Available online at www.sciencedirect.com

ScienceDirect

Procedia CIRP 61 (2017) 679 – 684

www.elsevier.com/locate/procedia

The 24th CIRP Conference on Life Cycle Engineering

Towards a sustainable business model for plastic shopping bag management in Sweden

Jagdeep Singh[a,b,*], Tim Cooper[b]

[a] *Division of Industrial Ecology, Department of Sustainable Development, Environmental Science and Engineering, KTH Royal Institute of Technology, Teknikringen 34, Stockholm, 10044, Sweden*

[b] *School of Architecture, Design and the Built Environment, Nottingham Trent University, Burton Street, Nottingham, NG1 4BU, United Kingdom*

* Corresponding author. Tel.: +46-764322389. *E-mail address:* jagdeep.singh@abe.kth.se

Abstract

From an environmental perspective, a separate collection and recycling system for post-consumer discards could contribute to improved environmental protection as well as economic benefits. This paper investigates the environmental potential of a business model proposed in Sweden in order to improve the utilization of plastic shopping bags. The business model aims to reduce the consumption of plastic shopping bags and to collect and recycle discarded bags more effectively. Results from a life cycle assessment show that the proposed system could significantly reduce the carbon, energy and water footprints of the current system, even for very pessimistic scenarios for bag purchase and recovery rates. However, wider implementation of the proposed business model depends on the accessibility of the deposit/collection system, acceptance of such a 'take-back' system by retail managers, greater environmental awareness among customers and regulatory mechanisms.

Peer-review under responsibility of the scientific committee of the 24th CIRP Conference on Life Cycle Engineering

Keywords: Sustainable business models; plastic packaging; shopping bags; waste collection; recycling

1. Introduction

Shopping bags have become an integral part of our everyday lives. There are many types of shopping bags, which may be made from different materials such as high density polyethylene (HDPE), kraft paper, low density polyethylene (LDPE), degradable plastic and woven cotton [1]–[3]. However, the most commonly used are single-use polyethylene plastic bags. Globally, millions of single-use plastic shopping bags are discarded into mixed-waste streams every day [4], causing negative environmental impacts due to non-renewable resource consumption (for example, petroleum), use of chemicals (such as inks and other additives), and post-consumer plastic litter [5]. Consequently, they have been much debated in both industrialised and less affluent countries due to environmental impacts linked to their use and disposal [6]–[8].

In the past few years, several life cycle assessment (LCA) studies [1]–[3], [5], [9]–[11] around the world have compared the environmental impacts of using different kinds of shopping bags. Although the results from these studies are highly varied, it would appear that certain types of bag have more negative environmental impacts than others. For instance, several studies [9], [11], [12] have shown that reusable (plastic or cotton) bags require less energy and cause lower greenhouse gas emissions, whereas kraft paper bags have the greatest environmental impact due to the energy used, greenhouse gas emissions and water consumption. Further, plastic bags made from recycled materials have much lower environmental impacts compared to those made from virgin materials [3], [12].

Such studies have resulted in the introduction of instruments such as voluntary awareness-raising campaigns, shopping bag levies and even complete bans on the use of plastic bags. In some countries, such as Ireland and Australia, economic instruments have proved successful in reducing the consumption of plastic bags by dissuading consumers from requesting them. Some supermarket chains in Australia and the UK have introduced a voluntary, incentive-based 'take-back' recycling system in retail stores [3].

A 'take-back' system has recently been proposed in Stockholm, Sweden, and implemented at a pilot-level. This proposes a business model aimed at influencing the behaviour of key stakeholders in the plastic shopping bag system by introducing multi-level (dis)incentive mechanisms for retail

Peer-review under responsibility of the scientific committee of the 24th CIRP Conference on Life Cycle Engineering
doi:10.1016/j.procir.2016.11.268

customers and participating retail stores and recycling companies in order to reduce the unnecessary consumption of plastic shopping bags. Richardson [13] identifies three main components of a business model as the value proposition, value creation and delivery, and value capture, while Bocken et al. [14] describes business model innovations for sustainability that involve changes in order to create positive (and/or reduce negative) environmental and social impacts. The proposed business model in Sweden employs multiple sustainable business architypes, as proposed by Bocken et al. [14], by slowing and closing plastic material loops in the plastic shopping bag system.

