

The prospects of zero-packaging grocery stores to improve the social and environmental impacts of the food supply chain

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Abstract

Increasing consumer awareness of the environmental and social externalities of food supply chains in developed countries instigates the opening of grocery stores that renounce the use of disposable plastic packaging for their entire product range. The opportunities these novel stores offer in moving to an alternative, more sustainable retail system are currently not well understood. Semi-structured interviews with representatives of seven stores across Europe and six food supply chain experts were conducted in order to address this gap. Findings suggest that these stores may induce more resource-efficient behaviour in suppliers and consumers due to the reduction of packaging and food waste. Social benefits range from the support of small, regional farmers, to higher transparency along the supply chain and better informed consumers. However, these benefits come at the expense of consumer convenience due to slower shopping operations and limited product variety. A wider adoption of zero packaging will require influencing consumer behaviour, convincing suppliers to change their packaging practices, and solving the dependency of food logistics on packaging. In order to achieve wide-ranging, significant environmental and social benefits, zero-packaging stores will ultimately have to

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offer service levels that are comparable to conventional supermarkets. Potential pathways illustrating how zero-packaging could overcome current market limitations are presented.

Keywords

Food Retail; Reusable Packaging; Food Supply Chain; Green Business Model; Food Waste; Sustainable Supply Chain

1 Introduction

2 The UK Food Supply Chain (FSC) generated 17.3 million tonnes (Mt) of waste
3 which had an economic value of £19.2 billion in 2011 (WRAP, 2015). Almost
4 90% of this waste (15.3 Mt) is food waste which accounts for a third of all food
5 purchased. This resembles the trend in the European Union where 88 million
6 tonnes of food with an economic value of 143 billion Euros were wasted in 2012
7 (Stenmarck et al., 2016). Furthermore, the UK FSC emitted 176 Mt of CO₂
8 equivalents (CO₂e) in 2011. Hence, FSCs in developed countries are generally
9 not sustainable but wasteful (Tassou et al., 2014). Looking to the future, the
10 food industry faces many challenges: By 2030, global demand for food and
11 energy is expected to increase by 50%, leading to a 40% increase of water use
12 and freight transport (FoodDrinkEurope, 2012).

13 In addressing these challenges in developed countries, Fox and Vorley (2004)
14 recognise supermarkets as the 'gatekeepers' of FSCs. They not only hold the
15 power to induce positive change at both consumer and supplier side but can
16 also pass down their external costs and responsibilities to food processors and
17 farmers. Some measures on how to improve the social and environmental
18 impacts of the food industry have been proposed but *"more radical solutions will
19 be needed to reduce further energy demand in the food sector and mitigate the
20 related climate change impacts"* (Tassou et al., 2014, p. 163). Fundamental
21 change is necessary, but there is limited research on what such radical
22 solutions might look like and how they can be realised. Most efforts have
23 focussed on individual environmental or social impacts and on optimising rather
24 than rethinking the current system.

25 Even the UK government's ambition to move towards a zero waste economy
26 falls short of its expectations by promoting merely waste reduction and recycling
27 (DEFRA, 2010). As recognised in the waste hierarchy, a better strategy is
28 actually waste prevention (UNEP, 2010). Putting this first principle of the waste
29 hierarchy into practice, a number of grocery stores renouncing disposable
30 plastic packaging have opened across Europe. In these stores, consumers
31 bring their own containers, weigh the tare, fill in the product and pay according

1 to the weight. The potential of this approach to support the transition towards a
2 low-impact FSC are currently unknown.

3 This paper addresses this gap using Porter and Kramer (2006)'s value chain
4 framework in order to analyse the processes through which these stores
5 provide social and environmental benefits whilst profiting economically. Semi-
6 structured interviews were conducted with store owners and FSC experts in
7 order to address three key objectives:

- 8 1. Analyse and depict the operations at zero-packaging grocery stores;
- 9 2. Illustrate the interactions among FSC actors and the influences they
10 have on each other;
- 11 3. Assess and evaluate the environmental and social impacts.

12 Whilst we acknowledge that economic impacts (e.g. employment opportunities,
13 revenue generation, and product pricing) are important, they have not been
14 explicitly included in this study. The rationale being that the store concept is
15 novel and any economic analysis at this stage could be misleading due to a lack
16 of long-term data.

17 The paper is structured as follows: Section 2 reviews the environmental and
18 social impacts of the FSC and contextualizes zero-packaging stores against
19 other alternative food retail concepts. The methodology is discussed in Section
20 3. Section 4 presents the results from the interviews with both the store owners
21 and experts. Section 5 offers a discussion of the findings while the last section
22 identifies the barriers and drivers for long-term success and scalability of zero-
23 packaging grocery stores.

24 **2 Framing environmental and social impacts of the food** 25 **industry**

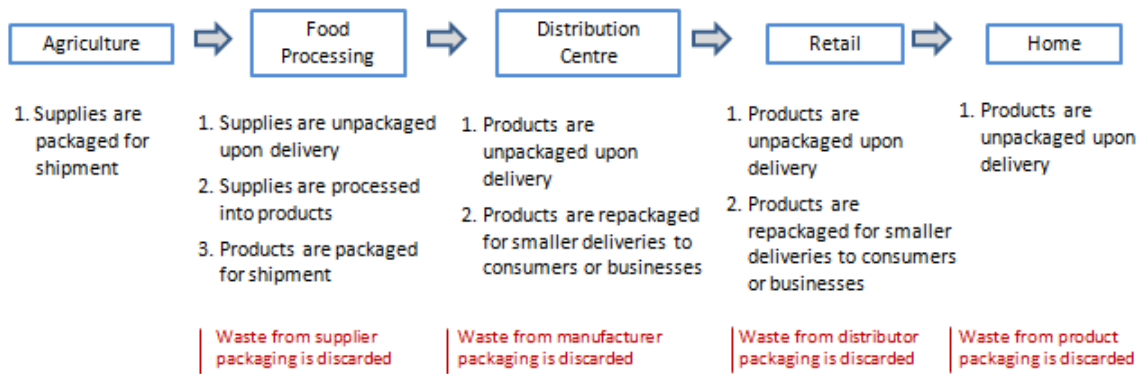
26 Environmental impacts focus on emissions, energy and water use, as well as
27 food and packaging waste. Social impacts include food safety, nutrition and
28 ethical trade. We recognise that describing a single exemplary market will
29 provide consistent understanding with regard to the magnitude of environmental

1 and social impacts of the respective FSC. As a result, we draw examples
2 primarily from the UK, a country of high quality data on food waste (Stenmarck
3 et al., 2016) and supplement this further with information from other comparable
4 markets where relevant. A discussion of the unique position of zero-packaging
5 stores in comparison to alternative food retail concepts like ethical, organic and
6 fair-trade concludes this section.

7 **2.1 Environmental impacts**

8 The food industry has changed significantly for both suppliers and consumers in
9 past decades. While in 1954 the product range in a grocery shop was 1,400
10 products, nowadays there are over 30,000 different products (Hayn et al., 2005;
11 J Sainsbury plc, 2016) and in some cases even up to 90,000 (Wood, 2015).
12 Large retailers are highly price-competitive, sourcing food globally and
13 managing their distribution through multi-tier structures. Consumers demand
14 fully stocked stores and a full product range irrespective of the season.
15 Opposing trends towards slow food and eating consciously versus consuming
16 more processed meals (DEFRA, 2006; Kuhn and Sternbeck, 2013) indicate
17 possible consumer trade-offs between the convenience of ready-made meals
18 and home cooking. Additional trends prevalent in Western economies are an
19 ageing population and smaller households, resulting in vastly different
20 consumption patterns. The proportion of single households is rising which
21 generate up to 45% more food waste per person than the average home.
22 Retailers offer products in smaller packaging, which might reduce food waste
23 but simultaneously increases the packaging per food unit (Akkerman et al.,
24 2010; Verghese et al., 2015).

25 A typical retail FSC including packaging practices is presented in Figure 1 with
26 packaging waste highlighted in red. It should be noted that the chain
27 configuration depends on the type of FSC. The FSC of local and unprocessed
28 food is usually less complex and shorter than FSCs of global and processed
29 food products (Smith, 2008).



1

2 **Figure 1 Main stages and packaging practices in the FSC**

3 Source: Adapted from Naik et al. (2010).

4 In 2011, the UK FSC consumed about 18% of total primary energy use,
 5 generating 115 MtCO₂e (around 21% of UK emissions, excluding emissions
 6 from non-fertiliser pre-farm production, packaging, food waste and land use
 7 change). Additionally net trade contributed 61 MtCO₂e (Defra, 2014a; Sneddon
 8 et al., 2015).

9 Agricultural production contributes between 47% and 61% of greenhouse gas
 10 (GHG) emissions related to the FSC (Vermeulen et al., 2012). Other agricultural
 11 impacts include biodiversity loss, degradation of fertile land and high water
 12 consumption (Baldwin, 2015). Studies suggest that certified organic production
 13 consumes 30% to 50% less energy due to reduced usage of fertilisers and
 14 pesticides. However, this advantage may not be valid per unit of output due to a
 15 lower productivity in comparison to intensive production (Garnett et al., 2003).

16 Food processing can be held accountable for high energy consumption, water
 17 use and waste generation, driven by an increasing demand for processed and
 18 packaged food (Baldwin, 2015; Canning et al., 2010). A life cycle assessment
 19 comparison of ready-made and home-made meals reports latter to be more
 20 environmentally responsible because of fewer manufacturing stages, less
 21 waste, and a decrease in cold storage (Schmidt Rivera et al., 2014).

