Food waste due to 'coercive' power in agri-food chains: Evidence from Sweden

R.K. Ghosh[1]; M. Eriksson[2]; A. Istamov[2]

1: Indian Institute of Management Ahmedabad (IIMA), Center for Management in Agriculture, India, 2: Swedish University of Agricultural Sciences, , Sweden

Corresponding author email: ranjang@iima.ac.in

Abstract:

Food produced but not consumed is one the greatest threats to sustainable food systems. While there is evidence in the literature to suggest that food is wasted at all stages of the agri-food chain, the role of take back agreements (TBAs) has not been emphasized. When market conditions are such that TBAs become a tool for the retailers to express 'coercive' power over the supplier, there is an incentive to over-order and hence waste. In this study, a case-based approach was used to explore the existence and implications of coercive power at the retailer-supplier interface due to presence of TBAs in the context of Swedish bread suppliers. Specifically, company data for a medium-sized premium bread supplier in Sweden was analyzed. This supplier faced 30% returns of its total volume produced in the period 2011-15 and had to bear the entire cost of bread rejections, collection and disposal. It was paid only for the bread sold to end customers, and not for the contracted quantity. The findings indicate that TBAs are drivers of food waste at the supplier-retailer interface as it reduces the incentives for retailers to prevent waste. Our study confirms that it is a problem requiring serious policy attention.

Acknowledegment: The study was funded by the European Union through the research programme ERA-Net SUSFOOD and the project COnsumers in a SUStainable food supply chain (COSUS). Primary data through interviews were provided by representatives of all major retailers and bread producers in Sweden, while detailed supply data were provided by the bread supplier Saltå Kvarn. The company has allowed access to its data for the purposes of research without any anonymity conditions. The authors would like to thank the staff at all the companies involved for their help and cooperation.

JEL Codes: Q57, A12

#1141

Food waste due to 'coercive' power in agri-food chains: Evidence from Sweden

Abstract: Food produced but not consumed is one the greatest threats to sustainable food systems. While there is evidence in the literature to suggest that food is wasted at all stages of the agri-food chain, the role of take back agreements (TBAs) has not been emphasized. When market conditions are such that TBAs become a tool for the retailers to express 'coercive' power over the supplier, there is an incentive to over-order and hence waste. In this study, a case-based approach was used to explore the existence and implications of coercive power at the retailer-supplier interface due to presence of TBAs in the context of Swedish bread suppliers. Specifically, company data for a medium-sized premium bread supplier in Sweden was analyzed. This supplier faced 30% returns of its total volume produced in the period 2011-15 and had to bear the entire cost of bread rejections, collection and disposal. It was paid only for the bread sold to end customers, and not for the contracted quantity. The findings indicate that TBAs are drivers of food waste at the supplier-retailer interface as it reduces the incentives for retailers to prevent waste. Our study confirms that it is a problem requiring serious policy attention.

Keywords: Agri-food chains; take-back agreements; coercive power; food waste

1. Introduction

In an agri-food chain, take back agreements (TBAs) refer to those arrangements where the store is only required to pay the supplier for the quantity sold, and not the quantity ordered [1]. This is a form of reverse supply chain (RSC) process emanating from extended producer responsibility (EPR) [2-4]. In theory, the concept of EPR and RSC is intended to bring sustainability to the supply chain by reconsidering its linear nature and implementing a cradle-to-cradle rather than cradle-to-grave philosophy. Whether RSCs always bring sustainability to the whole supply chain has been contested though, particularly in the context of food industries [5]. If TBAs can be used as a contractual penalty by retailers enjoying dominant market power, the manufacturer could simply be forced to operate the reverse logistics. In the event manufacturers do not find proper disposal channels, returned products may end up as waste [1,6].

Yet the role of TBAs as a cause of food waste has not been investigated enough. There have been some exceptions, but they focus primarily on fresh fruit and vegetables (FFV) in the context of Swedish retailers [7-9]. Eriksson, Ghosh, Mattsson and Ismatov [1] study reclamations in bread, milk and FFV supply chains in Sweden and find evidence of waste being highest in bread which also has fully enforced TBAs. Waste levels were lower in FFV and milk where rejection practices were not driven by the TBAs. Parfitt, Barthel and Macnaughton [5] estimated that contractual penalties, product take-back clauses and poor demand forecasting have a combined influence driving 10% over-production and high levels of wastage in the UK food supply chain. In Austria, recent studies of bread [10] and more recently of FFV [11] describe waste in supermarkets in detail without mentioning TBAs or rejections, with the exception of reverse supply chains (RSCs) for waste management of bread [10]. However, an earlier study in Austria reported that packed bread is commonly supplied on a "commission basis", where supermarkets do not pay for unsold bread [12]. Canali, et al. [13] claim that TBAs can work as a driver of food waste, since supermarket staff are not incentivised to order the correct amount of products when the cost of oversupply is covered by the supplier. Since there is also a risk of abuse in the take-back system, TBAs have been banned in Czech Republic [13].

More recently, Göbel, et al. [14] investigate the causes of food waste in the German food chain and conclude that waste happens at all stages in the chain. In FFV, quality standards and appearance turn out to be important factors. In bread and bakery, freshness of the products matters a lot while in milk and dairy, low shelf-life and leakages in the production process lead to waste. Apart for this,

cost pressures, market conventions, inventory mismanagement and demand for variety are other factors responsible for waste in the agri-food value chain. There is hardly any mention of supply agreements and their role in food waste. Canali, et al. [15] categorize drivers of waste in the food supply chain across Europe into various technological, institutional and social contexts for each segment in the agri-food supply chain. Readers are advised to see [15] for a very detailed investigation, but some of the key technological drivers are: perishability, automation, inadequate control systems, poor storage and handling, food contamination and inflexibility in portion size. Among supply chain coordination factors, return of unsold products for free and market power imbalances are mentioned. Contracts and agreements that enforce strong conditions for deliveries and unsold products are considered to be potentially leading to waste [16,17]. They point out that food chain operators with greater bargaining power have a 'tendency' to shift the risk and costs of unsold products to the weaker operators through free returns of last minute cancellations. When this happens, it is possible that such operators have a low incentive for accurate inventory forecasting and in some cases lead to illegal food waste disposal by the weaker actors [18-20].