The aim of this study was to investigate the potential environmental benefits, if any, of the proposed system over the existing system and explore socio-economic barriers/enablers to successful implementation of such a system. Specific objectives are to:

- analyse 'cradle-to-grave' environmental footprints – carbon, energy and water – of the existing plastic shopping bag system and the proposed alternative, using the GaBi [1] software tool.
- explore socio-economic barriers/enablers to implementing such a business model through stakeholder interviews.

2. Case Description and System Boundaries

2.1. A Brief Overview of Bag Consumption in Sweden

In Sweden, different kinds of bags are used to carrying grocery, fruit, other retail items and household garbage. An estimated annual consumption of different types of bags is shown in Fig. 1. Annual consumption of carrier bags in the Swedish grocery and non-grocery trade accounts for approximately 780 million and 680 million bags respectively [15]. Plastic and paper bags account for more than 97 percent of the total bag consumption (cf. Fig. 1). The non-grocery retail trade generally uses LDPE shopping bags. Plastic bags used for non-food applications, such as for clothing, are designed to be relatively thicker (up to 50 micro meters) and heavier (more than 50 grams) than plastic bags used in grocery stores [15]; this is because of brand image reasons rather carrying requirements.

2.1. Proposed Sustainable Business Model in the Swedish Plastic Bag Consumption System

A sustainable business model is proposed in Sweden to influence the behaviour of important stakeholders in plastic bag consumption system in order to reduce the unnecessary consumption of plastic shopping bags. A multi-level (dis)incentive mechanism is devised for not only the customers but also the participating retail stores and plastic waste recycling companies. This initiative has focused on both redesigning the current consumption system and the post-consumer waste collection and management system. Currently, stores in Swedish offer customers plastic shopping bags for free and there is no separate collection system for discarded bags (see Fig. 2a). A sustainable business model is proposed (see Fig. 2b) in which: (1) a small fee (two Swedish Krona) will be charged for the use of a plastic bag, the *'first-level avoid principle'*, to encourage customers to avoid the use of bags; (2) the full fee will be refunded to customers when they return the purchased bag to the store, the *'second-level reduce principle'*, to encourage customers to avoid discarding bags and enable the recovery of plastic waste; and (3) returned plastic shopping bags will be recycled into new bags by a Swedish plastic bag manufacturing company, 'Trioplast' [2], located in Smålandsstenar, Sweden. This is the *'third-level reuse principle'*, avoid mixing different types of plastic waste and thereby improve the efficiency of recycling operations by maintaining the quality of post-consumer plastic waste. The intention is to achieve a standardised material selection for plastic bags used in all of the participating retail chains and the use of bags with lower environmental impacts. The post-consumer bags will be taken by a waste collection company in Norrköping, Sweden, and then recycled by Trioplast. In the proposed business model, the retail chains make economic gains since they reduce the number of bags given away to customers. The participating recycling company gets better quality waste material that can be recycled to make new bags with a relatively higher market value (i.e. upcycling). Any purchased bags which are not returned are considered to be managed as in the existing system.

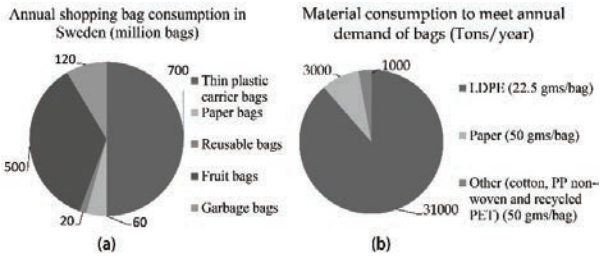

Fig. 1. An estimated annual consumption of shopping bags and material consumption in retail trade in Sweden. Data source: [15]

The proposed business model employs multiple sustainable business architypes as proposed by Bocken et al. [14]; these are shown in Table 1. The business model employs technological, social and organisational approaches to achieve sustainability. A pilot for the proposed business model (an initiative by PantaPåsen[3]) has already been introduced in a retail store, Teknikmagasinet[4], in Stockholm. Outcomes for four months (July-October 2016) are given in Appendix A. These enable different assumptions and scenarios to be explored in the GaBi model for the environmental systems analysis of the business model (more details in Section 3).