22 Food transport along the supply chain creates emissions, congestions and air
 23 pollution, which contributes to a range of health problems (Baldwin, 2015;
 24 Yakovleva, 2007). Refrigeration during transportation results in consumption of

1 further energy and chemical refrigerants, causing up to 40% of overall
2 transportation emissions. Transporting frozen food is about 1.7 times more
3 energy-intensive than transporting food at ambient temperature (James and
4 James, 2010). There are two key issues regarding transport. Firstly, shorter
5 transport distances may have fewer impacts, but entire product life cycles need
6 to be considered when assessing impacts. Although generalisations should be
7 made with caution, seasonal and native foods usually have lower carbon foot
8 prints (Akkerman et al., 2010; Saunders and Barber, 2008; Sim et al., 2007;
9 Weber and Matthews, 2008; Wilson, 2007). However, energy intensive
10 production in greenhouses or refrigerated storage is likely to balance out the
11 benefits of short distances. Secondly, the efficiency of the material and product
12 flow is essential (Azevedo et al., 2011). In the UK, around 23% of vehicles in
13 FSCs drive empty (Garnett et al., 2003) whilst more frequent deliveries with
14 smaller quantities lead to higher emissions. Hence, instead of focusing on food
15 miles, it is suggested that product assessment should look at “*the carbon*
16 *emission per unit of produce over the transport chain*” (Coley et al., 2009, p.
17 154). Using this approach, it is clear that the last mile, i.e. the shopping trip of
18 the consumer, causes high emissions per product (Gevaers et al., 2014;
19 Seebauer et al., 2015). While many large companies already manage their fleet
20 via decision support and information systems (Akkerman, et al., 2010),
21 increasing the sustainability of supply chain logistics remains an on-going
22 research area of international efforts². Food retail does not contribute
23 significantly to the overall energy use of the food industry, but nevertheless has
24 potential to reduce its environmental impacts by recovering heat and using
25 renewable energy systems in refrigeration (Tassou, 2014).

26 Emitting 18 MtCO₂e yearly, UK households including catering facilities are the
27 second biggest contributors to the GHG emissions of the food industry (Defra,
28 2014a). Recognising the role of dietary habits and lifestyle choices, including
29 increasing demand for meat products and convenience food, some scholars

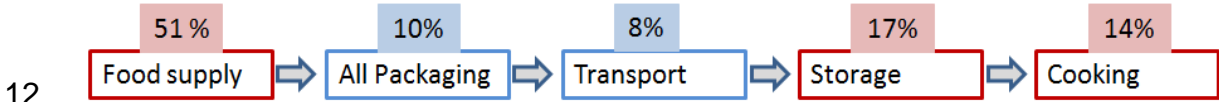
² Among this, Step Change in Agri-food Logistics Ecosystems (SCALE) project aims to establish different tools and frameworks to increase efficiency and sustainability of supply chain logistics.

1 argue that a change in diet would be the most sustainable solution (Garnett,
2 2011). On the other hand, households are also the principal contributor of food
3 waste (7.2 Mt, accounting for 46% of total food waste), followed by
4 manufacturing (26%), whereas grocery retail and wholesale generate only 2.9%
5 food waste (Defra, 2014b). Overall, 75% of the food waste, and hence
6 emissions related to food production, transportation, and processing could be
7 avoided (WRAP, 2015). For this reason, Rivera et al. (2014, p.308) claim that
8 food waste “*is the single most important factor for reducing the environmental*
9 *impacts of food*”. A study by WRAP (Waste and Resources Action Programme)
10 found that food not being used in time is the main reason for food waste
11 (Quested et al., 2013). In this context Verghese et al. (2015) state that
12 packaging helps to decrease food waste along the supply chain by reducing
13 damage in transport and handling as well as prolonging shelf life.

14 Packaging provides several functions: Protection, utility and communication in
15 physical, atmospheric and human environments. This includes containment to
16 avoid leakage and loss, safe and efficient transportation, as well as
17 convenience and attraction of consumers (Risch, 2009). While packaging
18 provides these functionalities, the global FSC also accounts for about 70% of
19 packaging waste (Emblem and Emblem, 2012). Furthermore, packaging is
20 responsible for 7% of the UK food-related GHG emissions (Garnett et al., 2003).
21 Plastic production uses approximately 8% of global oil production which is also
22 causing adverse environmental effects. One third of all food packaging is
23 produced for short time use only, even though it is unclear how many hundreds
24 of years plastic needs to fully degrade (Koelmans et al., 2014; Roy et al., 2009).
25 Jambeck et al. (2015) calculated that about 2-5% of the 275 Mt of plastic waste
26 generated in 192 coastal countries ended up as marine debris in 2010.
27 Increases in this plastic debris are of course correlated with the increasing
28 occurrence of single-use products and disposable packaging (Thompson et al.,
29 2009). As recycling only treats the symptoms and is rather costly due to the
30 separation and sorting of waste materials, prevention and re-use has the

1 highest priority in literature and legislation³ (Bartl, 2014; Emblem and Emblem,
2 2012). WRAP and major UK grocery organisations have agreed upon the
3 Courtauld Commitment, setting a voluntary target for the grocery sector to
4 reduce food, product and packaging waste by 1.1 Mt by 2015 which could
5 potentially save the industry and consumers £1.6 billion (DEFRA, 2013; WRAP,
6 2015).

7 The protection provided by food packaging serves an important function. Figure
8 2 shows the total energy inputs for a person's weekly consumption of food.
9 While packaging accounts for approximately 10% of the total energy input, it
10 ultimately protects the other 90% that could have gone to waste without
11 protective packaging (Verghese et al., 2015).



12 **Figure 2 Relative energy consumption for a person's weekly food intake**

13 Source: Adapted from Verghese et al. (2015)

15 2.2 Social impacts

16 Food production and consumption have several direct impacts on society. On
17 the supply side, cheap food prices in Europe may have negative impacts on the
18 livelihoods of small-scale producers in developing countries. Ethical trade
19 initiatives exist to counteract this issue (e.g. the UK Fairtrade Foundation),
20 ensuring fair prices for producers in developing countries (Baldwin, 2015). Yet,
21 small-scale farmers in developed countries also suffer from market powers of
22 large supermarkets⁴. For example, only four large retail companies make up
23 about three quarters of the UK market (Steedman and Falk, 2009). These large
24 market players use economies of scale to exert downward pressure on prices.

³ European directive 94/62/EC on packaging and packaging waste introduces minimum recovering (at 60%) and recycling (at 55%) targets to be achieved by 2008, which have been revised subsequently.

⁴ In the UK, as of January 2016, one of the large supermarkets is being investigated for deferral of payments to its suppliers, breaching the industry's code of conduct to protect grocery suppliers (<http://www.bbc.co.uk/news/business-35408064>).

1 As a result, energy-using machinery has in many cases substituted human
2 labour. Not only does this increase food-related energy use, but it also creates
3 further pressures on small-scale farmers all over the world as they cannot afford
4 investments in new technologies (Canning et al., 2010; Pimbert et al., 2006).
5 Whilst a lack of data does not allow the UK government (in particular
6 Department for Environment, Food and Rural Affairs, DEFRA) to identify
7 structural changes in the UK agribusiness (Langton, 2015), Germany has seen
8 a decrease in the number of farms of 20.6% between 1999 to 2007 while the
9 number of employees reduced by 12.9% (BMELV, 2010). Concentration of
10 market power at few major food corporations and retailers means they gain the
11 most profit in the FSC (Pimbert et al., 2006).

12 Concerns about food safety have also been increasing. In 2006, approximately
13 450 people died from foodborne illnesses in the UK (DEFRA, 2006). Food
14 safety can be increased by providing physical protection through packaging.
15 This prevents contamination while the protective atmosphere surrounding the
16 food inhibits bacteria growth (Davis, 2013). Food safety is furthermore impacted
17 by complex supply chains which make it difficult to trace individual product
18 inputs (Wognum et al., 2011). This lack of transparency is an important issue for
19 customers, 84% of whom mistrust the products they buy and are willing to pay
20 more for ethical and safe alternatives. They are concerned about the
21 correctness of certification (fair trade, eco, UTZ, rainforest alliance, etc.),
22 treatment of animals, conservation of natural resources and minimising pollution
23 and packaging (Co-op, 2004).

24 Another issue relevant to both policy makers and consumers is over- and
25 undernourishment. While over 1.5 billion people are either overweight or obese
26 globally, one billion are hungry and malnourished (Baldwin, 2015). Focusing on
27 the nutrition in developed countries, in the UK for example, 65% of men and
28 56% of women, equal to 24 million adults, are overweight or obese. An
29 unhealthy diet consists of high consumption of saturated fat, salt and sugar,
30 which are especially found in processed foods, and low intake of fruits and
31 vegetables. There are various obstacles to maintaining a well-balanced diet.

1 Even in Western societies many people live in poverty and cannot afford a
2 healthy diet. Food labelling and marketing is incomprehensive and misleading,
3 inhibiting truthful education and information transfer. A consumer survey
4 showed that the majority of Europeans find eating healthy challenging and 90%
5 of Britons would appreciate retailers to simplify a healthy diet (Mwatsama and
6 Stewart, 2005; Smith, 2008).