Although limited, the evidence so far suggests that contractual practices, such as TBAs could lead to perverse incentives for waste reduction in agri-food value chains. While it is acknowledged that food is wasted at all the stages of the supply chain ([14,21]), it is important to analyse under what conditions TBAs, specifically, could damage the sustainability of the food chain. In this study, we examine whether TBAs exist as a main practice in an important food chain (bread supply) in Sweden and whether they can be used as a tool of coercive power. The analysis is based specifically on five-year company data for a medium-sized premium bread supplier with unreasonably high waste levels. The origin of the TBA lies in environmental management norms of reverse logistics as part of extended producer responsibility (EPR). However, due to the high concentration in the Swedish retail market, where a very few retailers control a very large proportion of the market, there is a risk of coercive power, which makes the norms of EPR counter-productive. It may also potentially lead to increasing concentration on the supply side, where only those operators that can negotiate non-TBA contracts will survive. The next section begins with an explanation of the origins and functionalities of reverse supply chains (RSCs) as part of EPR and their relevance for the food chain.

2. Materials and Methods

2.1. The sustainability of reverse supply chains

Broadly defined, sustainability builds on three major constituents – environment, society and economic performance, which are closely interrelated and together form a triple bottom line [22]. This suggests that any firm embarking on a sustainability track is ideally able to operate in a way that has positive impacts for society and the environment and can simultaneously achieve long-term economic benefits [23,24]. One of the ways to bring sustainability to a supply chain is to reconsider the linear process of the chain and implement a cradle-to-cradle rather than cradle-to-grave philosophy. However, this requires the creation of an RSC that is not only sustainable, but also value-creating [2-4]. This concept has its roots in EPR, which aims to internalize the externalities of the supply chain through establishing an RSC [25-27]. The RSC concept has been introduced to address various environmental, social and even economic issues, by mandating a take-back practice that requires producers/suppliers to arrange recycling or reuse of any products that are unsellable or unsold [28-30]. A company is free to choose how to design its RSC, which may determine its performance [30]. Initially, the four major motivations for 'extending' supplier responsibility were aimed at: i) facilitating and improving recycling and recovery, ii) influencing decisions on product design, iii) creating new capabilities and iv) achieving financial benefits [26]. Later, the concept was developed to differentiate between different ways of achieving financial and environmental benefits through recreating value from returned products, i.e. using RSC designs as a way of improving the overall supply chain sustainability [25].

Some suppliers of perishable products are especially keen to create more agile, i.e. more flexible, responsive and faster, supply chains that help exploit emerging market opportunities, minimize waste, facilitate sustainable management of unsold/expired products, minimize the economic and environmental costs and enhance the overall sustainable performance of the supply chain [31-35]. Introduction of RSCs has been suggested as one way to help manage food surpluses in a more sustainable manner [2,33]. In the disposal phase, an RSC structure involves a combination of comprehensive take-back networks for reusing, remanufacturing and recycling the returned products [32].

However, there is a suspicion that RSCs do not necessarily make the entire chain sustainable. This can be particularly true at the retailer-supplier interface in the food industry, where the TBA can be used as a contractual penalty by retailers enjoying dominant market power [5,36,37]. The supplying company is in this case coerced to perform the reverse logistics and may struggle with finding proper disposal channels [37,38]. Hence, instead of being properly reused and recycled, returned products may end up in landfill [38,39] or, in the best case, used for energy recovery or as animal feed [6]. Moreover, studies from the food waste management sector [33,37] argue that existing take-back provisions in contracts between retailers and suppliers could translate into abuse of power on the part of retailers. For instance, product availability and variety is an important factor for retail stores, which always strive to keep their shelves well stocked. However, when there is a TBA where the store is only required to pay for the quantity sold, and not the quantity ordered, this may lead to over-ordering and neglect proper demand forecasting [33]. This is why there is a suspicion in the literature that TBAs can be used as a source of inadequate ordering and consequent over-production, with associated financial losses for the supplier companies and additional negative environmental consequences [5,33,36,37,40,41].

2.2. The coercive power of the TBA

The sustainability of RSCs and product take-back systems depends on whether the strategies for product returns and corresponding supply chain designs are efficient enough [42]. Some studies maintain that take-back systems at the supplier-retailer interface lead to one-sided power and have certain implications for each of the four pillars of sustainability through, for example, causing over-production and waste [37,41]. Grocery retailers are becoming increasingly influential, as they serve as an important (or often only) link between consumers and producers [43]. The structure of the European food retail market in particular raises major concerns, as the huge market share and dominant position of retailers is triggering change in food market structures [44,45]. This carries the risk of RSCs being imposed on suppliers by powerful retailers [5,37]. The supplier is obliged to take back any stock that has reached a specific amount of residual shelf-life (or has already passed the sell-by date) and dispose of it (ibid.). In this practice, the products can also be sent back from the retailer to the supplier due to close-out, seasonal return or surplus and overruns [42]. Major retailers, which hold the majority of market share and are attractive to suppliers, usually exercise their bargaining power through imposing practically non-negotiable rules [46,47]. Take-back may be one of these rules. Sending the unwanted product back to the supplier is the most desirable option for the retailer, as it can help save on the disposal costs. Moreover, such an agreement typically specifies that the supplier must give the retailer a full refund for any unsold products [37,38]. Consequently, a manufacturing company performing the reverse logistics operations (the take-back) is forced to deal with additional processes, such as transportation of the rejected products back to the supply site, remanufacturing (if required) and finding proper disposal options or an appropriate secondary market, which are not always easy or inexpensive tasks [37,38,48]. In some cases the product must be handled within a very short time, so that the residual value of the product that can still be recovered is utilized and is able to bring the company some profit. However, many companies do not dedicate sufficient time for immediate reprocessing, particularly when returned products are regarded as a costly failure [38]. The value continues to decline during the time a product is left unprocessed. The quantity of returned products may be quite large and often just a fraction of their value can be recovered, if any at all [39]. Otherwise, the company will have to deal with processing returned goods

with little recoverable value, an activity which entails additional costs rather than profits (Rogers et al., 2010). The RSC for the supplier might be further complicated by the nature of the product, especially if it wants to sell the returned products on a secondary market. The pricing of taken-back products may be very complex, depending on the characteristics of the product, its residual value and the quantities that need to be sold to the secondary market. The manufacturer is the party that carries the full burden of responsibility and has to work out the most profitable ways of disposal. The way in which a company disposes of returned products can make a competitive difference if it enables that company to reduce costs and raise revenues. However, if such ways are not found, the investments required (production, marketing, logistics) risk exceeding the revenues [38,42].

