



A system dynamics approach for enhancing social behaviours regarding the reuse of packaging



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ABSTRACT

There have been many attempts to reduce the amount of waste packaging through open dumping and burning, recycling, landfill, incineration, etc. However, there has been little attention paid to reuse as the simplest way to reduce waste. In order to motivate consumers to perform reuse behaviour, it is essential to understand how this behaviour can be influenced and what variables predict it. This paper aims to study the effectiveness of improving social aspects of reuse behaviour and investigate the variables that lead to increased reuse behaviour in a short time period. This paper selects a quantitative approach, the System Dynamics (SD) method, which offers a means by which to highlight the dynamics and interrelationships among the different social aspects in reuse behaviour. Different social aspects are extracted from Cognitive Behaviour Theory (CBT) as a basis with the Theory of Planning Behaviour (TOPB). The authors develop a Social Behaviour Aspect Model (SBAM) with three predictors: information values, awareness-changing variables and behavioural adaptation variables. The paper demonstrates its utility with a report on a recent empirical study that has used the model to provide important new findings about different social aspects to enhance reuse behaviour. These findings have clear implications for the packaging industry who intend to enhance reuse behaviour amongst consumers, encouraging them to take corrective and preventive actions at an early stage.

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1. Introduction

Waste in general threatens the survival of humans, and most types of plants and animals, as well as throttling all the natural resources that are necessary for human existence. As a consequence, public concern has been raised over waste and pollution problems (Williams, 2005). Over the last few decades, social behaviour together with development of lifestyles and consumption patterns have resulted in a problematic situation which increases the amount of waste produced (Oweis, Al-Widyan, & Ohood Al-Limoon, 2005). It was found that, out of the 146 kg of household waste generated per capita in the EU in 2013, an average of 45.3% went to landfill (Eurostat Statistics Explained, 2015). Moreover, social behaviour towards waste affects the industrial sector, in which they make an effort to design new systems or develop existing systems to overcome the issues of increased waste. Take, for instance, the recycling system: the main goal of recycling is to allow the production of secondary materials which can be used instead of primary materials. This system saves money, reduces the production of new materials and reduces en-

vironmental impact (Banar, Cokaygil, & Ozkan, 2009). Dealing with waste packaging as a part of all waste is essential. The use of packaging is increasing and the annual production of packaging is also increasing. In China, the volume of packaging is still increasing each year, and in 2010 packaging waste represented approximately 15% of municipal solid waste (Xie, Qiao, Sun, & Zhang, 2013). The main reason for this issue is that both the packaging waste recycling system and the composite packaging reuse technologies are undeveloped (Li, Yang, & Wang, 2005). In Germany, two main problems still face packaging waste treatment. First, high costs accrue during the recycling process, and sometimes there are limited resources and a lack of willingness to make environmental improvements. Second, there is uncertainty about the exact environmental improvements to be made (Neumayer, 2000).

A significant number of studies have examined the various dimensions of waste treatment such as open dump, burning, recycling, landfill and incineration. (Al-Khatib & Sato, 2009; Banar, Cokaygil, & Ozkan, 2009; Coker et al., 2009; Hossain, Santhanam, Nik Norulaini, & Omar, 2011). There are many advantages to these waste treatment approaches if they are used in a proper way; otherwise, they are not useful for the environment and do not benefit waste management systems. For instance, recycling has been identified as a major way to reduce waste (Anquilar-virgen, Armijo-de vega, Taboada-gonzalez, & Ojeda-benitez, 2010; European Environment Agency, 2007). However, limitations with recycling have emerged, partly because some

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materials remain non-recyclable (Rigamonti, Grosso, & Giugliano, 2009). Further, the materials produced after recycling have their properties changed owing to a lack of reprocessing efficiency. Inappropriate separation of materials at the recovery plant prior to reprocessing is another issue (Rigamonti, Grosso, & Giugliano, 2010). Landfill is a solution to most non-recyclable waste but countries, mainly developing countries, need to reduce their reliance on it (Brunner & Fellner, 2007). Additionally, although there are many techniques to minimise the risks from landfill sites (Cossu, Lai, & Pivnenko, 2012; Siddiqui, Richards, & Powrie, 2012), they still pose a threat to both people's health and the environment.

Reuse, as another waste treatment, is a primary solution, which should be considered before any other approaches. In England and Wales, the regulations rank the priority for waste management options according to what is the best for the environment. Priority is given when the waste is generated for 'preparing for re-use', then recycling, recovery and, finally, disposal (Department of Environment Food and Rural Affairs, 2011). The reuse of packaging has become a well-known attitude amongst communities, such as using different types of packaging material: glass, cartons, plastics, etc. (Langley, Turner, & Yoxall, 2011; Peattie & Shaw, 2007; Verdugo & Figueredo, 1999). Being able to identify social aspects influencing reuse behaviour which might have an impact on diverting waste from landfill is very important. Hence, this paper aims to study the effectiveness of improving social aspects of reuse behaviour and investigation of the variables that lead to increased reuse behaviour in a short time period. The novelty of this study lies in two points. The first one is integrating Cognitive Behaviour Theory (CBT) with Theory of Planning Behaviour (TOPB) in order to identify the social aspects that are relevant to enhancing reuse behaviour. The second one is the employment of a System Dynamics (SD) approach, which is not currently used, to present the social aspects of any waste treatment approaches. The paper consists of four parts. It provides a brief description of a conceptual model of social factors after reviewing the current literature. This is followed by a model description of the SD approach together with an analysis of results. Finally, the paper concludes with the findings within the model, along with some recommendations, before moving to a conclusion.

