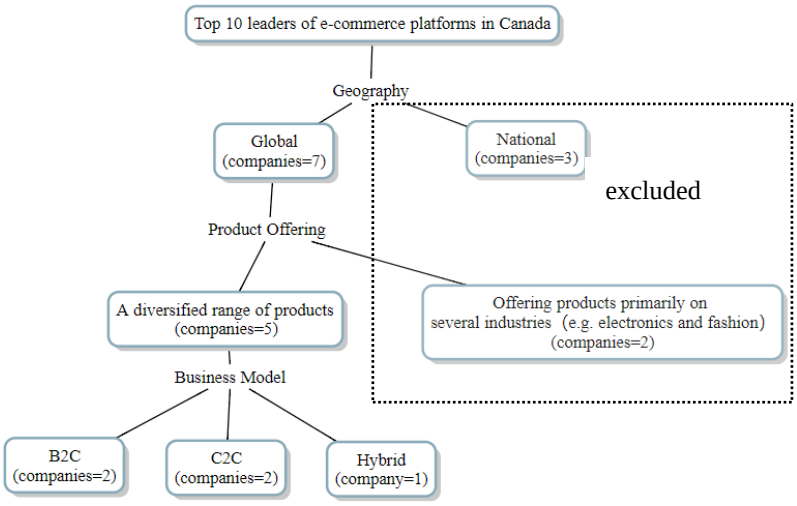

Figure 3 Schematic Representation of Case Selection

Comparing their geographical and business scopes, five companies with international platforms sell a diversified range of products: Amazon, Walmart, Costco, Etsy, and e-Bay (See Figure 3). Depending on their business model, they are divided into three groups B2C businesses (Walmart & Costco), C2C businesses (Etsy & e-Bay), and Hybrid businesses (Amazon).

3.2.2 Data Gathering and Analysis

The companies are multinational and have different packaging management strategies depending on the market scope. This study only considers their packaging strategies for the Canadian market. The data collection for each case was conducted from April 2020 to December 2021. All the case studies were performed according to the secondary data listed in table 12. Searched by keywords, the author reviewed at least three documents for each firm. Detailed documents and references can be found in Table 21(Appendix 2).

Table 12 Data Source for Case Studies

Collection instruments	Data source
Date range	2020.04 -2021.12
Data source	Annual sustainability reports Announcements Press releases on sustainability Environmental impact reports
Keywords	Packaging waste Sustainability Green practices

After understanding sustainable packaging guidelines and best practices, a content analysis was undertaken to assess the degree to each e-commerce firm's packaging sustainability (Kache and Seuring, 2014; Pereira et al., 2014; Seuring and Gold, 2012). It helps to find evidence and make inferences depending on the systematic and objective retrieve of specified characteristics in the text(Weber, 1990). As the purpose of case studies is to investigate the online platforms' response to institutional forces, manual coding was preferred due to the need for a profound examination of how documents describe (Pennebaker, Mehl, and Niederhoffer, 2003; Thistlethwaite & Wood, 2018). Specifically, the following steps were followed:

Step 1 is to determine coding categories. For a better assessment of corporate packaging management measures, the best practices identified and extracted from the systematic review help develop the coding categories and be evidence to compare five firms' packaging waste actions.

Then, Step 2 is coding the content. With the objective of the control experiment, selected online platforms are divided into three groups based on business models. Different corporate role in the online shopping supply chain leads to strategy differences.

Using the keywords listed in Table 12, the author reviewed 3 to 5 related documents and identified green packaging reduction practices for each firm. Then, the coding results will be filled in the same structure table as Table 13. In this table, corporate packaging management initiatives and programs will be coded and analyzed into four aspects of guidelines. Within each group, the packaging waste management program of the two platforms will be summarized and compared first. The B2C and C2C group will be used as control groups to provide reference data for the hybrid group.

Once the coding table for each group is completed, the author will combine them into a summary table identifying and comparing the evidence of five companies engaging in those best practices. Corporate strategy responses revealing evidence of packaging sustainability across any of the four categories (e.g., Optimizing resources, Responsible sourcing& Resources recovery, Material health, and Consumer engagement) were coded as '1' (no evidence, coded as '0'). A maximum score of '10 was possible with clear evidence of rescaling in packaging reduction across all four objectives. A score below '4' was assigned with clear evidence of rescaling within three categories, two categories, or one category.

The validity and reliability of this study were established using a manual coding approach. As demonstrated by Hart in Diction research (2001), a manual coding approach provides a more sophisticated examination of the text. The study included an assessment of respected firms' packaging waste management strategies. To reduce biases, two firms are selected for B2C and C2C groups as samples. The primary data source is annual reports published by respected case study companies.

Chapter 4: Results

This section presents the findings of the systematic review of best practices and case studies.

4.1 Best Practices of Packaging Waste Management in the E-commerce Industry

To gain an in-depth understanding of sustainable transport packaging waste management applied to the E-commerce business, Table13 shows the packaging waste management measures by packaging guidelines, primary practices, examples or contents of practice, sources, and citations. Papers supporting the Responsible sourcing& Resources recovery areas represented 41.03 percent of the publications indicating that there are main optimization objects that have great potential for packaging waste reduction and performance improvement. The next-highest represented area was Optimizing resources, accounting for 30.77 percent of the papers. Consumer engagement in waste packaging management means 23.08% of the articles. Material health, a traditional area of packaging generation and recycling, represented 5.13 percent of the publications. However, these papers were focused mainly on developing alternative packaging materials for human health and ecosystems.

From the central practice perspective, the most popular waste reduction strategy was "Design for Environment" under objective 1, "Optimizing resource," suggesting that businesses should save money and reduce the waste and pollution at the source. Furthermore, "Bettering design on product return process" can be an essential part of the Resources Recovery principle. While the generally high rate of returns for online purchases is a potential environmental impact factor, studies have shown that the average carbon footprint

of this behaviour is not significantly increased by the physical return of goods to the store (Weideli & Cheikhrouhou, 2013; Ameripen, 2017). Wang and Zhu (2020) reported that the return rate of online shopping is positively correlated with user satisfaction, but mixed protective packaging and overpackaging may also cause low customer satisfaction. They suggested that managers evaluate product packaging and propose an online product delivery scorecard to rationalize the type and quantity of packaging materials.

Surprisingly, the consumer engagement did find strong efforts on packaging waste recycling with low cost and high efficiency. It is also important to note that no empirical studies report direct commercial intervention in transforming basic packaging recycling systems in the E-commerce field. Additionally, most approaches were related to proposing frameworks and conceptual studies.