3. Methods and Materials

Both quantitative and qualitative methods have been employed in order to achieve the study's aims. A life cycle assessment (LCA) was used to evaluate and compare the

[1] GaBi is a life cycle assessment tool developed by PE International (www.gabi-software.com/index/)

[2] For more information about the company, visit: www.trioplast.com/sv/

[3] For more information visit: www.pantapasen.se/

[4] For more information visit: www.teknikmagasinet.se/

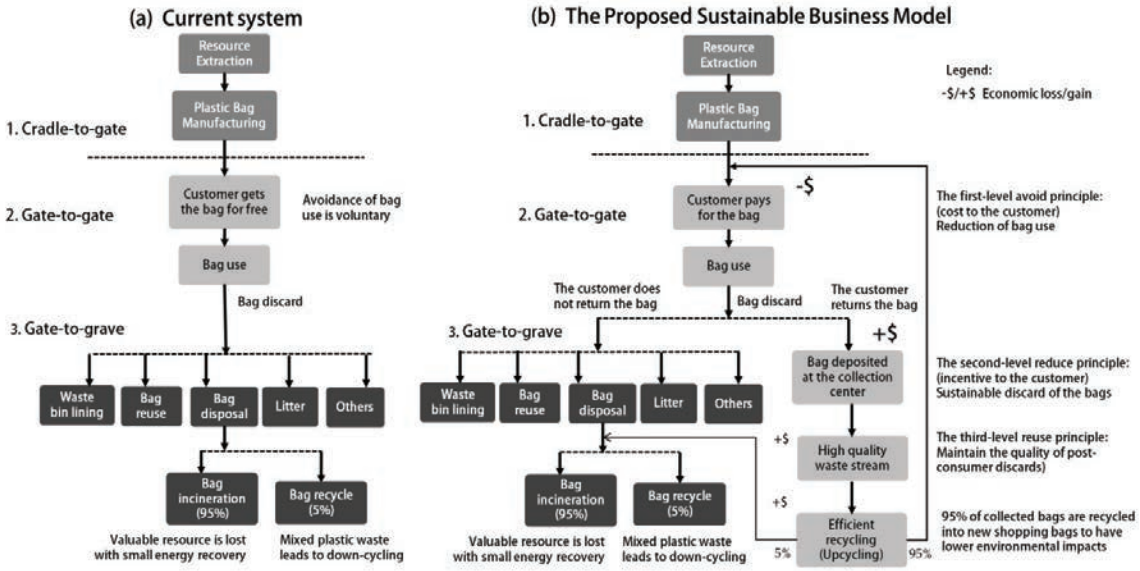

Fig. 2. Cradle-to-grave flow of single-use plastic shopping bags in Sweden (a) in the current system with voluntary, environmentally-conscious, consumer behaviour and (b) in the proposed business model with multiple-level (dis)incentive mechanisms to reduce unnecessary consumption of plastic bags.

Table 1. Various technological, social and organisational approaches employed in the proposed sustainable business model (Adapted from Bocken [14])

Sustainable business model focus and architypes		Approaches	Proposed business model
Technological	Maximise material and energy efficiency	Low carbon manufacturing solutions; dematerialisation	The first-level avoid principle aims at achieving a reduction in the consumption of plastic bags
	Creating value from waste	Circular economy; closed loop; industrial symbiosis; reuse, recycle, re-manufacturing; take back management; extended producer responsibility	The second-level reduce principle reduces the numbers of bags discarded to mixed waste streams The third-level reuse principle helps to improve the quality of post-consumer waste streams The second and third-level principles together lead to an efficient recycling of collected waste in order to achieve upcycling
Social	Deliver functionality rather than ownership	Use-oriented product-service system	The economic (dis)incentive mechanisms for an efficient take-back system where all the actors gain economically
	Adopt a stewardship role	Resource stewardship	The (plastic) resource is managed throughout its entire life-cycle to improve plastic resource utilisation
	Encourage sufficiency	Demand management; product longevity; frugal business; responsible product distribution	Different principles to achieve avoid, reduce and reuse lead to an overall reduction in the cost of plastic bag use and disposal
Organisational	Repurpose for society/ environment	Not for profit	Consumers incur no net cost in using bags unless they fail to return them after use. Retailers have economic incentives due to relatively fewer bags being consumed
	Develop scale-up solutions	Collaborative approaches	The proposed business model innovates sustainability through collaboration between consumers, retail stores and recyclers

environmental footprints of the current and proposed systems. GaBi, a Windows-based LCA tool, and the life cycle inventory database ecoinvent [5] were used to model the system. Interviews with some of the important stakeholders were conducted to explore socio-economic barriers/enablers for the wider implementation of such a business model in Sweden.