7 **2.3 Positioning of zero-packaging stores**

8 There are several well established alternative food retail concepts that aim to
9 address the aforementioned environmental and social impacts. In addition to
10 conventional supermarkets, these alternative retail concepts include organic
11 food, ethical sourcing and fair trade, regional sourcing, and also neighbourhood
12 or local stores. As mentioned, conventional supermarkets carry large product
13 assortments, e.g. potentially up to 90,000 stock keeping units (Wood, 2015),
14 and the associated distribution activities depend on food packaging in order to
15 facilitate trade and transport of food products (Risch, 2009). Organic food is
16 characterised by particular production standards, i.e. more natural methods of
17 growing and harvesting crops as well as avoidance of chemicals, and is
18 generally certified by a certification authority (ISTF, 2016). Ethical sourcing and
19 fair trade aim to embed improved environmental and social standards into
20 production and distribution and compensate the producers fairly (Raynolds,
21 2000). Regional sourcing is primarily concerned with established local food
22 supply chains, thereby reducing transportation requirements and supporting
23 local producers (Smith, 2008). Lastly, neighbourhood or local stores emphasise
24 proximity to the final customer and hence convenience. Proximity to the end-
25 customer may reduce the 'last mile', which is generally associated with a
26 significant environmental impact (Edwards et al., 2010).

27 A classification framework of these different food retail concepts is developed in
28 Table 1 which identifies the core attributes commonly connected to each of the
29 food retail concepts introduced. These attributes can be likened to the decisive
30 competitive criteria that a store concept exhibits, i.e. order winners. These
31 criteria can win customer orders against competitive offerings in the same

1 market (Hill and Hill, 2012). It needs to be emphasised that the connections
2 drawn here are indicative and cannot capture the unique characteristics of
3 individual stores. Actual stores may in fact exhibit the attributes from multiple
4 concepts and hence appeal to customers through multiple order winning
5 criteria. Nevertheless, it offers an insightful overview that captures essential
6 attributes of different store concepts.

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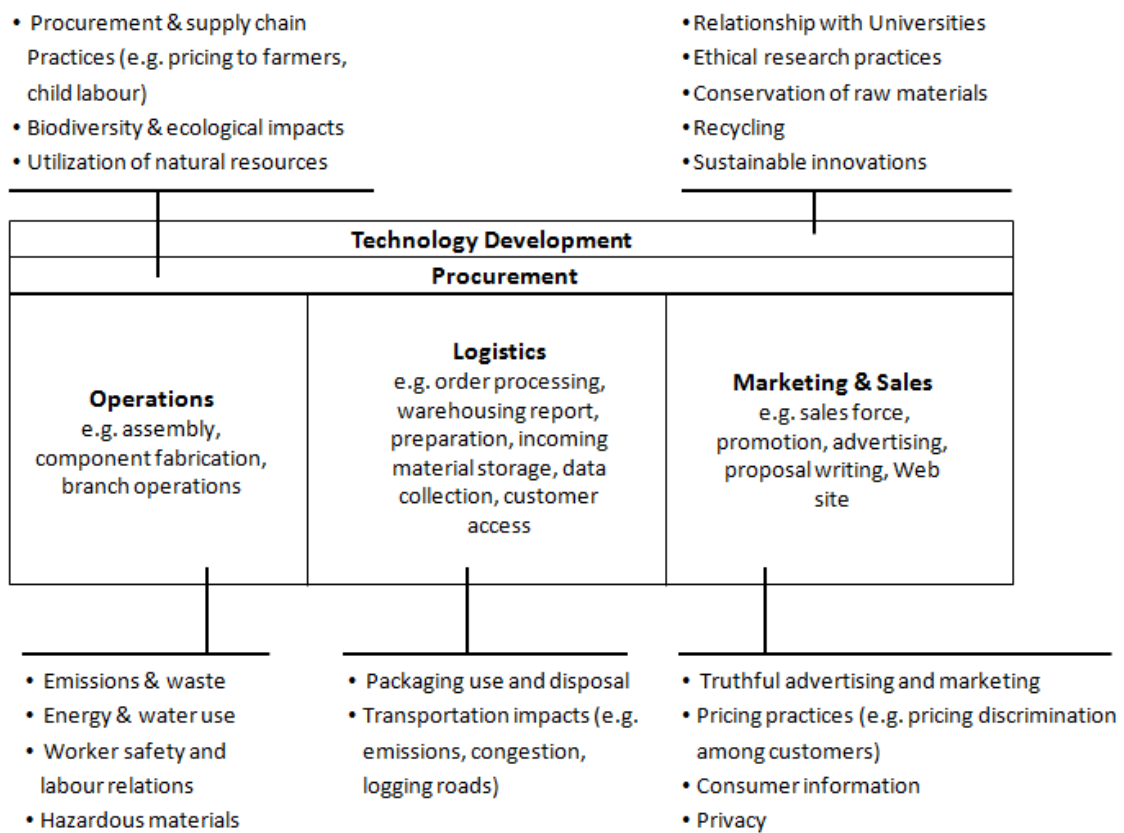
1 **Table 1 Indicative summary of core attributes of alternative food retail concepts**

Store Concept	Convenience	Ethical Sourcing	Environmental Protection	Health Benefits	Packaging Reduction	Product Selection	Transport Reduction
Conventional Supermarket	✓					✓	
Ethical / Fair Trade		✓					
Neighbourhood Stores	✓						✓
Organic food			✓	✓			
Regional Sourcing		✓					✓
Zero-packaging			✓		✓		

2 **3 Methodology**

3 Porter and Kramer (2006) and Wognum et al. (2011) argue that it is inefficient
 4 for businesses to deal with their business strategy and their economic and
 5 social performance separately. The integration of these impacts into their
 6 strategic long-term goals would unfold "*opportunity, innovation, and competitive*
 7 *advantage*" (Porter and Kramer, 2006, p. 1) which are the guiding principles of
 8 zero-packaging grocery stores. Hence, in analysing how zero-packaging
 9 grocery stores integrate their environmental and social performance into their
 10 business concept, we follow Porter and Kramer's (2006) strategic framework.
 11 Their strategic framework aims to enable businesses to identify their
 12 externalities, integrate them into their strategic long-term goals and quantify
 13 their benefits. They separate the business activities into primary (Inbound
 14 Logistics, Operations, Outbound Logistics, Marketing and Sales, and After-
 15 Sales Service) and support activities (procurement, technology development,
 16 human resource management and firm infrastructure). In this study, inbound
 17 and outbound logistics are combined due to the small scale of the stores under
 18 investigation. Furthermore, firm infrastructure and human resources can be
 19 regarded as less relevant at this stage. After-sales service in a conventional
 20 sense does also not apply and is not included in the study. Excluding these
 21 areas will not necessarily reduce the value of utilising the framework as Porter
 22 and Kramer (2006) recognise that companies cannot target each of these

1 areas. Instead they could select a few social initiatives such as customer
 2 information, truthful advertising, emissions and waste that benefit both society
 3 and their own competitiveness. In our analysis, we separate identified benefits
 4 into social and environmental categories as the former refers to favourable
 5 impacts on people whereas the latter to those on the planet. Using Porter and
 6 Kramer's (2006) value chain framework (Figure 3) we analyse through which
 7 processes zero-packaging stores provide social and environmental benefits
 8 whilst achieving gains for their business.



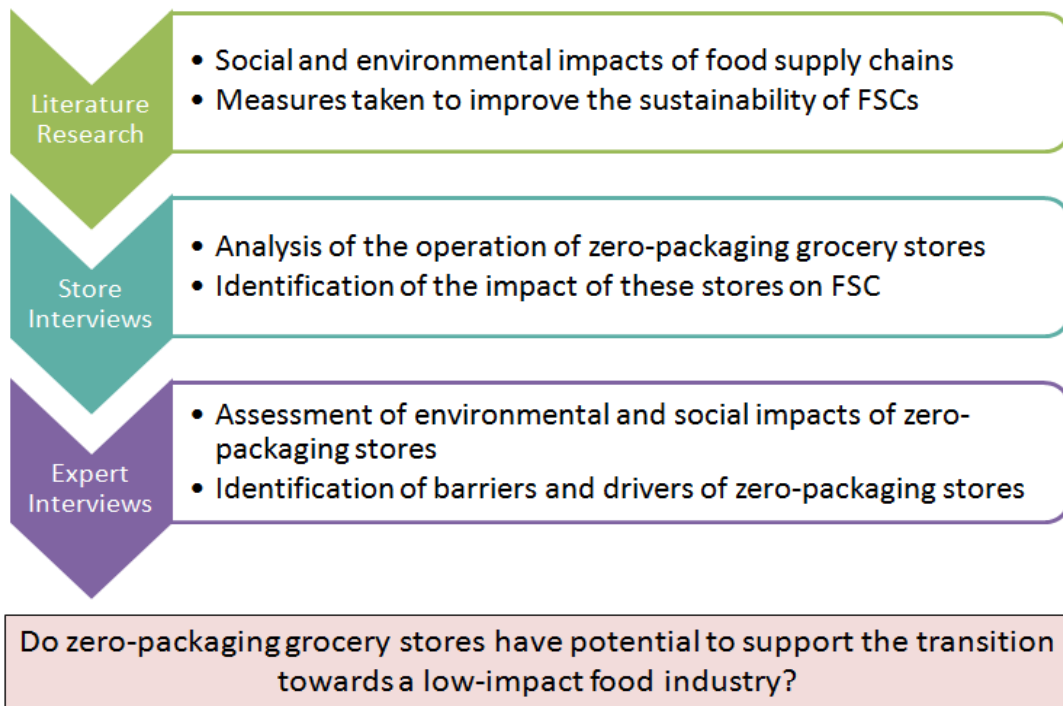
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10 **Figure 3 Social and environmental value maximising business concept of zero-**
 11 **packaging stores**

12 Source: Adapted from Porter and Kramer (2006)

13 The methodological approach followed is depicted in Figure 4. In order to
 14 identify zero-packaging grocery stores, a documentary analysis of websites,
 15 videos and newspaper articles was undertaken. In parallel, a literature review
 16 was targeted at understanding the environmental and social impacts of current
 17 FSCs and at identifying key research questions and knowledge gaps related to

1 a more sustainable food industry. Semi-structured interviews with store owners
2 and managers as well as domain experts were conducted in order to capture a
3 wide range of views whilst generating comparable results. Interviews with the
4 FSC experts were used to contextualise the findings of the store interviews and
5 identify the barriers and drivers that zero-packaging stores are facing.