Table 13 Best practices Organized According to Sustainable Packaging Objectives

Packaging guidelines	**Main practices**	**Examples or contents of the practice**	**Sources**	**Citations**
Objective 1: Optimizing resource	Create guidelines and goals	Set quantity targets or monitoring mechanisms according to industrial guidelines.	2	Cruz et al., (2014). Rubio, Ramos, Leitão, & Barbosa-Povoa, (2019)
	Design for Environment	1.Controlling excessive packaging with independent standards for proper packaging by industry 2. Light-weighting: using thinner packaging materials or by using alternate materials. Such as nanomaterial or biodegradable plastics. 3. Replacing Single use corrugated boxes and plastic bags (A reusable PP box and a reusable shipping bag） 4. Application of self-healing polymers in packaging 5. Increase the cost of plastic: making materials attractive in terms of price. 6. Conduct trial packaging assessment	10	Langley et al., (2011); Dharmad hikari, S. (2012); Barnes, (2019); Duan, Song, Qu, Dong, & Xu,(2019) ;Friedrich, (2020) ;Sarkar, Tayyab, Kim, & Habib, (2019);Su, Duan, Wang, Song, Kang, & Chen, (2020); Lu, Yang, Liu, Jia, (2020); Yen, & Wong, (2019) ; Zimmermann, Bliklen, (2020)
Objective 2&4: Responsible sourcing& Resources recovery	Bettering design on product return process	Encouraging consumers to reuse packaging for returned good and reduce new packaging used in return process. For example：a single-setup-multi-delivery (SSMD) policy	8	Weideli & Cheikhrouhou, (2013); Varun, Sharma, &Nautiyal, (2016); Ameripen. (2017); Yi, Wang, Wennersten, & Sun,(2017); Bertram, & Chi (2018); Porat, et al., (2018); Zhang, Yang, & Deng, (2018); Sarkar, Tayyab, Kim, & Habib, (2019)
	Adopt EPR Regulations	Producers of packed goods have to organize and pay for the collection and recycling of their products under a set of optimal taxes/subsidies. It is the directive on Packaging and Packaging Waste (219/2009/EC).	3	Ino, (2011); Defra, (2013); Groot, Xiaoyu, Hilk, & Jacqueline,(2014)
		Example： A deposit refund scheme (DRS): a tax on the purchase of a certain product, and a subsidy on the separate collection of the same product in its after-use stage.	2	Linderhof, Oosterhuis, van Beukering, & Bartelings, 2019); Oke, Osobajo, Obi, & Omotayo, (2020)
	Extended Service-Provider Responsibility	Express delivery service provider has the same responsibility to improve the recycling of post-consumer packaging materials.	1	Duan, Song, Qu, Dong, & Xu,(2019);

	Using a systematic assessment tool :A collaborative online packaging scorecard	It is a measurement tool that analyses product packaging using dynamic data from the viewpoints of product sellers, online platforms, logistic carriers, and consumers.	1	Wang, & Zhu, (2020).
	Technology innovation on material recovery	Microbes are used to accelerate the biodegradation of plastic since it serves as a carbon and energy source.	1	Auta, Emenike, & Fauziah,(2017)
Objective 3：Material health	Design for safety: Develop alternative packaging materials	It takes into account both human and environmental health. Use biopolymer-based materials rather than non-biodegradable and non-renewable resources like plastic, glass, and metals to lessen packaging waste and its effects on the environment.	2	Lewis, (2012); Khalil, et al., (2016)
Objective 5：consumer engagement	Design for accessibility	1. support source separated collection by making packaging material easy to separate: avoiding the use of tape	4	van Velzen, et al., (2013); Groot, Xiaoyu, Hilk, & Jacqueline, (2014); Hahladakis, Purnell, Iacovidou, Velis, & Atseyinku.(2018); Duan, Song, Qu, Dong, & Xu,(2019)
		2. Change customer's shopping habit: Promote zero-waste philosophy and zero-waste life	3	Dong& Hua, (2018); Zeiss, (2018); Holotová, Nagyová,& Holota, (2020)
	Provide convenience for customer	Using a creative recycling method, time savings, high efficiency, and the notion of smart categorized recycling	2	Liang& Li, (2020)； Wenjing,(2019)

4.2 Case analysis

The author describes the selected firms' case study results in this section. This part responds to the research questions regarding how E-commerce businesses cope with potential institutional factors on packaging waste management.

According to the business model identified in Section 3.22, there are three case groups. The results start with the background information of each E-commerce company, following the assessment of those companies' packaging waste programs' response to best practices.

4.2.1 Summary of Five Online Platforms' Package Sustainability Strategies in Group

The responses of five companies' package management strategies to the best practices are summarized below (Table 14). Based on the case study findings, it could be argued that E-commerce businesses are aware of packaging issues and take green practices. However, the packaging sustainability strategies vary across business models. It should be noted that firms under the same business model have similar packaging waste reduction practices, and the hybrid firm performs better than others and have the highest response to the best practices.

Table 14 Summary of the Five Selected Corporate Packaging Sustainability Strategies

		B2C E-commerce retailers		C2C E-commerce retailers		Hybrid E-commerce retailer
Themes of the Best practice		Walmart	Costco	e-Bay	Etsy	Amazon
Objective 1: Optimizing resource	Create guidelines and goals	1	1	1	1	1
	Design for Environment	1	1	0	1	1
Objective 2&4: Responsible sourcing& Resources recovery	Bettering design on product return process	0	0	0	0	1
	Adopt EPR Regulations	1	0	0	0	1
	Extended Service-Provider Responsibility	0	1	0	0	1
	Using a systematic assessment tool	1	1	0	1	1
	Technology innovation on material recovery	1	0	0	0	1
Objective 3：Material health	Design for safety: Develop alternative packaging materials	1	1	0	0	1
Objective 5：Consumer engagement	Design for accessibility	1	1	0	0	1
	Provide convenience for customer	1	1	0	0	1
Score		8	7	1	2	10
Ranking		2	3	5	4	1

- ‘1’ means firm has already adopt related measures satisfying best practices. no evidence, coded as ‘0’

4.2.2 Overview of Case Companies and Their Packaging Waste Program

Based on their commitments to the environment and sustainability reports, packaging waste solutions are summarized in Tables 15, 17 & 18 according to their business models. Overall, all five selected online retailers that submitted sustainability reports underscored their continued corporate concern for and commitment to sustainability. They have similar objectives: avoiding unnecessary packaging and increasing the waste diversion rate to achieve zero waste goals. For example, Walmart aims to achieve a zero waste goal by 2025. Each firm's current packaging reduction practices are also specified, and the packaging sustainability strategies of a business model are compared and explained based on the information obtained during the systematic review.

B2C E-commerce Retailers: Walmart and Costco

In B2C online retailing, the online platform controls the inventory and pricing of each good supplied by product sellers and is in charge of shipping to customers. Figure 4 shows the supply chain and transport package generated in B2C E-commerce retailing process. Due to the support of bricks-and-mortar warehouses, online platforms do not need to order goods from product sellers when order fulfillment. For example, product sellers often send goods in mass to Walmart and Costco’s warehouses requiring all three levels of transport packaging. Depending on orders, shipping carriers will decide whether to give additional packaging before long-distance devilry. When it comes to customers, they usually receive both primary and secondary packaging. It requires B2C E-commerce online platforms to be responsible for all three levels of transport packaging.

The current packaging management measures and assessments of Walmart and Costco are presented in Table 15. The analysis of their green packaging practices revealed that both Walmart and Costco had incorporated packaging sustainability strategies into four guidelines required objectives, getting 8 and 7 points, respectively. Most interestingly, Walmart and

Costco have a standardized product return policy but mentioned nothing about packaging in the return process.