3.1 LCA and Life Cycle Inventory

Over the past two decades, the use of LCA as a tool to compare different resource management systems has increased. Indeed, European Union [16] member states have recognised LCA as a policy tool for comparing different waste management options. LCA offers a complete life cycle perspective and assesses different impact categories in order to address trade-offs and partial solutions [17]. Different processes considered in this LCA study are illustrated in Fig. 3.

The goal of the LCA was to compare environmental impacts of the use of plastic bags in the current and proposed systems. Since shopping bags used in Sweden are of different sizes and weights, a reference LDPE bag with 22.5 gram weight has been assumed for an average-sized bag in Sweden; the weight was calculated through a survey conducted in

[5] ecoinvent is an organization that provides process data for thousands of products. More information can be found at: http://www.ecoinvent.org/database/database.html

Swedish retail stores (for more details see Appendix D). The reference flows of energy and materials used to manufacture one average-sized Swedish bag are given in Table 2.

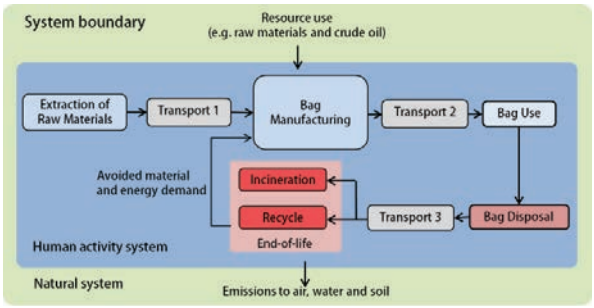

Fig. 3. System boundary considered in this study

The functional unit of the study is the number of bags used by one consumer over a one year period for each system. In current system, 70 LDPE plastic bags per person per year, with an average weight of 22.5 grams, are used. In contrast, the proposed business model assumes a 70% reduction in the use of bags, due to the introduction of a fee, and that 50% of the purchased bags will be deposited at collection points (see Table 3). These assumptions are based on the ongoing survey conducted at the pilot-scale project site in Stockholm (for more details see Appendix A).

Table 2. The reference energy and material flows considered in the study

Life cycle inventory	Flows for 1000 plastic bags*	Flows for one average-size bag used in Sweden
Electricity use (kWh/Kg)	0.932	0.02097
Heat Use (kWh/Kg)	0.399	0.00898
Manufacturing waste (grams)	171.2	0.00011
Ink (grams)	0.35	0.00023
Secondary packing materials:		
Corrugated cardboard (grams)	2560	0.00165

* Based on Environmental Agency [3]

Two end-of-life scenarios are considered for the discarded bags, incineration and mixed plastic-waste recycling. For the current system, incineration and recycling rates for post-consumer plastic shopping bags are 95% and 5% respectively [15]. For the proposed system, the incineration and recycling rates are assumed to be 5% and 95%, respectively. Since sampling data for collection rates is available for limited time period (4 months), the LCA results are calculated for a range of scenarios for reductions in the use of plastic bags and collection of used bags. For both the current and proposed systems it is assumed that 50% of the plastic bags are manufactured in Sweden and the other 50% imported from China [15]. A detailed description of the transport distances and technologies used for the transport of raw materials and plastic bags from the manufacturing sites (either in Sweden or abroad) to the places of consumption in Sweden is provided in Appendix B.

3.2 Bag Purchase Reduction Ratio and Bag Return Ratio

The carbon, energy and water environmental footprints of plastic shopping bag use and disposal within the proposed system depend on two major factors: (1) any reduction in the purchase of shopping bags due to the introduction of a fee; and (2) the number of purchased bags discarded by customers. The total operating space (in terms of environmental impacts) of the proposed system would depend on various combinations of these factors. In order to evaluate the environmental footprints for different combinations of these two factors, two ratios are defined:

$$\text{Bag purchase reduction ratio (\%)} = \sum_{i=1}^{m}\left\{\frac{B_{cs}-B_{ns}}{B_{cs}}\right\}\times 100$$

where B_{cs} is the number of bags used with the current system, B_{ns} is the number of bags purchased in the proposed system in m number of participating stores

$$\text{Bag return ratio (\%)} = \frac{\sum_{j=1}^{n} b_{ns}}{\sum_{i=1}^{m} B_{ns}}\times 100$$

where b_{ns} is the number of bags deposited at n number of collection points and B_{ns} is total number of bags used/purchased in m number of participating stores.