7 **Figure 4 Methodology and key research question**

8 **3.1 Store interviews**

9 In order to identify zero-packaging stores operating in Europe and North
10 America, a web-based search in English and German was performed. As of
11 July 2015, 19 operating stores were found that are located in Europe and North
12 America. Seven are about to open and there are various stores with
13 departments that offer unpackaged products. It should be acknowledged that a
14 number of unknown cases are likely since many stores may not have a web
15 presence or were not found due to language barriers. A detailed list of the
16 identified stores is provided in Appendix A. While one store dates back to 1885,
17 the rapid emergence of the stores started in 2014. One reason for the recent
18 development is that these stores use crowdfunding to raise initial financial

1 capital. Hence, the concept received worldwide attention and motivated people
2 to open their own store. Due to their innovative business models, two stores
3 that had not yet opened were also included in the study. Altogether, 21 stores
4 were asked to participate in the research in a personalized email request,
5 including a short information sheet and the questionnaire. Seven stores, located
6 across Germany, Austria and Italy, agreed, yielding a participation rate of
7 33.34%. Six respondents are store owners, while one respondent belongs to
8 the store management team. Several stores cited lack of time as a reason for
9 non-participation. Four phone interviews were conducted, while three stores
10 preferred to complete the questionnaire in written form. It has to be considered
11 that qualitative research is generally not about representativeness but rather
12 aims to “*generalize from and about cases across a range of cases*”
13 (Sandelowski and Barroso, 2007, p. 5). The interviews were guided via a
14 questionnaire framework, but additional, non-predefined questions were raised
15 for clarification and more in-depth information. The interviews were recorded,
16 translated to English (if necessary), and transcribed. It was furthermore checked
17 whether questions were neutral and that the interviewer did not influence
18 answers through implied opinions or judgements. As the majority of the
19 interviews were performed over the phone, non-verbal behaviour could not be
20 observed (Robson, 2002). The interviews were analysed using thematic coding
21 as explained in Rubin and Rubin (2005). There was one main analyst and
22 results were double checked with two more researchers. In the results, the store
23 respondents will not be further classified as it could compromise their
24 anonymity.

25 **3.2 Expert interviews**

26 An expert was defined as someone who has been working in the food industry
27 or conducting research about food sustainability or FSC management for at
28 least seven years. The experts were identified through relevant literature, web
29 based search and snowballing method. 22 experts were contacted with a
30 personalized email request, including a short information sheet and the
31 questionnaire. Six experts agreed to participate in the research. They have 7 to

1 23 years of experience in research and/ or the food industry (Table 2). The
 2 interviews took between 45 and 60 minutes. One interview was shortened to 15
 3 minutes because of time constraints. The interviews were analysed with the
 4 same method as those with store owners.

5

6 **Table 2 Key characteristics of experts**

Field of Research	Years of Experience		
	5-9	10-19	20+
Collaborative and sustainable supply chain management	✓		
Agri-food supply chain management Work experience in the food industry			✓
Optimisation of supply chain management		✓	
Supply chain management Food supply chain management*			✓
Food supply chain management	✓		
Food Science and Supply Chain Management		✓	

7 *10 years of experience was reported in food supply chain management

8 **4 Results**

9 In order to analyse the zero-packaging stores' business concepts and their
 10 social and environmental impacts holistically, we present our findings using
 11 Porter and Kramer (2006)'s framework. Findings from the store interviews are
 12 followed by those from the domain experts.

13 **4.1 Store interviews**

14 **4.1.1 Operations**

15 The seven stores that were interviewed for this study offer products free from
 16 disposable packaging: dry products (wheat, pasta, rice, lentils, etc.) in bulk bins;
 17 yoghurt, milk or jam in reusable glass jars or bottles and some also offer soap,
 18 shampoo, etc. Except for two stores, all offer fruits and vegetables. Some stores
 19 offer cheese, meat and fish at a refrigerated counter by trained staff, which is
 20 too expensive for other stores. Others are located next to a butcher or cheese

1 shop. The customers bring and weigh their containers and pay for their
2 purchase based on its weight. Generally, store owners mentioned that in-store
3 operations are more time-consuming and ideally customers need to plan ahead
4 and provide the different containers they will need for their purchase. However,
5 store respondent (SR) 1 argued that this is not necessarily a weakness but
6 rather a strength of the store concept as it increases the appreciation for the
7 food.

8 Product variety is considerably smaller than in conventional supermarkets,
9 ranging from 300 to 1500 products. They offer some convenience products
10 such as jam, pasta, sweets and sauces, but generally do not sell processed or
11 frozen food. Overall, they want to *“correspond to the day-to-day needs of the*
12 *customers”* and claim that *“the combination (of different produce in the meals) is*
13 *the diversity”* rather than the mere number of products stacked in the shelves
14 (SR 1 and 4). SR 6 highlighted the importance of offering products that are
15 consumed frequently to avoid food waste.

16 Five stores claimed to offer a very different shopping experience compared to
17 conventional food stores: less stressful, better consultation and customers see
18 and try the product. They *“want to prioritise the human again”* (SR 2). Three
19 stores also have a small coffee or a snack counter in the store.

20 One store offers exclusive nutrition counselling, cooking workshops and ‘recipe
21 boxes’, containing assembled raw materials for further preparation at home.
22 The owner emphasised that by buying the recipe boxes, the customers would
23 notice how big a portion actually is.

24 Another core characteristic of the stores highlighted by all correspondents is the
25 small amount of food waste they produce, which is often included in their
26 business pillars. The stores either i) donate perishing foods ii) process unsold
27 food and sell their products for example in a counter lunch, café or catering, or
28 iii) process it for personal use:

29 *“Ultimately, we are deciding which products are used in the counter lunch as*
30 *well as in the recipe boxes. That is why we are able to steer the product*

1 *demand, even if products are not purchased by customers. This is another*
2 *aspect, where unpackaged is a benefit. We are able to use the food products*
3 *from our supermarket. Our model is a building block system. Large*
4 *supermarkets cannot or are not allowed to do that” (SR 4).*

5 Furthermore, people are more likely to buy only the amounts they need which,
6 according to the store owners, reduces food waste at the consumer-end. SR 4
7 also suggests that fewer customers buy goods ahead of time nowadays. The
8 stores with gastronomy stated that they generate little food waste. Their focus is
9 on preventing the disposal of food due to reaching their best-before date, even
10 though they are still edible.

11 Regarding food safety, all stores follow the hygiene regulations applicable. Meat
12 and cheese require refrigeration and only some stores are thus able to offer
13 them. Several stores mentioned that they work closely with hygiene regulation
14 offices. Furthermore, they generally have to pay closer attention to the condition
15 of products on offer. Most of the stores also remind customers on their websites
16 to clean their containers in order to prevent contamination.

17 **4.1.2 Logistics**

18 For most zero-packaging stores, products are delivered by different suppliers
19 and they do not manage the inbound logistics. Only one store is planning to pick
20 up some of the fresh products from small and medium size suppliers with their
21 electric vehicle. Several stores are designed as a franchising concept, yet only
22 one had already established multiple stores. Managing a central and a local
23 warehouse for their distribution, they do not focus on regional products. Four
24 other stores offer delivery services, which are mainly run by bicycles, electric
25 bicycles and electric cars.

26 The main difference from the conventional grocery stores is the prevention of
27 packaging waste at the consumer-end. Packaging waste will be discussed in
28 detail in the section on Procurement (4.1.4). Overall, disposable packaging is
29 limited to paper bags which are available in most of the stores for customers not
30 bringing their own containers. One store uses stronger paper bags which can

1 be reused 10 to 20 times. Regarding packaging waste, the stores mainly
2 generate paper and carton waste and some plastic foil. The focus is on
3 reusable containers to avoid resources and emissions for the production,
4 recycling and disposal of the packaging material. In case of suppliers that do
5 not reuse containers, several store operators reuse them internally or
6 endeavour to find alternative use.

7 Only one store had already collected data about their packaging savings, but
8 most stores are planning to do so in the future: *“In one year, the elimination of*
9 *the packages on the sales of wine and detergent brings an overall saving of*
10 *resources equal to 104 290 kWh of energy, 34 tonnes of CO₂ emission in the*
11 *atmosphere and more than 9.8 million litres of water that were not used for the*
12 *production and disposal of packaging in excess” (SR 5).*

13 **4.1.3 Marketing and sales**

14 Another key difference to conventional supermarkets is that none of the
15 interviewed zero-packaging stores offer different brands of the same product as
16 *“Products have to be protagonists. There are no labels and no brands” (SR 5).*
17 SR 4 expressed that *“today’s grocery shopping is just not contemporary*
18 *anymore. It does not respond to the individual needs of the customer. No*
19 *packaging helps to respond to their needs by reducing the ‘food confusion’*
20 *caused by brands, packaging, product information and false advertising.”*

21 One store explicitly said that their advertisement is honest compared to
22 conventional stores. Store 7 advises their customers to wisely choose the
23 portion size and rather come back for more. Jointly with their suppliers, they
24 organise events like lectures on sustainability and cooking workshops to
25 increase customer awareness. Being consistent with their priority to be
26 transparent, they provide information about their suppliers. One store plans to
27 reveal how much the producer eventually receives of the product price.