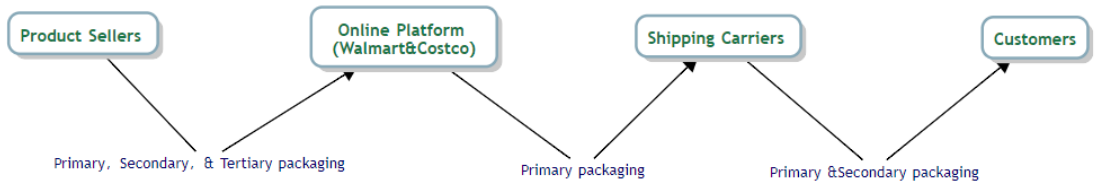

Figure 4 Transport Packaging Used in B2C Online Retailing

Table 15 B2C-Walmart and Costco's Packaging Waste Strategy Assessment

E-commerce company	**Packaging guidelines**	**Suggested best practice**	**Programs on packaging waste**	**Concept**	Code
Walmart	Objective 1: Optimizing resource	Create guidelines and goals	Zero Plastic Waste Aspiration	1. Aligning with the circular economy, Walmart extended the zero waste aspiration to the whole supply chain by 2050. 2. Increasing the post-consumer recycled content in private brand plastic packaging to 20% by 2050.	1
		Design for Environment	Increase the recycled content and transfer to recyclable, reusable, or compostable packaging	Using less plastic and aiming for 100% reusable, recyclable or industrially compostable packaging	1
	Objective 2&4: Responsible sourcing& Resources recovery	Bettering design on product return process	No information on optimizing return process	N/A	0
		Adopt EPR Regulations	Walmart Recycling Playbook	Providing information to suppliers and other firms interested in adopting sustainable packaging, such as package recyclability and recycled content targets.	1
		Extended Service-Provider Responsibility	Lack of clear requirements on shipping carriers.	N/A	0
		Using a systematic assessment tool	Encourage industry adoption-Project Gigaton	Assisting suppliers in identifying possible target areas, then decreasing needless packing, utilizing better packaging materials, and improving packaging reuse and recycling In addition, techniques for estimating the effects of emissions are provided.	1
		Technology innovation on material recovery	Develop PlasticIQ,	Adopt a scenario modelling tool to help U.S. companies set effective circularity strategies	1
	Objective 3：Material health	Design for safety: Develop alternative packaging materials	Reduce the use of plastic	Find viable alternatives to plastic and work with suppliers to reduce or eliminate plastic packaging where possible.	1

	Objective 5: consumer engagement	Design for accessibility	Develop in-store recycling points	Offering in-store recycling opportunities to make it simpler for customers to adopt greener habits.	1
		Provide convenience for the customer	Using How2Recycle labelling	Educate and inspire consumers to recycle by giving information on packaging.	1
Costco	Objective 1: Optimizing resource	Create guidelines and goals	1. Reduce operational packaging waste: continually decrease the amount of waste going to landfills. (divert 80% of waste generated within global operations） 2. Ask members to adopt sustainable packaging	In 2021, they further reduced plastic by over 17 million pounds.	1
		Design for Environment	1. Increase the recycled content and certified fiber materials in packaging 2. Expand the use of compostable packaging 3. Wastenet™	1. Using 100% recycled content in the E-commerce shipping box, two black plastic baking trays were replaced with fibre materials (reduce more than 300,000 pounds plastic) 2. Using third-party trash monitoring technologies to minimize the frequency of waste compactor pick-up.	1
	Objective 2&4: Responsible sourcing& Resources recovery	Bettering design on product return process	N/A	N/A	0
		Adopt EPR Regulations	No direct measures to organize and pay for packaging waste recycling and disposal.	N/A	0
		Extended Service-Provider Responsibility	Work with Cascades to recycle on Corrugated Cardboard and Shrink-wrap	Cascades, a third-party packaging maker in Canada, assists warehouses in frequently backhauling stretch-film and corrugated material created from everyday operations to distribution hubs for recycling.	1
		Using a systematic assessment tool	review and test items to reduce packaging footprint	They reduce plastic footprint by over 8.6 million pounds in 2019 and 2020.	1

		Technology innovation on material recovery	Lack of written innovates on material recovery.	N/A	0
	Objective 3：Material health	Design for safety: Develop alternative packaging materials	Ask for certified fibre and traceability in fibre and paper resources	Prefer for material certified by Forest Stewardship Council (FSC), Sustainable Forestry Initiative (SFI) or the Programme for the Endorsement of Forest Certification (PEFC).	1
	Objective 5：consumer engagement	Design for accessibility	Sold goods directly out of the boxes	Reduce the original packaging for products in one online order.	1
		Provide convenience for customer	Using and expansion the How2Recycle® label on packaging	It helps to analyze the recyclability of a package and communicate the proper sortation to their members.	1

C2C E-commerce Retailers: e-Bay and Etsy

In the C2C model, the online platform is an intermediary between product sellers and customers. Figure 5 shows the supply chain and transport package generated in C2C E-commerce retailing process. Individual sellers post information about goods online and wait for customers to place an order. The items with primary packaging will be brought to shipping carriers and perhaps added additional protective packaging. As a result, customers may get their goods with primary or primary and secondary packaging. Due to the lack of directly participate in the transportation process, C2C online platforms may have poor control over transport packaging (Figure 5).

Table 16 summarizes e-Bay and Esty's efforts on packaging reduction and responses to the best practices. Most notably, both e-Bay and Esty have been indirectly involved in packaging waste reduction in the shipping process. Yet, there was no evidence of engaging with the last three packaging sustainability principles.

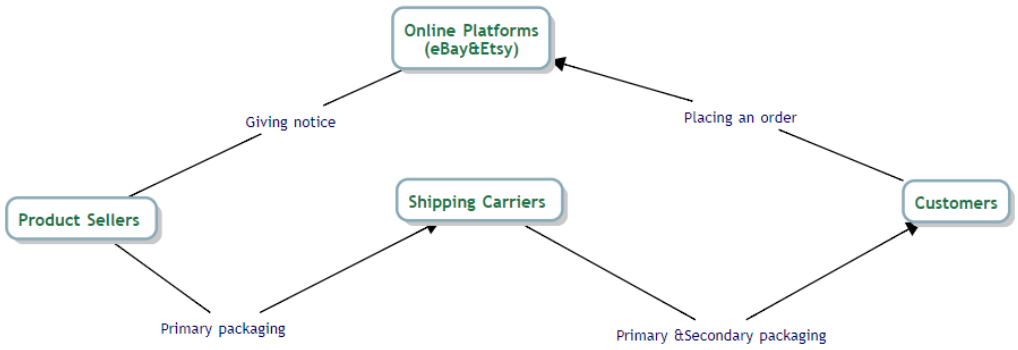

Figure 5 Transport Packaging Used in C2C Online Retailing.