Product availability and variety is an important factor for the retailer and represents a trade-off between a potential increase in unsold products and a decrease in customer satisfaction [33]. In general, stores do not want to order more than they can sell, but are simultaneously afraid of losing customers due to half-empty shelves. In such scenarios, retailers usually opt for ensuring customer satisfaction, which often results in over-ordering. In this context, a TBA can allow retailers to order an unnecessarily large supply of goods with little consideration for the actual demand, as they are not responsible for managing the waste. For that reason, TBAs can be a source of inadequate ordering and consequently over-production and waste accumulation [5,36,37,41]. In this case, the supplier, which has invested in production, packaging, marketing and distribution, receives no revenue on the product and only adds to its already snowballing costs [38,42].

Over-production not only leads to economic costs for the producing company, but also involves utilizing scarce resources and subjecting the environment to certain production processes [6,49,50]. All these environmental costs are unjustified if the product is ultimately left unconsumed and becomes waste [40]. Thus when retailers hold the balance of power at the supplier-retailer interface, the efficiency of take-back systems is not guaranteed (Parfitt et al., 2010; DEFRA, 2007). Finding secondary markets or other proper disposal channels for the products, especially those with short shelf-life, may be difficult [9]. Quite often, taken-back food products are impossible to dispose of at all, because of regulations [48]. For instance, Danish legislation forbids the resale of food products that have reached their "fresh until" date, although these products are still not obsolete and are suitable for consumption [2].

In Sweden, the best-before date is not a legal boundary for bread redistribution. Some Swedish supermarkets remove bread (even frozen bread) from their shelves three days before the best-before date [51], which should increase the potential for product recycling/reuse. However, some firms may be afraid of damaging their brand by selling their products on a secondary market. Thus, a significant amount of goods that could otherwise have been consumed without any risk to health, or disposed of beneficially through other channels, may end up in landfill [37]. Finding other channels for disposal that do not presuppose at least some monetary compensation for the returned stock might not even be considered by the company, or could be problematic [38,39]. Arranging for proper recycling might involve further investments and changes in many of the firm's processes, which might be unfeasible. Therefore, suppliers may decide to avoid these transaction costs and the returned products then eventually end up in landfill [38,39].

2.3. Food waste in the chain

In developed countries, customers want to choose from a wide variety of products and from fully stocked displays. Even though stores do not want to order more than they can sell, they are wary of losing customers due to half-empty shelves [33,40]. Thus stores must risk being left with a certain amount of outdated food, which has to be disposed of. This food usually ends up in landfill, which has serious environmental side-effects, such as methane emissions by anaerobic digestion of organic matter. Sweden, for example, has banned landfilling of organic waste and less than 2% of total municipal solid waste in the country goes to landfill. The rest is treated through incineration, material recycling, composting and digestion [40]. Yet, the amount of avoidable food waste is still very high. The wholesale/retail sector in Sweden generates more than 70,000 tons of avoidable food

waste a year [52]. It has also been calculated that if retailers and wholesalers could reduce their amount of food waste by 20%, they would save 47 million SEK per year.

Studies have shown that perishable food such as fresh baked goods and FFV contribute most to avoidable food waste [11,31,34]. In contrast to fresh fruit and vegetables, the logistics chain for bread in Sweden includes RSCs with take-back practices. The major producers supplying bakery products to retail stores in Sweden have a TBA whereby they take back all the bread that is approaching its best-before date and then dispose of it. Fresh fruit and vegetables are normally not associated with a take-back practice, but a rejection policy with insufficient control mechanisms can temporally and locally become a practice similar to a take-back policy [6,53]. This means that the supplier not only pays for taking back delivered food of insufficient quality, but also for products that are unsold for other reasons. Bread and FFV are among the high-volume perishable products with a short shelf-life. The customer order lead-time and the supply chain lead-time allowance are both very short for this type of product. Moreover, the supply chain for such products is often characterized by demand uncertainty, due to fast-changing customer preferences and customer demand for product variability [31,54]. Shelf-life, stock management, demand responsiveness and unsustainable management practices are considered to be the most frequent problems leading to negative externalities in food supply chains [31]. The highly variable demand and short-shelf life of bread and FFV make it more difficult to avoid waste arising. Managing this waste at the distribution stage rests with either the supplier or the retailer [38].

Discarding bread that is close to its best-before date can be costly since it involves activities such as storing, transporting the waste, renting containers and paying fees for discarding waste. Moreover, landfilling and incineration – the two most common ways of managing this type of waste – bring undesirable environmental consequences [41]. Given these problems and conflicting research findings about RSCs, it is unclear what implications the reverse logistics networks for bread have on waste generation and management at the supplier-retailer interface in Sweden, and how the take-back practice affects the overall sustainability of the supply chain in question. Exploring this particular supply chain practice for a type of food with the largest waste statistics is an effective way to address the food waste problem.

Previous research presents conflicting findings with regard to potential sustainability concerns about RSCs and does not provide a proper description of take-back practices for perishable food products at the supplier-retailer interface. Until recently, most studies in this area largely focused on the food production element, while research exploring the stage of distribution and disposal, especially at the supplier-retailer interface, is very limited [9,16,37,41,53,55]. However, the supplier-retailer interface provides many opportunities to substantially minimize food waste [2,31,34]. How the food is managed at the supplier-retailer interface is particularly important for the overall sustainability of the supply chain, as by then products have already passed through all the value-adding stages, have used valuable resources and have caused a certain environmental impact. One of the practices at this interface is examined in the present study, in order to gain insights into the problem of coercive power in general and in the context of food waste in particular.

3. Results

3.1. Overview of the Swedish food industry

Sweden has around 3593 food processing companies, which account for about 10% of Sweden's total industrial output. The most important sectors within the Swedish food industry are bakeries, meat plants and dairies, which represent more than 50% of the value of output [56]. In the past, the Swedish processing industries were largely dominated by cooperatives that divided up the market between them. Therefore, there was not much competition either for members/farmers or for trade and consumers. The deregulation of the food sector and Sweden's entry into the European Union (EU) changed the situation, however, and nowadays cooperatives dominate only in the dairy sector.