28 Two stores aim to inform their customers about the emissions they have saved
29 by renouncing disposable packaging via an application run on mobile devices or

1 a sustainability index on their website. By offering these services they claim to
2 increase the environmental awareness of their consumers.

3 The price difference to conventional supermarkets varies. Some stores
4 mentioned a price reduction of up to 12€/kg due to buying the products in big
5 bags. The producer saves packaging and marketing costs. Therefore, most of
6 them can sell their products cheaper than organic supermarkets. Yet, this was
7 contradicted by one store who said that they could not observe a great price
8 difference to packaged products. Yet, another store which does not focus on
9 regional products said consumers could save between 30-70% on average
10 compared to buying an equivalent packaged product. By purchasing only the
11 amounts needed, customers are flexible and can buy a greater variety of
12 products with the same or lower expenditure. Different stores embrace their
13 social goals by i) helping people to maintain a healthy diet at a reasonable cost,
14 ii) making organic products accessible to a wide range of consumer groups, and
15 iii) trying to offer products for every class of society. Therefore, one store offers
16 basic products at competitive prices, made possible by the direct transfer of
17 material and transportation cost savings onto the product price. Remaining
18 products are more expensive and consist of delicacies, such as self-developed
19 baking goods. When asked about the price comparison, one SR argued that
20 avoided environmental costs should be considered as well.

21 **4.1.4 Procurement**

22 Different criteria dominate the supplier selection on packaging, organic
23 production, regional origin and fair-trade.

24 Zero-packaging stores save disposable packaging at the consumer end, but
25 three of the stores stated that due to their small purchasing power, they do not
26 have an impact on packaging practices of the suppliers. They receive their
27 products in big bundles and bags (e.g. 25kg for rice or 1kg for spices). The
28 majority has a mixture of reusable and recyclable waste (cardboard, paper) and
29 some a minimum amount of disposable plastic foil, which is wrapped around the
30 pallets due to transportation regulation, or plastic bags for products such as
31 chocolate and nuts. Still, most SRs claim that having a little disposable

1 packaging waste from the suppliers does not balance out the immense
2 disposable waste savings at the consumer end. Yet, one SR is adamant not to
3 accept any products delivered in disposable packaging:

4 *“Every time they get the feeling that it [the negotiation] is getting strenuous or*
5 *that the supplier does not want to change their logistics, they should leave. [...]*
6 *And they [the suppliers] return on their own or they are just not the right supplier*
7 *for you. I rather renounce a product, before it is getting strenuous” (SR 1).*

8 While two respondents acknowledged that many suppliers are actually already
9 working with reusable packaging, others highlighted this as a barrier as there
10 are not many suppliers that can deliver the products in big bags. Especially
11 organic products are not available in big bundles. Therefore, the range and
12 quantity of suppliers depends on the region and the criteria stores impose upon
13 the suppliers, e.g. no plastic packaging, being in direct vicinity, using fair trade
14 products or organic production methods.

15 Two of the interviewed stores offer only organic products while the other five
16 also provide non-organic ones. The former group think organic products to be
17 ecologically valuable and healthier for both the consumers and the farmers.
18 Stores in Germany and Austria in particular emphasise organic products.

19 In general, the stores procure from smaller and medium farms directly as they
20 are not only more likely to change their packaging practices but will also help to
21 keep the transport distances as short as possible. Using regional products is a
22 priority for five stores with one store procuring products only within a 100km
23 radius:

24 *“We would like to offer an extensive vegetable and fruit assortment all year*
25 *long. But this is, for us and our philosophy, in no relation to the distances and*
26 *the effort that would have to be undertaken to offer it. This is why we decided to*
27 *offer seasonal fresh produce. Then, you cannot compete with the big*
28 *supermarket chains, but in return we are honest” (SR 2).*

29 Despite the aim to procure from the closest suppliers possible, in practice many
30 stores cannot completely adhere to this criterion as they do want to offer

1 specific products such as bananas (if offered, mainly organic and fair-trade) or
2 tomatoes during winter season.

3 **4.1.5 Technology development**

4 Removing packaging requires innovative ways of weighing and paying for
5 goods. One of the interviewed stores invented a paper made from used material
6 to wrap fish and meat. Another store developed a new, more convenient scale,
7 with the weight and size of the containers already programmed into. Thus,
8 customers only select the type of container being used and weigh it including
9 the product. The purchase is saved on a card and customers only need to show
10 the card during payment. The interviewed store also invented a beverage refill-
11 system with stainless steel containers that can be filled without contaminating
12 the content with oxygen, which could lead to shorter shelf lives and generate
13 food waste. Additionally, they designed plastic-free bulk bins that they also sell
14 to other stores.

15 **4.2 Expert Interviews**

16 Regarding the environmental impacts of the FSC, one expert acknowledged
17 that even though packaging is not the biggest emitter, it "*is the easiest element*
18 *that we can work on. Because you need to grow food, those emissions are*
19 *unavoidable*" (Expert 12). The experts described that large retailers decide upon
20 the packaging design to optimize promotion and distribution. Marketing can
21 cause more material use than actually necessary for protecting the food. Expert
22 12 suggests that conventional stores are externalising their problems since
23 customers have to dispose of packaging and pay a council tax for waste
24 management. Moreover, suppliers have to comply with standardized packaging
25 guidelines of conventional supermarkets, limiting process innovation.

26 **4.2.1 Operations**

27 Several experts reflected on inconveniences zero-packaging grocery stores
28 place on their customers. This inconvenience stems from a more time-
29 consuming shopping experience, limited product range and that containers
30 would have to be carried around all day if people wanted to shop after work.

1 The experts identified further risks that can arise from shopping practices in
2 these stores. Customers not cleaning their containers properly and cross-
3 contamination were mentioned as potential food safety risks. However, these
4 could be prevented by educating people. Considering the store management,
5 an expert concluded that there are no concerns that could not be solved with
6 technology development.

7 **4.2.2 Logistics**

8 Supply chain experts emphasized that the efficiency of distribution does
9 generally not depend on the size of the store but rather on the logistics system.
10 Hence, different packaging design or less packaging would influence
11 transportation and distribution related emissions. Less packaging would make
12 the transport lighter and enable the distributors to ship more products, reducing
13 overall energy consumption per unit. However, the missing protective function
14 of packaging during transport and distribution needs to be addressed.

15 **4.2.3 Marketing and sales**

16 Various experts view the stores' claim to reduce food waste at demand side to
17 be very profound in particular. This is because they do not tempt customers to
18 consume more than required with promotional activities used by conventional
19 supermarkets such as "buy 1, get 1 free" or larger family-packages.
20 Nonetheless, the experts cautioned against other potential sources of food
21 waste: Firstly, fruits usually perish earlier if they are not packaged and are
22 exposed to other perishing fruits. Secondly, consumers are used to products
23 with a long shelf life. Consumers would have to adapt accordingly as they will
24 otherwise generate more food waste.

25 While three experts did not see a direct influence of zero-packaging grocery
26 stores on the diets of the costumers, two experts identified positive impacts.
27 They highlighted the substitution of processed foods with self-cooked meals, the
28 different shopping experience, marketing and engagement with the food:

29 *"If they sell the right foods and people know how to cook, there are enough*
30 *products there to be able to provide good and healthy meals. Probably we*

1 *would avoid obesity and problems like that. [...] And I think [...] they won't be*
2 *influenced by the offers, the pressure and the end-of-peer promotions, etc., they*
3 *won't take home food they don't need."* (Expert 11).

4 **4.2.4 Procurement**

5 The '*dysfunctionality of the supply chain*' (Expert 13) where retail practices
6 generate food waste on the supply side was explained via an anecdote by
7 Expert 11: a befriended farmer has to plough back in 40% of their produced
8 leeks because they did not comply with the packaging guidelines set by the
9 retailers. Further, the farmer was also not allowed to sell it to other
10 supermarkets. In addition to avoiding potential food waste due to such
11 packaging guidelines, procurement of products from small farmers offers further
12 social and environmental benefits, such as independence from large retailers,
13 secured supply, and shorter delivery routes. Stronger ties with local/ regional
14 suppliers could possibly diversify the local agricultural production in some areas
15 and thus counteract habitation and biodiversity loss. Further, the retail market
16 would be more diversified and market power more distributed among the
17 players.

18 **4.3 Contextualising social and environmental impacts of zero-** 19 **packaging stores**

20 Expert 14, also working on climate change, explained three key considerations
21 for a sustainable food system: climate adapted production of food, reduction of
22 food waste along the supply chain and shifting towards a low-emitting
23 consumption. As the zero-packaging stores positively impact the two latter
24 areas, they could potentially have a significant impact if they were able to reach
25 scale. This would principally depend on product prices, followed by convenience
26 and thirdly environmental benefits. This expert argued that the majority of
27 consumers are not willing to pay more for a less convenient shopping
28 experience because of an improved environmental performance. On the other
29 hand, experts also noted that people are becoming more environmentally aware
30 and that there is a consumer niche that prioritises environmental performance.