Table 16 C2C- eBay and Esty's Packaging Waste Strategy Assessment

E-commerce company	**Packaging guidelines**	**Suggested best practice**	**Programs on packaging waste**	**Concept**	Code
eBay	Objective 1: Optimizing resource	Create guidelines and goals	Reducing consumption and diverting waste from entering landfills at eBay-owned and eBay-controlled sites	Mainly focus on office areas. For example, they diverted almost 555 tons of waste from landfills in San Jose headquarters in 2020 alone.	0
		Design for Environment	No information on packaging.	N/A	0
	Objective 2&4: Responsible sourcing& Resources recovery	Bettering design on product return process	N/A	N/A	0
		Adopt EPR Regulations	N/A	N/A	1
		Extended Service-Provider Responsibility	Not monition the package concept in delivery. Third-party sellers directly ship products to buyers	No data on shipment -This metric is not currently reported due to data collection limitations.	0
		Using a systematic assessment tool	N/A	N/A	0
		Technology innovation on material recovery	N/A	N/A	0
	Objective 3：Material health	Design for safety: Develop alternative packaging materials	N/A	N/A	0
	Objective 5：consumer engagement	Design for accessibility	N/A	N/A	0
		Provide convenience for customer	N/A	N/A	0
Esty	Objective 1: Optimizing resource	Create guidelines and goals	Balance the footprint by offsetting 100% of their emissions generated from Etsy.com shipping	They committed to reaching net zero emissions by 2030.	1
		Design for Environment	Investment in verified emissions reduction projects.	As a peer-to-peer marketplace, Etsy does not directly control seller shipping or the associated logistics networks. However, they are committed to addressing carbon emissions from shipping thought investments on environmental projects with the help	1

				of 3Degrees.	
	Objective 2&4: Responsible sourcing& Resources recovery	Bettering design on product return process	N/A	N/A	0
		Adopt EPR Regulations	N/A	N/A	0
		Extended Service-Provider Responsibility	N/A	N/A	1
		Using a systematic assessment tool	Calculating packaging footprint	Esty releases carbon emissions statistics for various packing materials, volumes, and weights based on data collected from vendors. Esty tries to reduce the environmental impact of packaging by calculating the related emissions factor from the Franklin Associates research.	1
		Technology innovation on material recovery	N/A	N/A	0
	Objective 3：Material health	Design for safety: Develop alternative packaging materials	N/A	N/A	0
	Objective 5：consumer engagement	Design for accessibility	N/A	N/A	0
		Provide convenience for customer	N/A	N/A	0

Hybrid E-commerce Retailer: Amazon

Allowing both first-party (1P) vendor and third-party (3P) vendor sales on its online platform, Amazon is defined as a hybrid E-commerce retailer in this study. In 2018, the 3P sales outpaced the 1P sales and accounted for 58 percent of GMV (Amazon, 2018).

Figure 6 and Table 17 show the value chain and transport package generated in the hybrid E-commerce retailing process. The combination of 1P and 3P in Amazon provides consumers with various and flexible shopping services and increases the complexity of their packaging waste management systems.

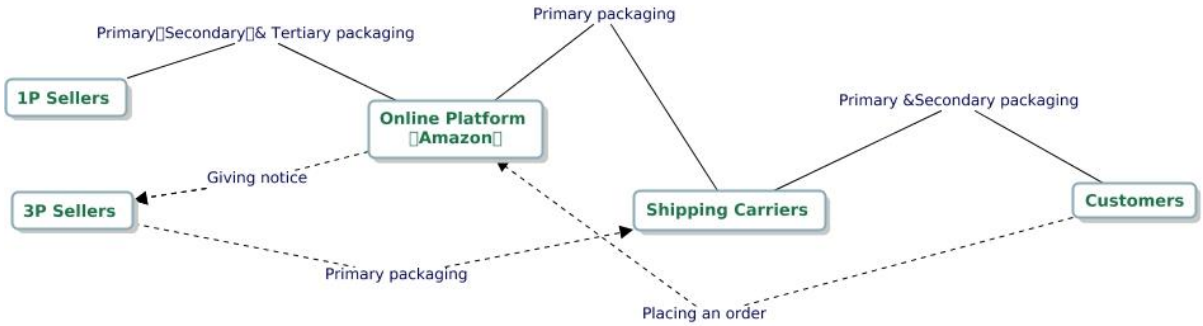

Figure 6 Transport Packaging Used in Hybrid Online Retailing.

Table 17 Transport Packaging Used in Hybrid Online Retailing.

Transport packaging received	B2C (1P sale)	C2C (3P sale or Amazon Renewed)
Product sellers	Primary, secondary, and Tertiary packaging	Primary packaging
Online platforms	Primary packaging	N/A
Shipping carriers	Primary & Secondary packaging	Primary packaging
Customers	Primary & Secondary packaging	Primary & Secondary packaging

The first party (1P) vendor sales are the product sellers who send their inventory to Amazon and commission Amazon to sell and ship items to the customer. Those items are included in the “ships from and sold by Amazon.ca” listings. 1P sellers can control the pricing and enjoy priority selling and trust through Amazon’s credibility. This model is similar to B2C retailing as Amazon represents different brand suppliers as a whole business. Amazon also allows individuals and professional sellers as 3P on its online platform. 3P's

goods are included in the list of "sold by MERCHANT and Fulfilled by Amazon / Fulfilled by MERCHANT." In order fulfillment, customers can select "Fulfillment by Amazon (FBA)" or "Fulfillment by Merchant (FBM)." Greater pricing control and more attractive payment terms make 3P item popular with customers.

Table 18 shows the packaging management practices adopted by Amazon for both 1P and 3P sales coding in suggested best practices under four objectives. In the process of case analysis, the author finds that Amazon's packaging measures are applied to both 1P and 3P sales, and hybrid retailers seem to have better waste management strategies than B2C and C2C retailers. Amazon achieves the most expectations of each packaging sustainability principle and has the best strategy across the three groups.

Table 18 Hybrid- Amazon's Packaging Waste Strategies Assessment

E-commerce company	Packaging guidelines	Suggested best practice	Programs on packaging waste	Concept	Code
	Objective 1: Optimizing resource	Create guidelines and goals	The Climate Pledge	Amazon aims to meet net zero carbon across the business by 2040, ahead of the Paris Agreement goal of 2050.	1
		Design for Environment	Shipment Zero Frustration-Free Packaging program	A Shipment Zero order will be delivered with carbon-neutral packaging or without additional packaging. 1.SIOC certification-this certifies that a product's original packaging is intended to transport without needing an Amazon shipping box. 2. A totally recyclable paper cushioned envelope that protects things during shipment while taking up less space. 3. Encouraging businesses to package their products in easy-to-open, 100% recyclable packaging eliminates the need for a separate shipping box.	1
	Objective 2&4: Responsible sourcing& Resources recovery	Bettering design on product return process	Manage return: Amazon Second Chance site	Providing information on recycling Amazon packaging.	1
		Adopt EPR Regulations	Engaging with Vendors and Industry Partnering to Improve Recycling Infrastructure	Amazon collaborates with leading brands and vendors to rethink their packaging for waste reduction in e-commerce, such as optimal packaging that allows items to be sent in their container.	1
		Extended Service-Provider Responsibility	Machine Learning	Using machine learning algorithms to choose the optimal delivery package options.	1
		Using a systematic assessment tool	Carbon footprint- Science Based Targets Initiative (SBTi)	Amazon joined SBTi in May 2020 and will publish our science-based objectives in 2022, per SBTi's target-setting procedure.	1
		Technology innovation on material recovery	Improving the design and materials used for packaging assortment.	Amazon has committed to lighter packing materials and more durable packaging. To facilitate package-free returns at Amazon drop-off locations in the United States, Amazon was converting plastic film into 100% recyclable poly bags.	1