The Swedish food retail market is one of the most concentrated markets in Europe and the degree of concentration is still growing. In general, the EU gives high priority to the abolition of

certain types of (anti-competitive) agreements and dominant positions, as indicated e.g. by the prohibitions codified in the EEC Treaty (articles 81 and 82 EC). However, there may also be 'inherent' barriers within certain production and marketing activities, which often means that they are not within the reach of legislation and policymakers. Swedish grocery stores are becoming significantly fewer and larger, e.g. the total number of stores decreased by 16% during the period 1996-2002, while sales increased from 220 billion SEK to 243 billion SEK. The Swedish market is now characterised by the dominance of a few large retailer chains. In 2012, the three largest chains, ICA, Coop and Axfood, together controlled over 73% of the national market [56]. This has given them greater leverage in imposing requirements on food processors and producers.

3.1. Mechanics of RSC in the Swedish bread industry

In this investigation of RSCs at the supplier-retailer interface, representatives from all the major Swedish retail food chains were initially interviewed. In total, nine interviews were conducted with representatives of Willys, Hemköp and Tempo (all in the Axfood company group); Matdax and Mattöppet (both in the Bergendahl company group); ICA; Coop; Lidl and Netto. These retailers were selected based on a list of all major brands and corporate ownership in the Swedish retail market presented by Eriksson (2012). The retail stores were initially contacted by phone, email or through short visits. During these contacts, initial information on TBAs was collected. Stores were asked if they had such agreements with any of their suppliers. After the initial interviews, it became clear that most of the stores in all the different retail chains had TBAs with major bread companies. The retail stores surveyed varied in size, location and turnover, yet all had TBAs with their respective bread suppliers1. The interviewees were selected based on their knowledge about the take-back clauses and RSCs. At the retail stores, either the person responsible for the bread section or the store manager took part in the study. All the interviewees from bread companies were either the executive officer or the region's senior manager. The three major bread producers in Sweden (Pågen, Fazer and Polarbröd) that have RSCs and take care of the unsold products were also approached. These companies together represent 85% of the bakery market in Sweden.

The interviews revealed that all the bakeries have very short lead times. Thus it is very important in the bakery business to organise the logistics in advance, so that the bread arrives on the store shelves while it is still fresh. The bread producers therefore strive to deliver the bread to the retailers as quickly as possible. They are responsible for ordering and delivering, as well as taking back the leftovers for disposal. The truck drivers collect the expired bread while they are delivering a fresh batch. The drivers who deliver bread are also the sellers, servicing a certain district with a certain number of retailers on a regular basis. One driver usually drives to the same stores and is responsible for forecasting and negotiating the assortment and quantities of bread that should be delivered to those stores. The more the drivers sell and the lower the volume of rejects they take back, the higher their salary. In fact, the truck drivers have to carry back the rejected products2 and do not get paid for this. In order to forecast the demand as accurately as possible, the drivers use historical data on sales and negotiate with the bread department at a retail store. The drivers also track advertising campaigns, competitor behaviour and any other relevant information that can influence bread sales. However, a major drawback for the drivers is that majority of the stores do not have any bread department manager with whom to negotiate, as it is known to the store manager that the bread supplier is fully responsible for shelf replenishment. As a result, it is often the driver who is the end decision-maker on volumes.

---

1 For more details on our interviews and data see 57. Ismatov, A. The sustainability implications of "product take-back clause" in supplier/retailer interface. 2015.

2 Some fraction of the rejected products goes to charitable organizations, some are sent back to the bakery for yeast production and anaerobic digestion, while the majority sent for incineration due to the large volumes involved.

Figure 1 shows the RSC in the Swedish bread industry. Bread companies have bakeries that are connected to depots, each serving a particular region. A certain number of trucks are linked to a depot, where they pick up fresh bread and drop rejected bread. The rejected bread (flow shown by dotted arrows in Figure 1) is then stored in containers until pig farmers come and collect it to feed to their pigs. These farmers buy the bread from the nearest depot, as they usually sign yearly contracts with depot managers. Some farmers even invest in special machines that separate the plastic packaging from the bread. The cost of the bread to the pig farmers is about 1 SEK/kg, whereas the average manufacturing cost of fresh bread is 14-15 SEK/kg. Apart from this, a fraction of the rejected products goes to charitable organisations, some are sent back to the bakery for yeast production and anaerobic digestion, while the remainder are sent for incineration due to the large volumes involved. In interviews, it was implied that the volume of rejects depends on the size of the store, its turnover and its location.

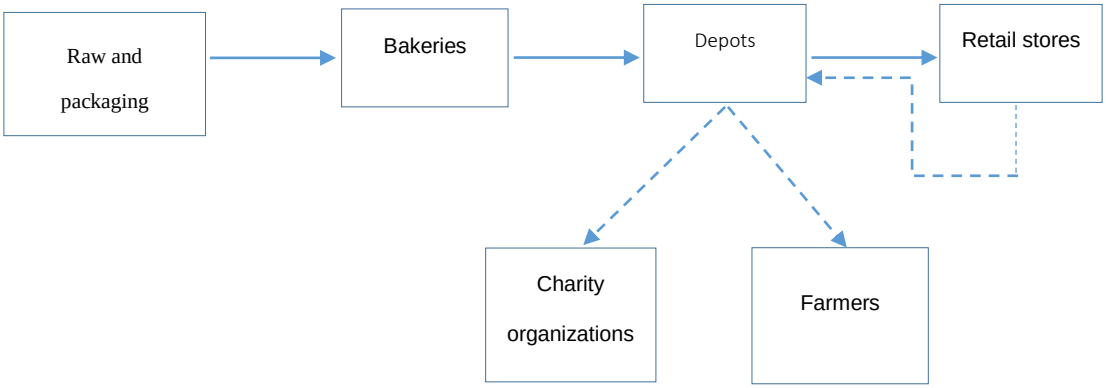

Figure 1: Reverse supply chain (RSC) and disposal channels in the Swedish bread industry.