3.3 Stakeholder Interviews

Personal interviews were conducted with important stakeholders, such as corporate social responsibility (CSR) managers, marketing managers and procurement managers, in 29 major retail chains in Stockholm. These interviews focused on investigating social, legal, financial and other barriers to the proposed business model. Further, customers visiting the pilot store were asked for their opinions about the proposed new system, including the fee for bags. Further details on the interviews and stakeholder reactions are provided in Appendix C.

4. Results and Discussions

4.1 Environmental Footprints

Overall, results of the study show that the proposed business model has significant potential to reduce the environmental footprints of the current system of plastic bag use and disposal. A comparison of carbon, energy and water footprints of the current and proposed systems is shown in Table 4 for different scenarios for reductions in the number of bags purchased (bag purchase reduction ratio) and discarded (bag return ratio). Fig. 4 shows the carbon, energy and water footprints on contour surface diagrams for different values of bag purchase reduction and bag return ratios. These surfaces represent the total operating space for the proposed system for the different performance indicators defined in Section 3.2 – the ratios representing reduction in the purchase of shopping bags and environmentally-conscious disposal of the bags.

The proposed system reduces the carbon, energy and water footprints of the current system even with bag purchase reduction and bag return ratios as low as 10%, a highly unlikely scenario considering the results from the pilot project presented in Table 5. The contour surfaces are drawn for the most probable combinations of the two defined ratios. The results suggest that the proposed system, with separate collection and recycling of plastic bags, is more environmentally sustainable than the current system, in which incineration of plastic bags is the norm.

Table 3. Different scenarios for the current and the proposed system

Life cycle stage	Process	Current system	The proposed system
Resource extraction	Crude oil for virgin LDPE granulate	100% supplied from the Middle East	100% supplied from the Middle East
	Corrugated board boxes for packaging	Originated from the producing country	Originated from the producing country
	Ink for colouring	Originated from the producing country	Originated from the producing country
Manufacturing of plastic bags		50% of the bags are made in China	50% of the bags are made in China
		50% of the bags are made in Sweden	50% of the bags are made in Sweden
Bag use/purchase		The bags are given for free	The bags will be charged
		70 bags per capita per year	21 bags per capita per year
Bag disposal	Incineration of mixed waste in Sweden	Most bags get mixed waste streams	Separate collection of the purchased bags
		95% of the discarded bags are incineration	5% of the recovered bags are incinerated
		5% of the discarded bags are recycled	95% of recovered bags are recycled

Table 4. Comparison of carbon, energy and water footprints of the current system and the proposed system for different reductions in plastic bag purchase and bag return ratios.

Environ-mental Footprint	Current system	Bag purchase reduction ratio (%)	The proposed system: Bag return ratio (%) 20	40	60	80
Carbon (Co2-eqv.)	5.55	20	3.39	3.15	2.14	1.67
		40	2.91	2.36	1.81	1.25
		60	1.94	1.57	1.2	0.84
		80	0.98	0.79	0.60	0.42
Energy (MJ)	104	20	72.4	58.4	44.4	30.3
		40	54.3	43.8	33.3	22.8
		60	36.2	29.2	22.2	15.2
		80	18.1	14.6	11.1	7.58
Water (Kg)	3390	20	2710	2700	2690	2680
		40	2030	2020	2020	2010
		60	1350	1350	1340	1340
		80	676	674	672	670

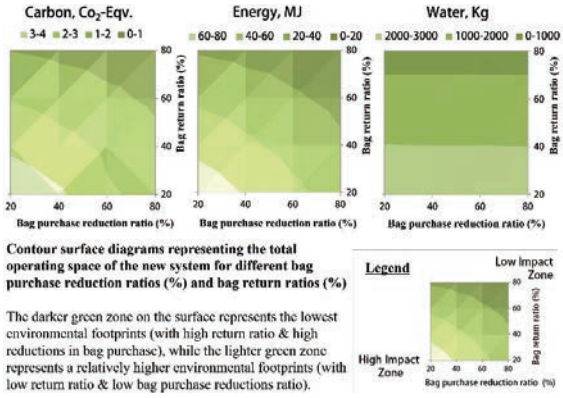

Fig. 4. Contour surface diagrams representing the total operating space of the proposed system for different bag purchase reduction ratio (%) and bag return ratio (%). The results are shown for the defined functional unit.