	Objective 3: Material health	Design for safety: Develop alternative packaging materials	Recyclable Paper Padded Mailer	Paper cushioned mailer is a novel packaging material discovered by Amazon that takes up less space in transportation and the recycle bin. Also, it is simple to separate.	1
	Objective 5: consumer engagement	Design for accessibility	Amazon Renewed	Open-box, used, and refurbished items are recycled and sold at a discount.	1
		Provide convenience for customer	Using eco-labels in packaging On-site plastic film recycling	To let customers know about these updates and offer instructions on how to recycle their packing materials, Amazon inserted on-package text. As of June 2021, more than 168 North America and Europe Amazon sites provide on-site plastic film recycling.	1

Chapter 5: Discussion

Considering the best practices on E-commerce packaging sustainability and basic strategies adopted by leading Online shopping platforms, the author will discuss how institutional factors influence packaging waste management in the E-commerce industry in Canada from a business perspective. This analysis confirms that online platforms should be considered the packaging producer and take responsibility for meeting outcomes-based waste reduction requirements with the Ontario policy. Based on the literature review, systematic review, and case study, recommendations such as identifying the role of online platforms as producers, developing cross-industry transport packaging sustainability guidelines, and learning from the industry leader are proposed to improve packaging sustainability in the E-commerce industry.

5.1 Best Practices on Packaging Waste Management

Current research often places the focus on the design and material choices of packaging (e.g., Su, Duan, Wang, Song, Kang, & Chen, 2020; Lu, Yang, Liu, &Jia, 2020; Yen, & Wong, 2019), the broad perspective of considering the factors leading sustainability in E-commerce packaging has yet to be explored empirically (Escursell, 2021).

Based on the findings of the systematic review, the majority of papers support the importance of packaging sustainability in the E-commerce industry and ask for action for further improvement (Langley et al., 2011; Dharmad, 2012; Barnes, 2019; Duan, Song, Qu, Dong, & Xu, 2019; Friedrich, 2020; Escursell, 2021). Organized by sustainable packaging guidelines, those studies have evaluated EPR regulations and effectiveness in packaging sustainability (Rubio et al., 2019; Diggle & Walker, 2020; Jang et al., 2020) and provide general practices for producers in post-consumer packaging waste management. Canada has

recognized the packaging problem, and efforts are being made to address the issue by taking EPR regulations in several provinces.

Ontario, one of the provinces that adopted EPR regulations, is working on transitioning blue box collection to a 100% industry-funded waste recycling system that allows producers the flexibility to collect some packaging through other methods (Government of Ontario, 2021). However, no specific process has been made across industries. In addition, the E-commerce retail systems made package producers hard to be identified and coordinate. Some programs for paper and packaging in the IC&I sectors under the Environmental Protection Act, but progress on E-commerce transport packages still lags.

Moving toward a circular economy, Ontario implements producer responsibility approaches and other targeted measures to manage waste. A transition toward a complete producer responsibility framework is facilitated with the introduction of The Waste Diversion Transition Act, 2016. The current waste diversion programs deal with materials without competitors due to the single industry funding organizations (IFOs) existing for each recycling program (Government of Ontario,2021). Producers only need to remit fees to IFOs and have low power in participating and controlling diversion programs. It resulted in weak incentives for businesses to enhance product and package design to minimize waste or develop new ways to recover their End-of-Life packaging. Full producer responsibility is considered a new approach to address the impeding progress of current waste diversion systems in Ontario. Also, the outcomes-based requirements provide opportunities for businesses to save costs and increase their competitive strength.

5.2 Evaluation of E-commerce Packaging Waste Programs with the Institutional Theory

This section uses results captured by the content analysis to explain how to do institutional factors influence packaging waste management in the E-commerce industry in

Canada. For a cross-firm comparison, the corporate strategy response and strategies of packaging sustainability have been demonstrated. This analysis confirms that firms in the same industry become similar to meet the needs of legitimacy (DiMaggio &Powell, 1983), and institutional pressures affect green practices (Juárez-Luis et al., 2018). E-commerce businesses are aware of packaging issues and take green practices, but the packaging sustainability strategies vary across business models.

The findings of case studies reveal that companies with the same business model have similar strategies in four aspects. The results strongly support the coercive isomorphism of the institutional theory. As mentioned earlier, Institutional theory research is concerned with how institutional norms and values can help explain an organization's similar actions in the same field (Giunipero & Ketchen, 2004). Three findings stand out. First, B2C and C2C retailers have poor return improvement strategies and no requirements on packaging waste reduction in the return policy. Similar to what was reported in a study by Yang (2014), B2C e-commerce has adopted reverse logistics, but the mechanism of returns requires improvement. Yang (2014) stated that managing returns in China's B2C market are challenging due to financial constraints, the lack of awareness of the reverse logistics practice, and no legal requirements. His study considered the practical application of reverse logistics in the B2C return process and was not regarded as C2C e-commerce. And Mangiaracina et al. (2015) claimed a robust relationship between GHG emission and product return in B2C and C2C e-commerce. Therefore, it is vital to assess the return process in B2C and C2C e-commerce, and the implementation difficulties may differ in Canada's context. Second, C2C retailers have low control over product shipping and take little action on packaging waste reduction and recycling. Third, with both B2C and C2C business models, the hybrid retailer does not have the above two problems. The last two findings have not been proven in previous studies. These similarities and differences can be explained by institutional theory.

The institutional theory helps explain the similar practices adopted by online retailers in the context of Ontario and identifies the common barriers to increasing the efficiency and effectiveness of material recovery and disposal.

5.2.1 Limited focus by B2C and C2C on Reverse Logistics

Online shopping tends to be more controllable in reducing GHG emissions by improving the design of packaging and return processes (Weideli & Cheikhrouhou, 2013). Bettering the design of the product return process is a suggested best practice under the objective of Responsible sourcing& Resource recovery. Compared with traditional in-store retail, customers return 15 to 30 percent of online purchases (CBRE, 2018). However, B2C and C2C firms have poor return process improvement. According to Table 14, all four firms in B2C and C2C groups had no information on optimizing the return process. The results are interesting as previous studies only proved the difficulties of B2C reverse logistics without mentioning the C2C aspect. Also, those findings align with previous research on the institutional theory, which has noted that institutional pressures affect green practices (Juárez-Luis et al., 2018). Analyzing regulative, normative, and cultural-cognitive institutional forces would also help find barriers and drivers to E-commerce packaging waste management in Canada.

Institutional norms and values within the same region may have similar impacts on the green practices done by organizations, as discussed by institutional theory. The regulatory force is essential to determine the environmental initiatives of an industry (Campbell, 2007; Pfahl, 2005; Ortas et al., 2015). It is not denied that E-commerce retailers have responded to the Zero Waste policy and taken measures for their legitimacy. However, there are omissions in their efforts compared to the best practices. Five selected firms set zero waste goals and integrated waste reduction into their corporate strategy. For example, in response to the Zero Plastic Waste Aspiration, Walmart commits to increase the post-consumer recycled content in

private brand plastic packaging to 20% by 2050(Walmart,2021). The lack of packaging requirements in the return process is one of the omissions of B2C and C2C E-commerce retailing packaging waste reduction. Selected firms in B2C and C2C groups have a clear return policy and receive a physical and online return without any requirements on the packaging. With the translation to a complete producer-responsible framework, the value of end-of-life packaging materials is easily ignored due to unclear responsibility.