The interviews provided an insight into how the chain works and confirmed the suspicion that TBAs exist between bread suppliers and retail stores. There were also indications that the level of rejection and the resulting loss to suppliers depended on the size of the supplier, with some of the bigger suppliers being able to negotiate better contracts. However, in order to obtain convincing data on the problem, the role of power in this relationship and the consequences, we needed cross-sectional data across supplier firms and their transactions with retail partners over time. This proved be an impossible venture given the high secrecy surrounding company data. However, we were successful in getting transparent records from one major organic bread supplier in Sweden. We therefore discuss the case of this company since, to the best of our knowledge, this is the only evidence available in the Swedish context and very likely even in the international context3.

3.2. Saltå Kvarn's exit from the supply chain

3 Due to secrecy surrounding company data, it was not possible for us to examine all the major bread suppliers in detail. However, based on the interviews with company managers, an average of 4.3-9% of production is added by them in the supply price in anticipation of returns, indicating that all of them face this problem. For more details see 57. Ismatov, A. The sustainability implications of "product take-back clause" in supplier/retailer interface. 2015.

Saltå Kvarn is a medium-sized organic food company and owns one of oldest organic bread bakeries in Sweden. In the period 2011-2015, its major retail buyers included Axfood, Bergendahl, Coop and ICA. It also supplied bread to the large-scale bread manufacturer Pågen until 2012, when Pågen set up its own organic bakery. In addition, Saltå Kvarn supplies to other non-retail buyers such as schools, restaurants, bakeries, hotels, internet cafes, and other small buyers. Figure 2 shows the mean supplies for each major food retail company and the non-retail category over the period 2011-2015.

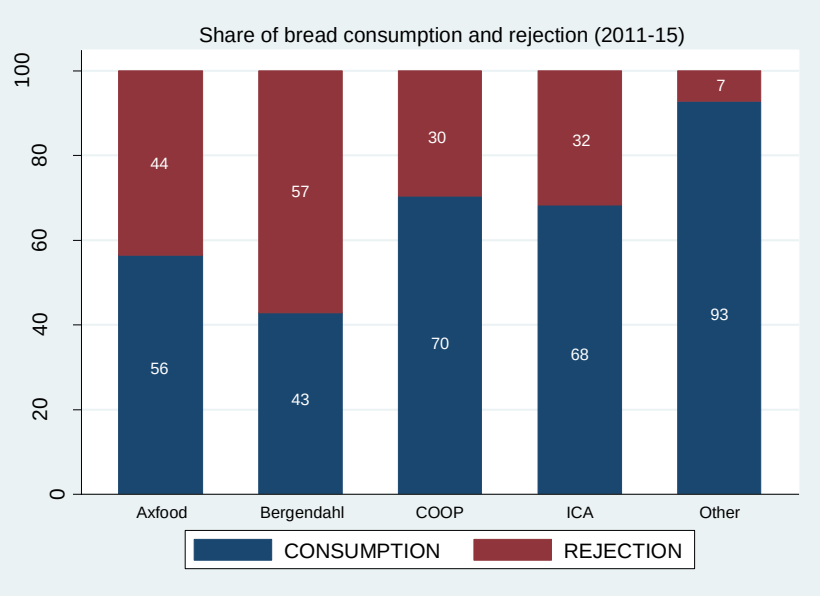

Figure 2: Consumption and rejection of bread products as a percentage of the total supplied by Saltå Kvarn (buyer-wise, 2011-15).

Retail stores have a TBA with Saltå Kvarn as part of standard practice with all bread suppliers. This kind of contractual relationship is implicit in nature and is not in any written form. For its non-retail buyers, Saltå Kvarn did not have a TBA, so the buyers paid for the rejected products and the company was paid for everything it supplied. The result of such a relationship can be seen in Figure 3, which shows the proportion of bread taken back by the supplier (Saltå Kvarn) from each of its buyers in 2011 (which we use as a reference base year).

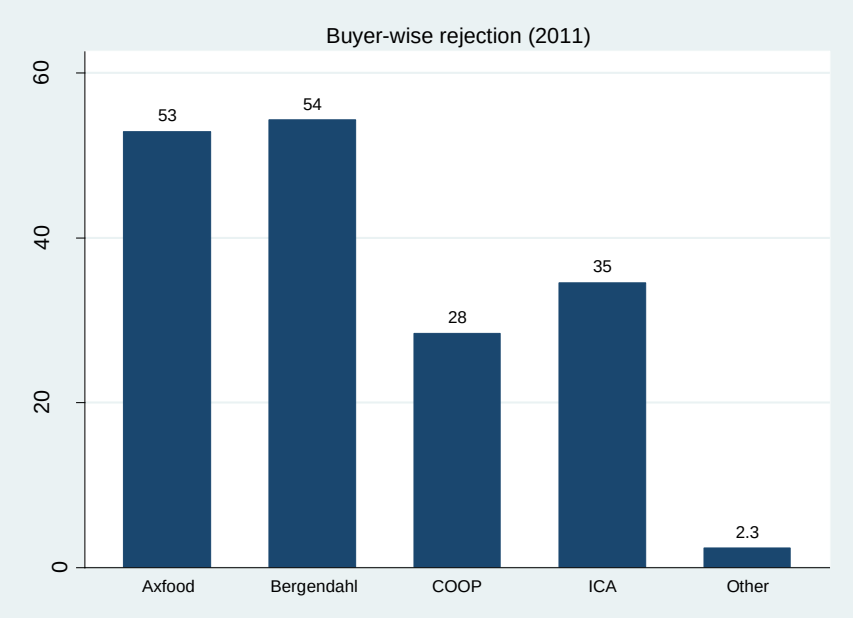

Figure 3: Buyer-wise rejection of baked goods as a percentage of supply from Saltå Kvarn during 2011.

For instance, from the entire supply consisting of 40,547 loaves of bread to Axfood, the amount which was returned as waste was 22,265, or 52.9%. Similarly, for the other retail buyers Bergendahl, COOP and ICA, the percentage returned was 54.3%, 28.4% and 34.5%, respectively. For the non-retail category, the rejection rate was 2.34%. The quantities involved and percentage rejection rates for the other years up to 2015 can be seen in Table 1.