1 Yet, reaching scale could also lead to new barriers as “*supermarkets would fight*
2 *back and possibly try to persuade governments that there are food safety and*
3 *technological reasons not to allow it*” (Expert 11). However, Expert 14
4 emphasised that the expansion of small stores is not going to be sufficient and
5 that large retailers need to adapt zero-packaging practices as well. As this
6 system fundamentally changes consumer-brand relationships and operations of
7 large retailers, government incentives and regulations are needed to convince
8 large retailers. For example, since May 2015 France forces retailers to donate
9 or process unsold food (N24, 2015). Also, UK supermarkets reported significant
10 reductions in plastic bag usage since the introduction of a 5 pence charge for all
11 single-use plastic bags in October 2015 (The Guardian, 2015).

12 Overall, experts have highlighted many positive outcomes these stores stand to
13 provide by offering products without packaging, enabling consumers to control
14 product portions and focusing on healthier nutrition. Yet, the scope and
15 significance of these benefits would depend on them being distributed more
16 widely.

17 Table 2 presents a detailed overview of the environmental and social impacts of
18 zero-packaging stores, as articulated by the experts and store respondents,
19 reflecting on the performance of the food industry regarding emissions, energy
20 and water use, packaging and food waste, nutrition, ethical trade, food safety
21 and consumer convenience.

22

23

Table 3 Impact of zero-packaging grocery stores on environmental and social performance of food industry based on expert interviews (Green Arrow = positive impact, Red Arrow = negative impact, ↓↑ = inconclusive / positive and negative impacts)

	Emissions	Electricity	Water	Packaging Waste	Food Waste	Healthy Nutrition	Ethical Trade	Food Safety	Customer Convenience	Notes
OPERATIONS										
No disposable packaging	↓	↓	↓	↓	↓	-	-	↓	↓↑	Customers see and try the product / Portion control / Time-intensive / Higher risks for food contamination
No processed or frozen food	↓	↓	↓	↓	-	↑	-	↑	↓↑	Cooking skills required / Shorter FSC / Less refrigeration needed / Lifestyle change needed
300-1500 Products	↓	↓	-	-	-	↑	-	-	↓↑	Smaller stores -> less emissions / inconvenient
Perishing foods are donated or processed into meals	↓	↓	↓	-	↓	-	-	-	↑	Stores with catering steer product demand / Portion control might reduce food waste in households
Trained Staff	-	-	-	-	↓	↑	-	↑	↑	Increased customer knowledge about nutrition, balanced diets and handling of food
LOGISTICS										
No Warehouses	↓	↓	-	↓	-	-	-	-	-	Only one store-chain has warehouses
Delivery Service by Bike or E-Vehicles	↓	↓	-	-	-	-	-	-	-	Reduces fossil fuel consumption
5 stores focus on regionality	↓↑	↓↑	-	↓	-	-	↑	↑	-	Shorter Distances / non-seasonal foods need refrigerated storage or energy-intensive greenhouse production
Transport of big bags or reusable containers	↓	↓	↓	↓	-	-	-	-	-	Prevention of packaging waste at end-consumer and partly - fully at retail-level / Could increase truck load but reusable containers might weigh more
MARKETING AND SALES										
No brands	-	-	-	-	-	↑	↑	↓	↓↑	No misleading marketing / No promotion of more consumption / No information about cooking or storage
Honesty and Transparency	-	-	-	-	-	-	↑	↑	↑	Increases trust of customers / Facilitates food safety

Price Comparison	-	-	-	-	-	↑	-	-	↑	Same/Cheaper than organic or conventional stores (30-70%)
Information on Websites and Events with Suppliers	-	-	-	-	-	↑	↑	↑	↑	Increases trust and knowledge of customers
PROCUREMENT										
In Big Bags or Reusable Containers	↓	↓	↓	↓	-	-	-	-	-	Reduces long-term material use and emission of production / No packaging or product standards for farmers and suppliers
2 fully and 5 partly organic stores	↓	↓	↓	-	-	-	-	-	-	(Arguably) decreases environmental impacts of agricultural production
1 fully and 4 partly regional stores	↓	↓	↓	↓	-	-	↑	-	-	Support of local small farmers / Possible agricultural diversification/ Shorter FSC

1 **5 Discussion**

2 This study aimed to analyse the operation of zero-packaging grocery stores;
3 find out their interactions with FSC actors and influences they have on them;
4 and ultimately assess their environmental and social impacts. We extended
5 Porter and Kramer's (2006) value chain framework in order to identify
6 processes through which social and environmental benefits emerge. The study
7 considered the operation, logistics, marketing and sales as well as procurement
8 functions of zero-packaging stores in order to assess their social and
9 environmental performance in comparison to conventional supermarkets.
10 Following a discussion of their performance to reduce food and packaging
11 waste, resource use and increase social benefits, we analyse their unique
12 characteristics compared to more established food retail concepts such as
13 ethical and organic food. Then we identify alternative pathways through which
14 zero-packaging could become more mainstream and thus drive more
15 sustainable consumption and production patterns. While we recognise the
16 importance of regional contexts in shaping the emergence and success of
17 potential pathways, the broad similarities in impacts of FSCs in different
18 markets (see e.g. Stenmarck et al., 2016) give confidence that the conclusions
19 drawn here are applicable across a wide range of international contexts.

20

21 **5.1 Food and packaging waste**

22 Their most obvious positive environmental impact is the material and emissions
23 savings through renouncing disposable packaging – not only at consumer and
24 retail end, but also by influencing the packaging practices of suppliers. Yet,
25 packaging does not significantly contribute to the greenhouse gas emissions of
26 the food industry (Garnett et al., 2003). Moreover, Verghese et al. (2015) claim
27 packaging saves considerable emissions due to the prevention of food waste,
28 which is the most effective measure for minimising the environmental impact of
29 the food industry (Schmidt Rivera et al., 2014). Although not all the products

1 available in conventional supermarkets can be offered without packaging or
2 reusable packaging, some zero-packaging stores offer up to 1500 products. On
3 the one hand, unpackaged fruits and vegetables might perish faster. On the
4 other hand, zero-packaging stores enable consumers to control the product
5 amount they buy, whilst also being less restrictive on size or form standards for
6 fruits and vegetables that farmers usually have to comply with. Hence, some
7 experts suggest that packaging standards might even lead to more food waste
8 than no packaging; thus, contradicting the argument that packaging is
9 preventing food waste. Furthermore, some of the interviewed stores are able to
10 avoid food waste by processing and serving unsold food at integrated snack
11 counters or catering services. This not only allows them to offer a greater
12 variety of products that are not consumed regularly but also extends the
13 potential reduction of food waste from consumer end to include retailer and
14 suppliers. In summary, comparing the pros and cons of zero-packaging stores
15 becomes rather complex and hence demands further investigation.

16 **5.2 Resource use and emissions**

17 Selling of fresh, limited refrigerated, less processed and more seasonal food
18 should lead to a significant reduction in energy and water consumption and
19 emissions, not only in the retail stores but also along the FSC as many of the
20 manufacturing processes are excluded. While Schmidt Rivera et al. (2014)
21 suggest home-made meals consume less energy and resources, differences in
22 cooking practices and lifestyle choices (e.g. cooking vs roasting) make the
23 calculation of energy needed for home cooking rather difficult. Products from
24 small-scale producers possibly have higher emissions than products from large
25 producers due to economies of scale, potentially reducing the benefits of these
26 stores. On the other hand seasonal products might balance out this effect.
27 Despite seasonal food potentially causing lower emissions, consumers are
28 accustomed to products being available all year round. Geographical
29 differences in climate and soil types/quality mean that the products zero-
30 packaging stores can offer become limited if they opted to offer only seasonal
31 and regional products. The majority of interviewed stores understand that

1 regional products are only environmentally beneficial if they are not produced in
2 greenhouses or require excessive refrigerated storage.

3 Another factor impacting emissions is the efficiency of logistics. On the one
4 hand emissions might decrease, if less packaging results in increased
5 truckloads but could also increase due to heavier reusable containers and
6 increased backhaul transportation. Additionally, any adverse effects of missing
7 product protection, e.g. damages and food waste, need to be considered.
8 Regional products lead to shorter distances from the supplier to the store.
9 Besides lower emissions, a short supply chain enables easier and faster
10 communication and quicker response times to fluctuating demand (Reiner and
11 Trcka, 2004). However, it should be considered that the procurement at
12 suppliers was not explicitly investigated here. Hence, supply chains might
13 actually be longer than articulated by SRs and there was no data with regard to
14 the frequency of deliveries.

15 **5.3 Social impacts**

16 Zero-packaging stores return power to consumers by offering better portion
17 control and to suppliers by presenting an alternative to their conventional
18 consolidated buyers. Portion control is not only an environmental but also a
19 social benefit, as it reduces costs and avoids overconsumption. While
20 conventional supermarkets may also offer smaller portions, they simultaneously
21 introduce more packaging and charge a higher unit price. Monkhouse and Dibb
22 (2011, p. 22) argue that people need to be enabled to “*do the right thing more*
23 *easily*”. If people are trying to renounce plastic in their lives, zero-packaging
24 stores will indeed simplify the process and provide an alternative and empower
25 people to have a more sustainable and healthy lifestyle.