Moreover, online shopping platforms are not packaging producers in the traditional sense, which leads to the fact that platforms are not subject to EPR policies and have no explicit obligation to participate in the recycling of packaging waste (OECD, 2014; Hilton et al., 2019). Given the lack of physical and regional restrictions on online platforms, the enforcement of EPR regulation is often limited by the inability to find subjects. It means that bettering the return process would not be mandatory, and there would be no punishment for firms that refused to take initiatives in packaging recycling. As a result, B2C and C2C e-commerce would not consider packaging in reverse logistics.

From the normative institutional perspective, these norms, standards, and expectations of experts may not be as apparent when regulative force does not require it. As the literature review mentioned, there are no clear and widely used packaging waste management guidelines and standards in the Canadian online shopping industry, especially for online shopping platforms. Although the case studies found that the approaches adopted by e-commerce retailers are consistent with the best practices summarized in this paper, this only indicates that these best practices are feasible to be implemented. Specific measures still need to be adapted depending on the company's actual status, and best practices can only show the company the direction of packaging sustainability. It is also an opportunity for E-commerce retailers to implement innovative measures to win users' trust and increase their competitiveness. Several approaches, such as material choice, logistic optimization (utilizing

reverse logistics for packaging recovery), and consumer Feedback (social media), are suggested as reasonable packaging return process optimization measures (Weideli & Cheikhrouhou, 2013).

There is no direct evidence that cultural-cognitive institutions affect the e-commerce packaging reverse logistics in the context of Ontario. Although cultural-cognitive factors can influence enterprise innovation through behaviour and attitude(Shane et al., 1995), the cases in this paper are assumed to be all under the influence of the cultural context of circular economy and sustainable development. They publicly declared their support for packaging sustainability and zero waste initiatives. Both B2C and C2C companies have not shown some breakthroughs and innovations in the face of uncertainties in packaging returns management. However, hybrid companies like Amazon have considered packaging in their reverse logistics. The following section explains why hybrid firms prefer better.

5.2.2 Hybrid E-commerce Retailer Responses to Most Best Practices

When looking at the hybrid E-commerce retailer, the author found that Amazon did not have the two problems discussed above and its packaging waste management performed better than the other two groups. This finding can answer the second research question: How do institutional factors influence packaging waste management in the E-commerce industry in Canada?

Regulative and normative institutions do affect the corporate strategies of packaging waste management. Juárez-Luis et al.'s research (2018) shows that institutional pressures affect green practices. Organizations not only seek reasonable goals of efficiency but also focus on changes in social values and regulations (Gibbs & Kraemer, 2004). Given the institutional factors such as the unclear definition of producers, lack of awareness of packaging reverse logistics, and lack of clearly defined standards and guidelines, Amazon adopted similar practices but targeted more themes of the best practices than the B2C and

C2C groups. Amazon has two types of online shopping chancel and needs to meet all requirements of B2C and C2C retailing. Amazon does not separate these two channels in its annual environmental report and takes different green measures. It has set a series of packaging requirements for suppliers and provides packaging materials and shipping channels, as well as packaging return and recycling options for consumers. As mentioned above, the regulative institution increases the legitimacy of the organization's behaviour, and the normative institution provides the organization's reference scheme of green practice (Deephouse, 1996).

In the face of uncertainty, a Cultural-Cognitive institution increases the creativity and competitiveness of an organization, enabling it to be a leader in its field (DiMaggio & Powell 1983). Sharing the same belief of the Paris Agreement goal of 2050, Amazon sets a net zero carbon objective and provides a series of leading packaging waste sustainable measures. It intends to reduce its carbon footprint by lowering total packaging waste throughout the fulfillment process. One of the ways they do this is by using eco-friendly packaging named Frustration-Free Packaging. They also actively research and apply packaging technologies that allow them to use as little material as possible while still ensuring the safety of their products during shipping.

5.2.3 C2C: Low Control on Product Shipping

Unlike B2C and hybrid e-commerce, C2C e-commerce extends the lifecycle of products but may increase the packaging used in shipping. The case study findings reveal that C2C e-commerce does not adopt green initiatives on responsible sourcing& resources recovery, material health, and consumer engagement. According to the analysis of e-Bay and Esty's packaging strategies, almost no actions needed to drive packaging waste management exist in the C2C retailing shipping process, either for the online platforms or the customers, and few corporate environmental reports are currently trying to introduce them. Both e-Bay and Etsy

choose to invest in green projects to reduce their carbon footprint instead of contributing to control packaging used in private product delivery. Besides the above factors in the last section, this result is related to the fact that C2C online retail does not directly participate in the product transportation process.

It is essential to recognize and certify the intermediary role of online platforms in C2C online retailing. There's been little research on package reduction in the C2C E-commerce business. While B2C retailers face the same institutional pressures, C2C retailers do not take the same approach due to their different supply chain compositions. This further illustrates that institutional factors can only influence an organization's behaviours and attitudes and are not binding (Shane et al., 1995). Government should also develop policies emphasizing EPR to manage packaging waste generated in C2C online purchases. The question is of how difficult for C2C online retailers to control the shipping process in online shopping might need further research.

The following section identifies three barriers to the efficient management of packaging waste in the e-commerce industry.

5.3 Barriers to Efficient Management of Packaging Waste

This section presents the conclusions of an analysis of barriers and their reasons in the e-commerce industry regarding packaging waste management.

5.3.1 Barrier 1: the Unclear Identification of Producer

The producer's identification is the first barrier to engaging online retailers in packaging sustainability. Based on the findings of best practices, the subject of producers is not frequently mentioned in online purchases, especially the producers of package waste. Currently, producers are defined as brand owners, manufacturers, or first importers in Canada under the Resource Recovery and Circular Economy Act, 2016. Compared with IC&I sectors,

the E-commerce industry producers are hard to identify and monitor in taking environmentally accountable and financially responsible for reducing waste associated with their products and packaging. According to Wang & Zhu's report (2020) on A collaborative online packaging scorecard, four major supply chain parties are responsible for managing transport packaging generated in the online purchase, including product sellers, online platforms, logistics carriers, and consumers. Each of them can affect the performance of packaging design and product return by requiring different levels of transport packaging in practice. Online platforms are essential in coordinating product sellers, shipping carriers, and customers by deciding whether and when additional packaging is needed. As the core hub in E-commerce logistics, online platforms should be responsible for pre-consumer and post-consumer packaging. Identifying and measuring online platforms' role and responsibility in packaging waste recycling is a problem.