Table 1: Amount of bread supplied by Saltå Kvarn, total rejections and rejection rate (%) among different retail and non-retail buyers (2011-15)

2011	Total supply (number of loaves)	Total rejects (number of loaves)	Rejection rate (%)
Axfood	40,547	22,265	52.9
Bergendahl	4511	2794	54.3
COOP	172,964	50,335	28.4
ICA	113,141	39,635	34.5
Non-retail	34,659	723	2.34
2012			
Axfood	59,013	23,946	40.6
Bergendahl	3008	1711	56.9
COOP	259,704	77,899	30.0
ICA	195,373	65771	33.7
Non-retail	25,775	1498.5	5.8
2013			
Axfood	110,669	51706	46.7
Bergendahl	3640	1881	51.7
COOP	428,524	129,272	30.2
ICA	233,249	75727	32.5
Non-retail	37,799	3602	9.5
2014			
Axfood	81,335	32,630	40.1
Bergendahl	69	34	49.3

COOP	383,771	108,591	28.3
ICA	168,018	47,528	28.3
Non-retail	40,018	3744	9.4
2015			
Axfood	29,833	9239	31.0
Bergendahl	0	0	0.00
COOP	92,501	31,635	34.2
ICA	52,792	14,071	26.7
Non-retail	27,601	2435	8.8

Source: Saltå Kvarn

In 2015, the rejection rate by Axfood and ICA decreased to 31% and 26.7%, respectively. Saltå Kvarn stopped supplying bread to Bergendahl in 20154. On the other hand, for COOP and the non-retail category, the rejection rate in 2015 increased by nearly 6 percentage points each, to 34.2% and 8.8%, respectively. Figure 4 illustrates these year-wise trends.

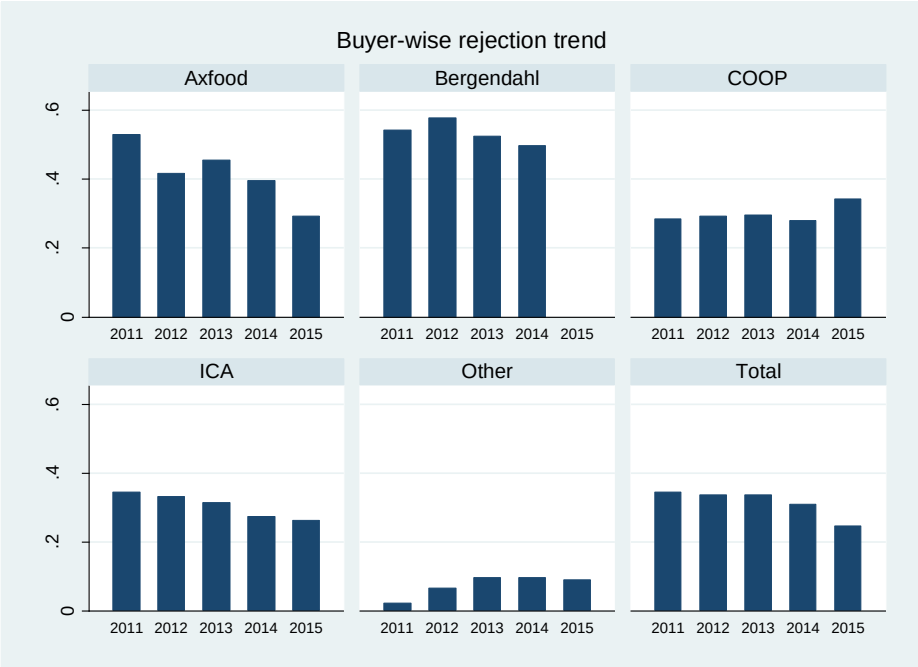

Figure 4: Rejection rate (%) of Saltå Kvarn products by different retail food buyers, 2011-15.

However, the data did not suggest any strong relationship as regards rejection level and buyer category (retail compared with non-retail). Therefore, a pairwise means test was carried out by splitting the rejects into two categories: retail (calculated mean for all years across the four retail buyers) and non-retail. As shown in Table 2, the results rejected the null hypothesis that the mean across both categories is equal. This indicates that the rejection level differed significantly between retails and non-retail buyers.

4 According to Saltå Kvarn company managers, this decision was based on consistently high levels of rejects from this buyer on previous years and refusal to negotiate a different TBA.

Table 2. Pair-wise means test of rejection rate (%) of Saltå Kvarn products by retail and non-retail food buyers

Pair-wise comparison of means with equal variances (H0: retail mean = non-retail mean)						
Reclamation Rejection by category: retail (1) and non-retail (2)				Unadjusted	Unadjusted	
BUYER_GROUP 2 vs 1	Contrast	Std. Err.	T	P > |t|	[95% Conf. interval]	
	-28.79913	3.281233	-8.78	0.000	-35.31062	-22.28763

As a result of these high levels of waste, Saltå Kvarn company managers reported that there were high revenue losses. As can be seen in Figure 5, the annual rejection rate was rather consistent. The red segments of bars in that diagram, denoting the level of rejects returned as waste, also represent the loss suffered by Saltå Kvarn, as the company had to produce these products but was not paid for them. These high levels of revenue losses forced the company to stop supplying bread to retail food chains as of 2016. The company still makes bread, but only a very small amount compared with previously, mostly to serve its own internal store needs.

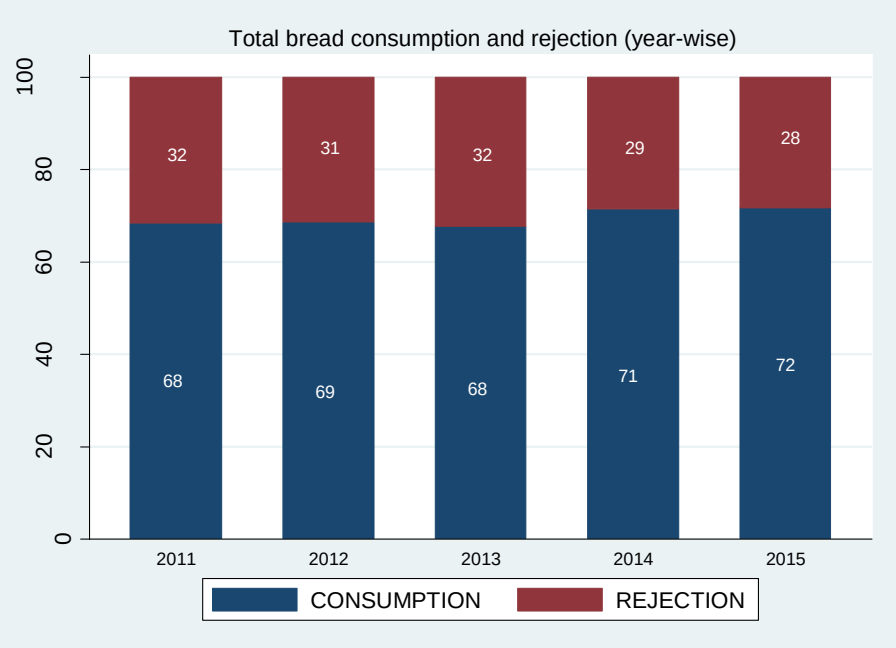

Figure 5: Annual ratio of consumption to rejection (share of total supply) of products supplied by Saltå Kvarn in years 1-5 of the study period (2011-2015).