4.2 Socio-economic Barriers/Enablers

In order to achieve a reduction in the overall environmental footprint, the proposed system must influence two key variables, plastic bag use (purchase) and/or bag return, which could further require transitions in the current socio-economic system of plastic use and disposal towards the 'low impact zone' shown in Fig. 4. In order to enable such transitions, the study thus explored some important aspects of the system such as accessibility of the deposit/collection systems, acceptance of such a 'take-back' system by the retail chains, customers' environmental awareness, and financial and regulatory settings for realising such a system.

During the first two months of the project in the pilot store, approximately 3200 customers were introduced to the new business model. During this period, a net reduction of approximately 80% in plastic bag use was noticed, indicating substantial potential to reduce (avoid) plastic shopping bag use in the current system. Overall, the stakeholders' response to the proposed system was positive (see Appendix A and C for more details). However, only approximately 2% of the total purchased bags were deposited back during the two months, although the pilot is ongoing. Currently, the proposed system has been introduced to only one store, in Stockholm, and therefore the low bag return ratio could be ascribed to low accessibility of the bag deposit system. In future, this issue could be addressed if more retail stores join the pilot and the number of bag deposit centres increases. The interviews found a mixed response from corporate social responsibility (CSR) executives, marketing managers and procurement managers. Overall, the stakeholders' main concern was about the reaction of customers to the proposed system in which they are required to pay for an item (i.e. shopping bag) which was (or still is) freely available. A detailed description of the interview results is provided in Appendix C.

Out of the total 29 interviewed stakeholders, 13 were not interested in participating in the proposed system. The stakeholders from three major retail chains indicted that they were interested but preferred to wait until more stores participate; this implies that they perceive a risk in taking part in a new system which is not yet widely accepted. One stakeholder revealed that the company did not want to reduce the number of bags offered to customers because they consider shopping bags to be an important advertisement channel.

In fact, most Swedish grocery stores already charge a fee for using plastic bags and generate huge revenues by selling them: total annual revenue for shopping bag sales in Swedish grocery stores is about 250 million SEK [15]. However, these stores are not obliged to 'take back' the bags that they have sold; instead, a third party organisation takes end-of-life responsibility for the discarded bags. Such stores might not be willing to lose revenue by participating in such a 'take back' system. Further, the bag fee system in these stores focuses

only on reducing the unnecessary use of bags. In contrast, the proposed system also introduces a novel reward mechanism to separately collect discarded plastic bags in order to maintain or improve the quality of material in the waste stream. Some stakeholders found the proposed system to be promising but did not have authority to take up the invitation to participate. Two retail stores have already been participating in alternative systems for plastic bag management. Further, stakeholders from two of the retail chains were interested to know if their competitors are (or will be) participating. Some stakeholders wanted to hold back on any their decision to take part until the release of new Swedish waste legislation in November 2016. Overall, a wide implementation of the proposed system would require appropriate legislative support as well as addressing the expectations of the customers and retail chain managers through environmental awareness campaigns.

5. Final Remarks

The aim of this study was to investigate the potential environmental gains and socio-economic aspects of a sustainable business model for plastic shopping bag management in Sweden. Overall, results indicated that the proposed business model appears likely to reduce the environmental footprint of the current system of plastic bag use and disposal. This is due to the focus of the proposed business model to: (1) reduce plastic bag use/purchase; (2) improve resource recovery from discarded plastic bags, and (3) reduce virgin raw material demand to manufacture plastic bags. There are several socio-economic dimensions to successful implementation of the proposed business model. Some immediate issues to be addressed are to (i) improve the accessibility of the deposit/collection system, (ii) address risks perceived by retail managers regarding a 'take-back' system, (iii) facilitate customers' environmental awareness, and (iv) support the proposed business model with appropriate financial and regulatory mechanisms. Results from the present study could provide important insights for similar business model innovations for other products aimed at achieving a circular economy. The present study excludes an important aspect of the proposed business model – the economic potential of such a business model for stakeholders such as consumers, retail stores and recycling companies. This could be important information for these stakeholders, enabling them to accept and participate in the proposed business model. Future studies could be devised to further investigate: (1) the economic potential for retail stores by reducing bag consumption; (2) avoided costs for participating recycling companies due to material and energy savings; and (3) other intangible benefits for participating organisations such as branding and avoiding negative environmental and social externalities.