5.3.2 Lack of Awareness of Packaging Reverse Logistics

Limited awareness of packaging requirements in product return policy and lack of systematic approach to creating EPR regulation for online platforms led to difficulty in suitable legal provisions. Consequently, the existing out-come based rules are selective and appear in the content of specific legal acts not directly related to the post-consumer packaging waste recycling in online retailing. Besides, such a barrier is only deepened by the low market value of used packaging and the different expectations of e-commerce businesses and the government. While many will offer both online and physical return options, existing e-commerce sites often only consider the integrity of the merchandise and the lack of impact on secondary sales when receiving returns, without caring about the channel and packaging options for consumer returns. Moreover, despite studies confirming the feasibility of returnable package use in the e-commerce industry, cost and size limitations remain issues

(Zimmermann & Bliklen, 2020, it also provides an opportunity for e-commerce to develop sustainable packaging initiatives and increase competitiveness in the return phase.

5.3.3 No Clear Packaging Standards in the E-commerce Industry

As the literature review mentioned, there are no clear and widely used packaging waste management guidelines and standards in the Canadian online shopping industry, especially for online shopping platforms. This paper is based on a review of the Design guidelines published by the Sustainable Packaging Coalition in 2006 and the 2020 updated sustainable packaging guideline published by APCO and provides a series of best practices summarized from a review of existing literature. The case study results confirmed the feasibility of these best practices, but improvements are required according to business size and model. Undeniably, the outcome-oriented policies proposed by the Canadian government will incentivize online retailers to innovate and develop packaging management frameworks to meet the marketplace's needs. However, there is still a risk of lengthy delays resulting from insufficiently qualified business and low efficient packaging waste reduction strategies. A regional government-certified packaging management standard will help e-commerce business s clarify their regional recycling goals and directions and take targeted and efficient measures to mitigate problems in the region's post-consumer waste recycling system.

The next chapter discusses solutions to the three barriers presented above.

5.4 Create a Transport Packaging Waste Management Framework: Opportunities and Risks

Table 19 sets out potential collaborations, stakeholders, and critical steps for developing efficient packaging waste management systems in the E-commerce industry, based on the literature review, systematic review, and case study findings. Actions and collaborations are required at three different levels: a) government, b) online retailers (online platforms), and c)

customers. These steps are interrelated and could coincide or in a different order, prioritizing policy instruments, as previously discussed.

Table 19 The Potential Roles and Responsibilities for Government, Online Retailers, and Customers Across E-commerce Industry to Facilitate a Shift towards a Full EPR Program

Stakeholder	Recommendations	Details
Government	1.Encourage the EPR regulation in the E-commerce industry 2. Set outcomes-based requirements for online retailers 3. develop a transport packaging sustainability guideline for E-commerce industry	1. Identify the role of online platform as packaging producer 2. Create packaging waste recycling standards
Online retailers (online platforms)	1.Develop a transport packaging sustainability framework 2.Take responsible for transport packaging reduction 3. Learning from leader	1. Encourage physical return 2. Integrate packaging sustainability into corporate strategies 3. learn from the best practices of the leading companies 4. work with suppliers, shipping carriers, and customers to recycle packaging
Customer	1.Behavioral changes on packaging choice and product return 2.Learn more knowledge on waste separation and recycling	1. Reuse and recycle packaging 2. Choose eco-friendly online shopping packaging 3. choose physical return

Moving to a full EPR of packaging waste depends on extensive cooperation and raised awareness among governments, online retailers, and customers. Improving E-commerce business communication and education would provide opportunities to combine resources, increase the use of recyclable packaging, and expand business opportunities. Increased public, governmental, and stakeholder awareness is needed, with stress placed on behavioural change towards reducing and reusing transport packaging and proper packaging disposal.

Based on the case study findings, harmonized identification of the packaging producer in the E-commerce industry is also needed, a fundamental requirement for EPR regulation implementation. The role and responsibilities of the online platform should be recognized in transport packaging sustainability, especially for C2C online retailing. Besides the government's outcome-results requirements, design and operation guidelines for sustainable packaging would be required in the E-commerce industry. The Design Guidelines for Sustainable Packaging (2006) and a new updated sustainable packaging guideline (2020)

published by the Australian Packaging Covenant Organization (APCO) can be helpful as a benchmark. Previous experiences in traditional retailing sectors have shown that physical return would not increase GHG emissions even if online purchases have a high return rate (Allen, 2018). Therefore, online retailers should consider packaging returns and optimize the product's physical return process. Online retailers should identify the most appropriate technology and environmental practices for the E-commerce firms' different sizes and business models and long-term balance between cost and customer satisfaction.

Chapter 6: Conclusion

The importance and urgency of the proper management of transport packaging waste in the E-commerce industry are spotlighted in this work. Due to free and easy returns, E-commerce continuously causes more packaging waste that is likely sent to landfills, resulting in severe environmental impacts. With a growing number of waste import bans in Asian countries, waste exports are now a less viable option. The high quality and low market value of post-consumer packaging increase the difficulties of packaging waste recycling. Implementing the EPR of packaging waste has a definite possibility to help reduce the current post-consumer packaging waste. However, there are no detailed packaging sustainability standards used in Canadian online retailers, especially for online platforms which are not defined as typical producers. The results reveal that online platforms should be considered the packaging producer and take responsibility for meeting outcomes-based waste reduction requirements with the Ontario policy. Therefore, developing a packaging waste management framework and finding barriers and drivers to implement would be more feasible in the E-commerce industry, which can also serve other waste generation sectors.

The systematic review results indicate that online retailers should think more about packaging design and material selection in packaging waste management. The best practices in packaging waste management are mainly based on five objectives of packaging sustainability guidelines, including optimizing resources, responsible sourcing, resource recovery, material health, and consumer engagement. Of these, consumer engagement is highlighted as a strong effort on packaging waste recycling with low cost and high efficiency. The detailed measures provided in this research would help identify and assess online platforms' responsibility and strategies for post-consumer packaging waste sustainability. Developing a packaging waste management framework for an online platform would allow Canada to take initial steps to translate into complete producer control in the packaging waste.

In addition, regulation and normative institutions affect the corporate strategies of packaging waste management. E-commerce businesses are aware of packaging issues and take green practices consistent with the best practices, but the packaging sustainability strategies vary across business models. Firms under the same business model have similar packaging waste reduction practices, and the hybrid firm performs better than others and has the highest response to the best practices. B2C and C2C firms have poor packaging reverse logistics as they do not consider packaging requirements in the return policy.

Besides, C2C e-commerce often relies on green investment to balance GHG emissions and does nothing about shipping control. These findings illuminate problems in packaging waste management strategies for B2C and C2C e-commerce businesses and point to breakthroughs for future improvements.

Moreover, this paper investigated three barriers to efficiently managing packaging waste in the e-commerce industry. First, online platforms are essential in coordinating product sellers, shipping carriers, and customers by deciding whether and when additional packaging is needed. However, the online platform - one of the subjects of packaging producers- is not considered in EPR regulations. Identifying and measuring online platforms' role and responsibility in packaging waste recycling is a problem. Second, limited awareness of considering packaging requirements in product return policy and a lack of systematic approach to creating EPR regulation for online platforms led to difficulty in suitable legal provisions. Finally, there are no clear and widely used packaging waste management guidelines and standards in the Canadian online shopping industry, especially for online shopping platforms. Taking the most environmentally friendly action as an online platform can be challenging. Despite many firms linking packaging with environmental issues, they still need substantial support to effectively work with stakeholders (such as suppliers,

shipping carriers, customers, and government) to reduce, reuse, and recycle post-consumer packaging.