4. Discussion: Coercive power and food waste

The classical definition of power in supply chains is "the ability of a channel member to control the decision variables in the marketing strategy of another member in a given channel at a different level of distribution" [58; p. 47]. It is also understood as a firm's ability to own and control critical assets in markets and supply chains, so that it can appropriate and accumulate value for itself by constantly leveraging its relationship with other actors [59-61]. Power can enable fulfilment of one actor's own goals at the expense of the other party through controlling their behaviour and decision-making [62]. In general, power sources can be categorised into mediated and non-mediated [63]. Rewards, coercive and legal legitimate, are types of mediated power imposed directly by the buyer

on the seller, and are intentional. Non-mediated power (such as expert, referent and traditional legitimate or informational) is more natural and unintentional and is sometimes exerted without the power holder even being aware of it [64].

Coercive power refers to the fear by an actor of being punished when it fails to comply with the requirements of the focal actor [60]. This punishment can take the form of dissolving contracts or renegotiating terms of trade. Coercive power has a direct effect on overall supply chain satisfaction, which is defined as "a feeling of equity with the supply chain no matter what power imbalance exists between the buyer and seller dyad" [64; p.4]. Maloni and Benton [65] show that when a power holder imposes its power this affects supply chain satisfaction, through dissent and under-performance, and hence affects the power holder too. This leads to problems of poor cooperation in the supply chain, which is basically an indication of conflict of interests. Cooperation within the supply chain network rests heavily on the individual motivation and interests of its actors, which are aligned through both formal and informal mechanisms [66]. Formal mechanisms consist primarily of contracts, whereas identification and embeddedness are more relational and informal in nature [67-70]. Cooperation in supply chain networks can lead to various improvements such as cost reduction, quality enhancement, delivery precision, flexibility and innovation.

However, powerful retailers play a major role in how cooperation develops along the chain, since in competitive business environments cooperation is not always forthcoming. This power can be misused, however. In the context of supply chain research, it has been shown that power can hamper cooperation under certain conditions [71-73]. In particular, the role of coercive power has been highlighted by several researchers in this regard. When coercive power is used disproportionately, then the weaker party may lose interest in the relationship [64,65,74]. On the economic analysis side, Peitz and Shin [47] show that when a retailer has high market power, it can adopt a 'buy-and burn' strategy whereby it can intentionally purchase more than it may need and dispose of the unsold goods. This can be a particularly frequently employed strategy when the disposal is costless to the retailer.

The case of Saltå Kvarn confirms that coercive power exists in the Swedish bread industry. This may lead to long-term loss of cooperation – as occurred between Saltå Kvarn and its major retail buyers, leading to lower chain satisfaction and ultimately Saltå Kvarn's exit from the relationship. The presence of TBAs in the highly concentrated food retail sector in Sweden provides perverse incentives for the high-powered partner to impose stringent conditions. The strength of this power was evident in the level of bread rejections in the case of Saltå Kvarn, through which the company incurred very high disposal and under-payment costs. Being a weaker party, Saltå Kvarn as the supplier was left with no option but to exit the relationship, not merely with one of its buyers, but with the entire retail sector. This chilling outcome of coercive power leads to higher food waste and sends a strong negative signal to smaller actors who may want to enter a niche supply segment. The larger suppliers claimed to have a lower return rate (around 9%), but this is still a high level of waste and confirms that the problem exists in the whole Swedish bread supply chain, although it seems to be dependent on company size and product volumes. However, it should be borne in mind that the empirical data analysed in this study is context- and case-specific. The extent of the problem in other contexts should be determined through more rigorous scrutiny of a wide range of empirical evidence, which was not possible here.

5. Conclusions

Food waste is a waste of vital resources. It not only has a negative effect on the environment, but also leads to monetary losses for the actors in the supply chain. One way to address food waste is to reconsider the linearity of the supply chain and implement RSC. Some consider RSCs, which are part of the larger EPR logic, to be sustainable and value adding. Others suspect that at the supplier-retailer interface, especially in the retail food industry, the presence of TBAs may expose suppliers to the coercive power of retailers. In this study, a primary case-based approach was used to explore the existence and implications of coercive power at the retailer-supplier interface due to presence of TBAs in the context of Swedish bread suppliers. All major bread-producing companies that supply bread

to retailers in Sweden were interviewed to understand how the chain operates. Furthermore, to test the hypothesis that coercive power exists in the bread supply chain and has a strong negative effect on the supplier, company data for a premium medium-sized bread supplier in Sweden is analysed. The company concerned was responsible for bread rejects, which represented on average 30% of its total supply in the study period (2011-15). The nature of the TBA with its buyers was such that it had to bear the entire cost of reject bread collection and disposal. More importantly, it was paid only for the proportion of the total supply bought by end customers, and not for the contracted quantity that it actually supplied. The revenue losses became so high that the company decided to leave the bakery business entirely. According to information obtained in stakeholder interviews, a number of small and medium-sized bakeries in Sweden have closed down recently, citing similar reasons. This has the additional effect of increasing concentration on the bread supply side, where only larger players that are able to negotiate better contracts can continue to exist in the chain. Moreover, by preserving a system of TBA's the largest bread companies can create an entry barrier for new actors. By absorbing a 5-10% wastage cost, oligopolistic positions can be maintained as a new producer wanting to enter directly needs large volumes, high bargaining power and good forecasting – things that need time to acquire. Insights from our study give a strong indication that abuse of coercive power by a chain actor can negatively affect the sustainability of agri-food supply chains.