Acknowledgements

The authors acknowledge the KTH Näringslivssamverkan (KTH Corporate Alliance) and the EPSRC funded Centre for Industrial Energy, Materials and Products, grant reference EP/N022645/1 for financial support and Suwar Mert of Sugi Group AB for his contribution in arranging the field data for the environmental footprints. Any shortcomings are our own responsibility.

Appendix A. Overview of the proposed business model for a sustainable management of plastic shopping bags

Please visit the following web-link:
https://docs.google.com/document/d/1U3s-dmGAntc21nZ3FFpfAn5tOJ-IDaMx0KknfAB3Un4/edit?usp=sharing

Appendix B. Raw material and transport inventory used in the GaBi model

To access inventory data, please visit the following web-link:
https://docs.google.com/document/d/1hvJdxcDAjDN2QGM7OS8tUis7PbjpWeh5QhaVTv82Ez8/edit?usp=sharing

Appendix C. An overview of the response of corporate social responsibility (CSR)/procurement managers of some of the major retail chains in Stockholm

To access the data, visit the following web-link:
https://docs.google.com/document/d/1SFdcJLqrMwNLUjyJd-anedEuo0QDgAvcv7tSwR4QN2Q/edit?usp=sharing

Appendix D. Specification of different shopping bags used in Swedish retail stores

To access the data, visit the following web-link:
https://docs.google.com/document/d/1g6fOD2BFbakKyqUmN5-4XkBbpqr10PiThLXPITEKZ7w/edit?usp=sharing

References

[1] S. S. Muthu, "13 – LCA of cotton shopping bags," in Handbook of Life Cycle Assessment (LCA) of Textiles and Clothing, 2015, pp. 283–299.
[2] S. S. Muthu, Y. Li, J. Y. Hu, and P. Y. Mok, "Carbon footprint of shopping (grocery) bags in China, Hong Kong and India," Atmos. Environ., vol. 45, no. 2, pp. 469–475, 2011.
[3] Environmental Agency, "Life Cycle Assessment of Supermarket Carrier Bags," Bristol, 2011.
[4] J. Larsen and V. Savina, "Plan B Updates: The Downfall of the Plastic Bag, A Global Picture," in Plan B, 2014.
[5] United Nations Environment Programme, "UNEP Year Book 2011: Emerging Issues in Our Global Environment 2011." Nairobi, 2011.
[6] J. Dikgang, A. Leiman, and M. Visser, "Analysis of the plastic-bag levy in South Africa," Resour. Conserv. Recycl., vol. 66, pp. 59–65, 2012.
[7] Q. Zhu, "An Appraisal and Analysis of the Law of 'Plastic-Bag Ban,'" Energy Procedia, vol. 5, pp. 2516–2521, 2011.
[8] O. Ayalon, T. Goldrath, G. Rosenthal, and M. Grossman, "Reduction of plastic carrier bag use: An analysis of alternatives in Israel," Waste Manag., vol. 29, no. 7, pp. 2025–2032, 2009.
[9] Sustainability Victoria, "Comparison of existing life cycle analysis of shopping bag alternatives," Australia, 2007.
[10] J. Greene, "Life Cycle Assessment of Reusable and Single-use Plastic Bags in California," California, 2011.
[11] Environment Australia, "Plastic Shopping Bags – Analysis of Levies and Environmental Impacts," Victoria, 2002.
[12] Business for Social Responsibility, "Building long term solutions: Retail shopping bag impacts and options," 2010.
[13] J. Richardson, "The business model: an integrative framework for strategy execution," Strateg. Chang., vol. 17, no. 5–6, pp. 133–144, Aug. 2008.
[14] Bocken, S. W. Short, P. Rana, and S. Evans, "A literature and practice review to develop sustainable business model archetypes," J. Clean. Prod., vol. 65, pp. 42–56, Feb. 2014.
[15] Swedish Environmental Protection Agency, "Konsekvensanalys för begränsad användning av bärkassar (in Swedish)," Stockholm, Sweden, 2014.
[16] EU, "European Union Framework Directive on Waste." European Union, 2008.
[17] Joint Research Centre, "International Reference Life Cycle Data System (ILCD) Handbook - General guide for Life Cycle Assessment - Detailed guidance.," Luxembourg, 2010.