Finally, those barriers are also opportunities. Moving to a full EPR of packaging waste depends on extensive cooperation and raised awareness among governments, online retailers, and customers. Improving E-commerce business communication and education would provide opportunities to combine resources, increase the use of recyclable packaging, and expand business opportunities. It is required to increase governmental, business, and public awareness, with stress placed on behavioural change towards reducing and reusing transport packaging and proper packaging disposal. E-commerce businesses should also take their responsibilities to facilitate a transition toward a complete EPR system, adopting sustainable initiatives to increase the product recovery rate and promote eco-design, thus mitigating pollution and packaging wastes.

6.1 Limitation and Future Research

Some limitations should be considered when considering this study's results. First, the research objective of E-commerce and packaging waste management is limited to large companies. At the same time, the survey of small and medium-sized enterprises (SMEs) is rare. The institutional environment analysis is in the context of Canada, where SMEs account for more than 98 percent of Canadian businesses (Canada, 2020). SMEs are less engaged with environmental initiatives than larger firms. Although waste reduction can lead to financial and environmental benefits, the value of waste reduction varies heavily between business sizes (Hui, Chan &Pun, 2001; Redmond, Walker and Wang, 2008). Second, the best practices for packaging waste reduction are not generalized. Changes are required in different circumstances (Salváet al., 2013). The techniques for three general strategies- reduce, reuse, and recycle- differ based on product life cycle stages and packaging materials. Third, this research uses Amazon as a single case in the hybrid group, which might lead to bias due to

the small sample size. This case study assumes that firms in the same industry will take similar actions and learn from leaders. All the data from primary and secondary sources might be biased that Amazon did well on packaging waste management. Third-party news and reports involved, and group comparison would assess this case study's validity.

This article is the first attempt to evaluate online platforms' current packaging waste sustainability and the potential for complete producer control in the E-commerce industry. This research provided a basis for further research and investigations on the proper implementation of EPR regulation in packaging waste management. Future works can focus on:

1. Best practices on packaging waste reduction in government and customer perspectives
2. How difficult is it for C2C retailers to control the shipping process in online shopping? Why do they do nothing on packaging generated in the product shipping process?
3. How does the E-commerce industry behave in developed vs. developing countries?

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Appendices

Appendix 1

The concept of sustainable packaging under Design Guidelines for Sustainable Packaging:

"A. Is beneficial, safe & healthy for individuals and communities throughout its life cycle.

B. Meets market criteria for performance and cost.

C. Is sourced, manufactured, transported, and recycled using renewable energy.

D. Optimizes the use of renewable or recycled source materials.

E. Is manufactured using clean production technologies and best practices.

F. Is made from materials healthy throughout the life cycle.

G. Is physically designed to optimize materials and energy.

H. Is effectively recovered and utilized in biological and/or industrial closed loop cycles?

（Sustainable Packaging Coalition,2006）

Table 20 Guidelines for Sustainable Packaging

Guidelines for sustainable packaging	Design guidelines 2006	Sustainable packaging guidelines 2020
Similar Principles	Optimizing resources	1.Optimize material efficiency 2.Design for transport efficiency 3. Design to reduce product waste
	Responsible sourcing	4.Use renewable materials 5. Use recycled materials
	Material health	6.Eliminate hazardous materials
	Resources recovery	7.Design for recovery 8.Design to minimize litter
Something new		9.Design for accessibility 10. Provide consumer information on sustainability

From Table 20, sustainable packaging guidelines 2020 provide more detailed principles of design and procurement of packaging under the four design objectives identified by 2006 guidelines and take consumer protection and engagement into consideration. Those design objectives are introduced associated with their contents, importance, and possible solutions as following:

Objective 1: Optimizing resource

This objective aims to reduce material consumption and environmental impacts by optimizing the volume and weight of the packaging. It can save money and reduce the waste and pollution at the source. In 2020 guidelines, it links to optimize material efficiency, design for transport efficiency, and design to reduce product waste.

Objectives 2&4: Responsible sourcing& Resources recovery

As raw materials are extracted, refined, and manufactured into materials for packaging, various pollutants and large quantities of by-products may be created with inevitable environmental impacts. It is important to understand the environmental footprint of packaging materials. In cleaning production, extending the life of packaging by recycling and reusing end-of-life packaging as raw materials has both financial and environmental benefits. It can be achieved by such practices in 2020 guidelines, including using renewable materials, using recycled materials, design for recovery, and design to minimize litter.

Objective 3: Material health

It aims to avoid hazardous substances used in packaging production. If used at levels that exceed regulatory limits, potentially hazardous substances may pose risks to ecosystems and human health. Avoiding or minimizing the use of these substances may reduce the costs associated with the disposal of hazardous waste from manufacturing. This objective is reflected as eliminating hazardous materials in 2020 guidelines.

What is new?: consumer engagement

It not only the producers and logistic carriers' responsibility on sustainable packaging, but not also consumers should contribute to packaging waste reduction. Accessibility of packaging requires packaging must be easy to open, have legible labeling, and not compromise safety or quality (APCO, 2020). With the increasing concerns on easy-to-open and functional packaging, labeling is a good tool to provide consumer information on environmental sustainability.

Appendix 2

Table 21 The List of Document Review of Five Firms

Firms	Documents	**Sources**
Walmart	https://plasticiq.org/ https://www.walmartsustainabilityhub.com/climate/project-gigaton/packaging https://corporate.walmart.com/esgreport/esg-issues/waste-plastics	3
Costco	Sustainability -packaging （https://www.costco.com/sustainability-packaging.html） 2019-2020 packaging footprint summary 2019 - 2020 increase of recyclable content https://www.costco.com/sustainability-waste-minimization.html https://mobilecontent.costco.com/live/resource/img/static-us-landing-pages/Closed-Loop-Story.pdf https://mobilecontent.costco.com/live/resource/img/static-us-landing-pages/2019_2020-Reduction-Archives.pdf	6
eBay	https://www.ebayinc.com/impact/sustainable-commerce/ https://static.ebayinc.com/assets/Uploads/Documents/eBay-Recommerce-Report-2020.pdf https://static.ebayinc.com/assets/Uploads/Documents/eBay-Impact-2020-Report.pdf	3
Etsy	https://www.etsy.com/ca/impact?ref=ftr https://investors.etsy.com/impact-reporting/ecological-impact/default.aspx https://s22.q4cdn.com/941741262/files/doc_downloads/2021/11/2020-CDP-Climate-Change-Response.pdf https://medium.com/etsy-impact/measuring-the-impact-of-shipping-and-packaging-c1ab7243129d https://medium.com/etsy-impact/etsy-becomes-the-first-global-ecommerce-company-to-completely-offset-carbon-emissions-from-shipping-b8ede4322e44	5
Amazon	https://www.aboutamazon.com/planet/improving-packaging/overview https://www.aboutamazon.com/planet/improving-packaging https://sustainability.aboutamazon.com/pdfBuilderDownload?name=report-environment https://www.aboutamazon.com/planet/improving-packaging/case-studies https://www.aboutamazon.com/news/operations/free-returns-with-no-box-tape-or-label-needed	5