26 Another customer benefit is the improved customer service in stores and
27 transparency about their suppliers, which could improve consumers’
28 understanding of FSCs. Coupled with the provision of recipe boxes, these
29 stores aim to facilitate a healthy diet. A disadvantage of unpackaged food is the
30 lack of information regarding cooking, storage and ingredients which is usually
31 provided on the packaging. Customers need specific knowledge and cooking

1 skills in order to handle and prepare the food properly. Interestingly, neither
2 store owners nor experts identified missing ingredient information as a problem
3 for allergies. Compared to conventional stores, zero-packaging stores have a
4 greater need to focus on hygiene and prevent food contamination. However,
5 several bulk stores have been successfully operating for years and meeting
6 food safety standards does not seem to emerge as a particular challenge.

7 Some stores articulated that they are able to offer further benefits to consumers
8 via competitive prices, claiming to offer some of the products cheaper than
9 conventional stores. As the majority of the interviewed stores prefer organic
10 products, the prices are comparable or lower than in organic grocery stores.
11 Thus, they could make organic products available for people who usually
12 cannot afford organic products. Although studies assert that prices of
13 unpackaged products decrease due to lower material and marketing costs
14 (WRAP, 2007), not all interviewed stores observe this trend. These differences
15 might depend on the store size and the region. Additionally, only few suppliers
16 are suitable for zero-packaging stores at the moment. If the stores reached
17 scale and more suppliers would be able to offer bulk products, it could
18 potentially lead to further price competition.

19 **5.4 Distinction from existing sustainable store concepts**

20 Zero-packaging grocery stores follow a model that offers a radical change and
21 disruptive innovation. They operate at a scale close to a neighbourhood store
22 with a more limited product variety than found in conventional supermarkets. A
23 significant number of stores combine well-established, more sustainable retail
24 concepts such as organic and regional sourcing. In addition to supporting local
25 and small-scale farmers, some stores procure fair-trade products from
26 developing countries which are common practices for many supermarkets.
27 Even though they are far from presenting a homogenous set of practices, their
28 unique and common characteristic is the prevention of packaging waste at the
29 consumer end. Their conceptual and organisational business model sets a stark
30 contrast to efficiency-driven conventional supermarkets. By enabling consumers
31 to buy as much as they need without the allure of market offers and promotions

1 they prevent food waste and potential over-consumption whilst encouraging a
2 varied diet. Their flexibility to use unwanted products in food counters is another
3 practice that reduces potential food waste as reported by some of the stores.
4 They provide not only information and transparency but also allow consumers to
5 change their habits and simultaneously impact the operation of suppliers and
6 producers. Indeed, in their assessment of large retailers' initiatives to reduce
7 consumers' emissions, Morgan et al. (2015) report a lack of integration across
8 individual social material contexts in order to induce change in consumer
9 behaviour and practice. In this regard, zero-packaging stores integrate these
10 concepts across business activities by offering individual information supported
11 by a set of institutions along the supply chain. They stand to transform the
12 relation to and understanding of nutrition and offer quality food products for
13 moderate prices and with less environmental impact.

14 **5.5 Transformative market potential of zero-packaging concept**

15 As it stands, zero-packaging stores are a 'niche' concept. Our findings point to a
16 number of alternative pathways for zero-packaging to become more widely
17 adopted, i.e. opening more zero-packaging stores, online shopping and
18 adoption of this concept by conventional supermarkets. On the first pathway,
19 our analysis reveals the presence of two kinds of zero-packaging stores. The
20 smaller 'neighbourhood' stores which offer comparable (but not necessarily
21 lower) prices, portion control and an improved environmental conscience.
22 Whereas larger stores induce innovation, impact suppliers, offer a larger
23 product range, lower prices and are comparatively convenient. Stores in the
24 latter category are eager to develop digital tools to inform their customers of
25 emissions they save by renouncing packaging.

26 Given the expected preparedness of the consumer to bring their containers,
27 compared to making a momentarily shopping decision on the go, online
28 shopping (Anesbury et al., 2016; Moth, 2015) can contribute to their penetration
29 in the market. In such a system, reusable containers can be used as part of a
30 deposit-refund system which is shown to be effective in reducing emissions
31 (Simon et al., 2016). Two issues might be relevant for this pathway's success

1 though: Associated energy and water use to ensure the hygiene of containers
2 and the lack of one-to-one personal interaction to provide advice to consumer
3 on using products with shorter shelf lives.

4 Given large market shares of conventional supermarkets, a pathway that can be
5 more transformative is their adoption of zero-packaging concept as previously
6 done with organic food. In his analysis of organic food penetrating the
7 mainstream, Smith (2006) documents how the initial conception of organic
8 farms serving local communities with seasonal food became fragmented over
9 time. High compatibility of organic food with technologies, materials and
10 practices of conventional supermarkets, coupled with interests and positive
11 perceptions of multiple actors (such as soil associations, consumers, and
12 environmental organisations) drove conventional supermarkets to integrate
13 organic food into their product portfolios. Cost, availability and convenience
14 demands of conventional system have fragmented its ethos and resulted in
15 organically produced ingredients to be imported across the globe, processed
16 and packaged as with other (non-organic) goods. Yet, parallel to this, the more
17 complete organic vision continued its survival at niche level via farmer markets
18 or organic box scheme suppliers. Smith (2006) reveals that the higher the
19 degree of mainstream compatibility of a niche, the higher the chance of it being
20 adopted and integrated into standard routines and practices. The corollary is
21 that this compatibility blunts the transformative potential of niche. This example
22 can give us clues into which factors of the incumbent market regime are likely to
23 support or limit the niche development of the zero-packaging concept for
24 different business processes as articulated by Porter and Kramer (2006) (Table
25 4).
26

1 **Table 4. Comparing the adoption of organic food versus zero-packaging concept**
 2 **by conventional supermarkets**

	Adoption of organic food concept	Adoption of zero-packaging concept
Operations	Handling, processing and packaging practices were able to continue as before other than changing the source of the ingredients.	Operations in conventional supermarkets are largely dependent on packaging. Hence, substantial changes are required.
Procurement	Suppliers are assessed by certification bodies.	Zero-packaging needs to be ensured throughout the supply chain. Appropriate certification schemes are currently non-existent.
Logistics	Compatible since packaging is similar to non-organic food.	Particular challenges for product protection and logistics activities such as transport and sorting. Changes may be required.
Marketing and sales	Higher costs but clear environmental and social benefits as articulated by a multitude of actors. Shorter lifetime of products as additives and preservatives are not included. No changes in the way consumers buy or use the products.	Might need staff in order to provide consumer advice and engagement.

3

4 Our analysis reveals a larger number of practices and routines of conventional
 5 retailers that are more of a limiting than supporting nature compared to the
 6 adoption of organic food. We identify in particular three issues that might
 7 significantly impede this concept penetrating the mainstream. Shopping,
 8 cooking and consuming non-packaged food requires consumers to get used to
 9 products with shorter shelf lives and no use-by-date reminders. The second
 10 issue relates to the traceability of non-packaged goods and the distribution of
 11 associated costs and benefits across the FSC. Not only were the benefits of
 12 organic food clear and supported by a multitude of actors but its introduction did
 13 also not require changes in distributor, retailer and consumer routines and
 14 practices. As the higher cost of organic food production was passed down to the
 15 consumer directly, it did not pose a threat to conventional supermarkets'

1 business model in terms of promotions and market offers. However removing
2 packaging starting from the producers will require the distributors and retailers
3 to develop new handling, processing and logistics operations. It is also likely to
4 require more consumer facing staff to provide advice and help. Even though the
5 system benefits of zero-packaging are relatively transparent, it is not clear
6 which actors would actually reap the benefits or incur new costs. If it costs a
7 producer less to send bulk amounts but the retailer incurs higher costs due to
8 new handling procedures, should the consumer pay more or less? Currently
9 some large retailers in the UK offer some fruits and vegetables packaged and
10 non-packaged side by side. There are some organic stores with a bulk
11 department⁵ operating in North America as well. As our research did not
12 analyse these operations, we do not have any evidence on how these practices
13 are aligned with the ethos of the zero-packaging concept.

14 Another issue linked to the supply chain is the quantification of environmental
15 benefits. Whilst stricter environmental laws and regulations on the amount of
16 waste retailers create can incentivise the supermarkets to reduce packaging
17 waste, the fact that it is distributed across the supply chain makes it difficult to
18 identify responsibilities. Institutional arrangements for eco-branding and third-
19 party certification (Chkanikova and Lehneron, 2015), similar to that for organic
20 products, can give consumers assurance and evidence on what benefits they
21 are getting in return for a less convenient shopping experience.

22 Despite these limitations, even though store respondents do not view cost
23 savings as their main message, communication of cost-saving advantages to
24 consumers might support zero-packaging stores in gaining access to a wider
25 customer base. Garnett (2011) points out that consumer could use their savings
26 to purchase more expensive food (meat) or non-food products, which could
27 possibly have a higher environmental impact ('rebound effect'). In this regard,
28 adherence to transparent pricing schemes and avoiding consumer confusion is

⁵ There are over 450 whole food stores operating in the US, Canada and the UK (URL <http://www.wholefoodsmarket.com/departments/bulk>, accessed 15.7.2016). There are similar, but smaller independent stores operating in other European countries (Appendix A3).

1 paramount as breaches of consumer law can result in enforcement action⁶ and
2 may influence the reputation of the retailers.

3 Conventional grocery stores, non-governmental organisations and government
4 initiatives try to change consumer behaviour by providing additional information
5 (often on packaging) whilst industry performance is usually influenced by the
6 introduction of new laws and regulations (WRAP, 2014). Another factor that will
7 support the growth of zero-packaging stores is the adoption of stricter laws and
8 regulations on the amount of packaging waste generated across the supply
9 chain.