2. Literature review

As this research concentrates on waste packaging, it will use the definition of 'reuse' from the Packaging Waste Directive 94/62/EC (Environmental Regulations, 2005): an "Operation by which packaging, which has been conceived and designed to accomplish within its life cycle a minimum number of trips or rotations, is refilled or used for the same purpose for which it was conceived with or without the support of auxiliary products present on the market enabling the packaging to be refilled: such reused packaging will become packaging waste when no longer subject to reuse".

Many studies have found some advantage in using reusable packaging in relation to many kinds of waste issues, such as high volume of solid waste, frequency of product damage, inefficient storage or warehouse space, worker safety, ergonomic issues and hygiene demand. For example, the research conducted by the Foundation for Reusable Systems assessed whether disposable or reusable packaging can save food from spoilage (Karst, 2013), and found that reusable packaging has an advantage in terms of reducing the amount of packaging going to waste schemes and recycling processes due to its strength, consistent size and compatibility compared to one-way packaging. Langley et al. (2011) confirmed that any products that fell into the reuse route were not thought of as waste by consumers. With regard to the environment, reuse is advantageous in several ways, according to the Industry Council for Packaging and the Environment (2009). As stated by Carter, Kale, and Grimm (2000), firms' revenues can be positively affected if there is increasing demand for

environmental products. The number of times a product/packaging can be reused will help to decide cost factors and minimise any additional cost for recycling, waste disposal and waste management (Dubiel, 1996). Although a reusable product might be twice as thick as a single-use product, and thus more cost to manufacture, a multi-use product can compensate the cost with increased utilisation and an overall reduction of consumption of materials. Therefore, reuse is a significant saving for materials and manufacturing, and for the collection and disposal operation (Jarupan, Kamarthi, & Gupta, 2011).

This paper will present a literature review about packaging reuse. In the past, there have been a few attempts to use reusable packaging in a traditional way but these met with little success. For instance, in Canada, the average number of refillable beer bottles reduced from 47% in 1985 to 5% in 1997 due to the industrial use of non-refillable bottles (Grimes-Casey, Seager, Theis, & Powers, 2007). In Western Europe, there is a high prevalence of refillable packaging used for beverage containers. However, the average overall number of refillable bottles has slowly fallen across Europe. In 1979, around 81% of the beer bottles sold in Europe were refillable, whereas in 1997 this was only 60%. The main reason behind this is that the European beer market has favoured one-way packaging (Rowe & Platt, 2002). In the United States, reusable packaging for soft drinks has declined from 100% in 1947 to 1% in 2000 due to increased use of metal cans and plastic (PET) bottles (Rowe & Platt, 2002).

There are many recent examples of companies implementing reusable packaging in consumer products. In 2010, Kentucky Fried Chicken introduced a reusable side container. This reusable packaging is made of polypropylene and uses a "ventless vent technology", which allows moisture to escape without requiring a hole in the lid. According to the company, this reusable packaging is safe to wash and microwave (Kentucky Fried Chicken, 2010). Pizza Hut Enterprise has introduced a new pizza box design that allows the box to be broken down into plates and a smaller box for leftovers. The company states that the packaging is eco-friendly, highly functional, and easy to store and dispose of. This new packaging design was developed under partnership with Central American Packaging Manufacturer SigmaQ and uses Ecovention's patented Green Box technology. The inventor of this idea is Scott Wiener, who states that designing reusable packaging has the power to solve waste conflicts and make the world a better place to live (Kelley, 2013). Another company, PUMA, also introduced a new packaging design in 2010 called 'Clever Little Bag' and a 'Half-size Clever Apparel Pack' in 2012 (PUMA, 2012). It is a red, reusable shoe bag used to package its footwear. Moreover, Coca-Cola produced refillable packaging with a lower price than one-way packaging as motivation for consumer to use reusable cups (Rowe & Platt, 2002). The Starbucks reusable cup is another example of a reusable cup in the market. As stated in the Starbucks annual report (Starbucks, 2013), there is a need to increase the number of customers who reuse their personal reusable cup. As shown in the Starbucks annual report, in 2013, an increasing number of beverages were served in reusable cups (49.9 million beverages) compared with 2012, which was 35.8 million beverages. The annual report highlights the need for more improvement in order to achieve a 5% increase in the number of users of reusable cups. Hence, these reusable packaging examples are trying to increase the prevalence of reuse behaviour amongst societies but people are paying little attention to it. Hence, there is a need to understand how to enhance consumers' reuse behaviour and what kind of social aspects can predict it.

Many studies have investigated how to enhance recycling, waste reduction, waste incineration and other waste treatment approaches amongst societies (Bratt, 1999; Chu & Chiu, 2003; DeYoung, 1986; Joos, Carabias, Winistoerfer, & Stuecheli, 1999; Larsen, 1995; Lima, 1996; Vicente & Reis, 2008); however, there are also a few studies that have investigated reuse behaviour. For instance, a study conducted by Barr, Gilg, and Ford (2001) of differences between household waste behaviours concluded that one strong predictor of reuse

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