10 A factor that will carry a larger weight on the expansion and adoption of zero-
11 packaging concept is increasing consumer demand for more transparency and
12 sustainability along the FSC supply chain and an appreciation of freshly made
13 food over processed food. Table 5 offers a summary of the barriers and drivers
14 zero-packaging is facing in gaining wider adoption.

15 **Table 5. Barriers and drivers for the expansion of zero-packaging concept**

Barriers	Drivers
- Lifestyle change and cooking skills required of consumers	- Consumer demand more transparency and sustainability
- Suppliers have to change their practices	- Price advantage due to avoided cost in production and disposal
- Fundamental change of marketing and consumer-brand relationship	- Facilitating low-impact and healthy consumer behaviour
- Establishing trust in food safety	- Competitive advantage regarding environmental behaviour
- Pressure of main market player	

16

17 How these drivers and barriers might influence the emergence and success of
18 the suggested alternative pathways is very much dependent on the regional
19 context, including the regulatory framework and legislations, affluence of the

⁶ Potentially misleading special offers, unit pricing, price-matching schemes and changing pack sizes were the subject of recent a review by the UK Competition and Markets authority (URL <https://www.gov.uk/government/news/cma-recommends-changes-to-help-shoppers-in-supermarkets>, accessed 6.7.2016).

1 market and customer preferences. For example, in contrast to the experts' view
2 on customers not wanting to pay more for a less convenient shopping
3 experience, a study shows that more than 80% of German customers would
4 buy non-packaged goods: 35% in zero-packaging stores, 63% in supermarkets
5 with a bulk department (PwC, 2015). The most important reason is to protect
6 the environment, followed by portion control. A third of them would be willing to
7 pay a higher price. To what degree similar views will be echoed in other
8 countries is a big unknown as Germany is well-known for its discounters and
9 cheap food prices whereas quality of food is potentially more important in e.g.
10 France or Spain. On the other hand, our small sample size does not allow
11 separating out the influence of regional contexts on the operation of the zero-
12 packaging concept.

13 **6 Conclusions and Further Research**

14 The aim of this study was to analyse the prospects of zero-packaging grocery
15 stores to present a resource efficient and socially valuable alternative to
16 traditional food retailers. Zero-packaging stores renounce disposable packaging
17 and influence suppliers to adapt reusable packaging practices. As food waste is
18 the biggest negative externality of the FSC, the main advantage over
19 conventional stores is their potential to reduce food waste at supplier, retail and
20 consumer end. Utilising unsold food and focusing on seasonal and unprocessed
21 food avoids energy-intensive storage, manufacturing, and disposal processes.
22 By supporting small-scale farmers, zero-packaging stores may shorten supply
23 chains and increase overall transparency of the FSC. Operating with
24 unpackaged food requires close collaboration with hygiene regulation offices to
25 prevent food safety issues. Barriers to healthier diets are reduced by offering
26 portion control, healthy food for lower prices and increasing knowledge by
27 employing trained staff and carrying out events about sustainability and food
28 topics. Hence, the zero-packaging concept holds considerable potential to
29 improve the environmental and social performance of the food industry. Yet, this
30 comes at the expense of consumer convenience due to more time-consuming
31 shopping and a limited product range.

1 Our analysis points to three potential pathways by which these stores penetrate
2 the mainstream. The first pathway comprises the expansion of zero-packaging
3 stores. We identify two distinct types of stores: small stores resembling the
4 classical 'corner shops', versus more innovative ones developing new operation
5 systems to increase consumer convenience. The second pathway involves
6 online delivery. A third and more transformative pathway would be the adoption
7 of this concept by conventional supermarkets.

8 This qualitative, exploratory research has two main limitations. Firstly, most of
9 the stores are relatively young and therefore do not have empirical data to
10 quantify their advantages or disadvantages in terms of avoided packaging,
11 waste and emissions. Secondly, the expert interviews conducted provide an
12 initial reflection on the issues at hand and might not be representative or
13 provide full coverage. Nonetheless, this study gives first insights into the
14 operation of zero-packaging grocery stores and the impacts that zero-packaging
15 grocery stores have on the environmental and social performance of the food
16 industry. Future studies can aim to shed light on which characteristics of
17 regional contexts might support or limit the emergence and operation of zero-
18 packaging stores and how this varies across different countries. As our study
19 presents zero-packaging stores operating in European markets, further studies
20 can look into other international contexts such as Asia, Australia and Africa.
21 Another knowledge gap is around consumer attitudes and behaviours, including
22 how frequently they shop, their socio-economic demographics, and their
23 motivational factors (Chekima et al., 2016). Our research did not explore
24 whether customer loyalty is positively correlated with increased contact with
25 store personnel. Further research can analyse how no packaging impacts the
26 logistics along FSC and how that varies by seasons. Quantitative studies are
27 also needed to measure the impact: e.g. generation and prevention of
28 packaging waste and food waste (at supplier, store and consumer level), as well
29 as impacts on local economies and small producers. This could be done
30 through longitudinal studies in companies planning to reduce packaging or also
31 through archival research on previously implemented changes to packaging
32 practices. The resulting findings could be instrumental in finding the optimal

- 1 zero-packaging model for consumers and thus also support social research
- 2 about changing consumer behaviour for a more sustainable lifestyle.

3

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APPENDIX A

Table A 1 List of all operating zero-packaging grocery stores (x = all products, o = mixture, / = no information)

Name	Location	Opening Date	Products			Business Model
			Regional	Organic	Range	
Austria						
Frida	Hohenhems	01.03.2015	o	x	/	Café incl. Breakfast and Lunch, Information about Suppliers on Website
Lunzers Maß-Greißlerei	Vienna	26.02.2015	x	o	ca. 400	Café
Belgium						
Content	Leuven	2014	x	o	/	Lunch corner, Café, Workshops, Lectures, Events, Information about suppliers on website
Robuust! The Zero Waste Shop	Antweerp	2014?	x	x	/	Including blog, DIY products (e.g. toothpaste)
Czech Republic						
Opobchod	Prague	/	/	/	/	
Bezobalu	Prague	2014	o	/	/	First year non-profit to test the concept.
Germany						
Unverpackt	Kiel	01.02.2014	o	o	> 400	Coffee Corner, Tasting Events, Consultation Workshops
Original Unverpackt	Berlin	13.09.2014	o	o	400	Consultation Workshops
Freikost Deinet	Bonn	01.05.2015	x	x	300	Café with sandwiches, soups, coffee, tea / supportive community - membership fee guarantees lower prices / Get-to-Know the Supplier - Events

Name	Location	Opening Date	Products			Business Model
			Regional	Organic	Range	
Germany						
Unverpackt	Mainz	08.06.2015	x	x	999	Talks and Events about Sustainability / Consultation Workshop Coffee Corner
Lose Annas	Dresden	01.04.2015	o	x	/	
Unverpacktes	Heidelberg	18.06.2015	o	x	> 150	
Regional und unverpackt	Schwäbisch Gmünd	01.07.2015	x	o	/	
Italy						
Effecorta	Milano		o	o	/	Events with Suppliers and/or about cooking
Negoziolleggero	12 Stores	2009	o	x	> 1500	Supported by Research Institute Ecologos, Bike-Deliveries
Spain						
Graneria Sala	Barcelona	1885	/	o	/	Deliveries are managed by an external distribution company, Promotion of slow food concept
Granel	Barcelon/Ibiza/ Vic	2011	x	x	/	
United Kingdom						
Beunpacked	London	2006/2015	–	x	50-100	Started in 2007, expanded after 5 years including a café & bar, but closed a year later. Reopened in 2015 in the store Planet Organic.

Name	Location	Opening Date	Products			Business Model
			Regional	Organic	Range	
Belgium						
Content	Leuven	2014	x	o	/	Lunch corner, Café, Workshops, Lectures, Events, Information about suppliers on website
Robuust! The Zero Waste Shop	Antweerp	2014?	x	x	/	Including blog, DIY products (e.g. toothpaste)
Canada						
Strictly Bulk	Toronto	1987	/	/	/	Small coffee corner

Table A 2 List of zero-packaging grocery stores under construction A1 List of zero-packaging grocery stores under construction

Store Name	Location
Liebe und Lose	Innsbruck, Austria
Holis Market	Linz, Austria
Tütenlos	Köln, Germany
LoLa	Hannover, Germany
OHNE	Munich, Germany
Louise genießt	Erfurt, Germany
Bag & Buy	Utrecht, Netherlands

Table A 3 Selection of zero-packaging departments in grocery stores

Store Name	Location
Bio-Laden Familie Matzer	Graz, Austria
Genussplatzl Wasserwald	Linz, Austria
Veganladenkollektiv	Berlin, Germany
Holtorf Feinkost & Kolonialwaren	Bremen, Germany
12 Monkey - Vegankrams	Hamburg, Germany
Calenberger Bioladen	Hannover, Germany
Mercado Mundial	Schortens, Germany
Biosphäre	Berlin, Germany
Bittersüß	Hannover, Germany
Kräuterwelt	Würzburg, Germany
Veganz	Leipzig, Germany
Obgeweckt Noord	Groningen, Netherlands
Chornlade Idaplatz	Zürich, Switzerland
Chornlade Limmatplatz	Zürich, Switzerland
HISBE (How it should be)	Brighton, United Kingdom

The prospects of zero-packaging grocery stores to improve the social and environmental impacts of the food supply chain

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