Acknowledgments: The study was funded by the European Union through the research programme ERA-Net SUSFOOD and the project COnsumers in a SUStainable food supply chain (COSUS). Primary data through interviews were provided by representatives of all major retailers and bread producers in Sweden, while detailed supply data were provided by the bread supplier Saltå Kvarn. The company has allowed access to its data for the purposes of research without any anonymity conditions. The funding organizations took no part in execution of the study. The companies involved provided study cases and recorded data, but took no part in interpreting the data. The authors would like to thank the staff at all the companies involved for their help and cooperation.

Conflicts of Interest: "The authors declare no conflict of interest."

References

1. Eriksson, M.; Ghosh, R.; Mattsson, L.; Ismatov, A. Take-back agreements in the perspective of food waste generation at the supplier-retailer interface. Resources, Conservation and Recycling 2017, 122, 83-93.
2. Jensen, J.K.; Munksgaard, K.B.; Arlbjørn, J.S. Chasing value offerings through green supply chain innovation. European Business Review 2013, 25.2, 124-146.
3. Lehr, C.B.; Thun, J.-H.; Milling, P.M. From waste to value–a system dynamics model for strategic decision-making in closed-loop supply chains. International Journal of Production Research 2013, 51.13, 4105-4116.
4. Halldórsson, Á.; Kotzab, H.; Skjøtt-Larsen, T. Supply chain management on the crossroad to sustainability: A blessing or a curse? Logistics Research 2009, 1.2, 83-94.
5. Parfitt, J.; Barthel, M.; Macnaughton, S. Food waste within food supply chains: Quantification and potential for change to 2050. Philosophical Transactions of the Royal Society of London B: Biological Sciences 2010, 365.1554, 3065-3081.
6. Eriksson, M. Prevention and management of supermarket food waste: With focus on reducing greenhouse gas emissions. Doctoral thesis 119, Acta Universitatis agriculturae Sueciae, Swedish university of Agricultural Science, Uppsala, 2015.
7. Eriksson, M.; Strid, I.; Hansson, P.-A. Food losses in six swedish retail stores: Wastage of fruit and vegetables in relation to quantities delivered. Resources, Conservation and Recycling 2012, 68, 14-20.
8. Eriksson, M.; Strid, I.; Hansson, P.-A. Carbon footprint of food waste management options in the waste hierarchy–a swedish case study. Journal of Cleaner Production 2015, 93, 115-125.
9. Eriksson, M.; Strid, I. Svinnreducerande åtgärder i butik: Effekter på kvantitet, ekonomi och klimatpåverkan. Naturvårdverket: 2013.
10. Scherhaufer, S.; Schneider, F. Prevention, recycling and disposal of waste bread in austria; Thirteenth International landfill Symposium, Cagliari, Sardinia, 2011.

11. Lebersorger, S.; Schneider, F. Food loss rates at the food retail, influencing factors and reasons as a basis for waste prevention measures. Waste Management 2014, 34.11, 1911-1919.
12. Schneider, F.; Scherhaufer, S. Aufkommen und verwertung ehemaliger lebensmittel – am beispiel von brot und gebäck, boku, vienna. 2009.
13. Canali, M.; Östergren, K.; Amani, P.; Aramyan, L.; Sijtsema, S.; Korhonen, S.; Silvennoinen, K.; Moates, G.; Waldron, K.; O'Connor, C. Drivers of current food waste generation, threats of future increase and opportunities for reduction, fusions, bologna. 2014.
14. Göbel, C.; Langen, N.; Blumenthal, A.; Teitscheid, P.; Ritter, G. Cutting food waste through cooperation along the food supply chain. Sustainability 2015, 7.2, 1429-1445.
15. Canali, M.; Amani, P.; Aramyan, L.; Gheoldus, M.; Moates, G.; Östergren, K.; Silvennoinen, K.; Waldron, K.; Vittuari, M. Food waste drivers in europe, from identification to possible interventions. Sustainability 2016, 9.1, 37.
16. Mena, C.; Adenso-Diaz, B.; Yurt, O. The causes of food waste in the supplier–retailer interface: Evidences from the uk and spain. Resources, Conservation and Recycling 2011, 55.6, 648-658.
17. Darlington, R.; Staikos, T.; Rahimifard, S. Analytical methods for waste minimisation in the convenience food industry. Waste Management 2009, 29.4, 1274-1281.
18. Service, B.I. Preparatory study on food waste across eu 27. European Commission - DG Environment: Brussels, Belgium 2010.
19. Stenmarck, Å.; Jörgen Hanssen, O.; Silvennoinen, K.; Katajajuuri, J.-M.; Werge, M. Initiatives on prevention of food waste in the retail and wholesale trades. Nordic Council of Ministers: 2011.
20. Salhofer, S.; Obersteiner, G.; Schneider, F.; Lebersorger, S. Potentials for the prevention of municipal solid waste. Waste management 2008, 28.2, 245-259.
21. Aschemann-Witzel, J.; de Hooge, I.; Amani, P.; Bech-Larsen, T.; Oostindjer, M. Consumer-related food waste: Causes and potential for action. Sustainability 2015, 7, 6457-6477.
22. Elkington, J. Triple bottom-line reporting: Looking for balance. AUSTRALIAN CPA 1999, 69, 18-21.
23. Carter, C.R.; Rogers, D.S. A framework of sustainable supply chain management: Moving toward new theory. International Journal of Physical Distribution and Logistics Management 2008, 38.5, 360-387.
24. Hart, S.L.; Milstein, M.B. Creating sustainable value. The Academy of Management Executive 2003, 17.2, 56-67.
25. Ji, G.; Gunasekaran, A.; Yang, G. Constructing sustainable supply chain under double environmental medium regulations. International Journal of Production Economics 2014, 147, 211-219.
26. Lifset, R.J. Take it back: Extended producer responsibility as a form of incentive-based environmental policy. Journal of Resource Management and Technology 1993, 21.4, 163-163.
27. Lai, K.-h.; Wu, S.J.; Wong, C.W.Y. Did reverse logistics practices hit the triple bottom line of chinese manufacturers? International Journal of Production Economics 2013, 146.1, 106-117.
28. Atasu, A.; Van Wassenhove, L.N.; Sarvary, M. Efficient take-back legislation. Production and Operations Management 2009, 18.3, 243-258.
29. Scarlett, L. Product take-back systems: Mandates reconsidered. Center for the Study of American Business, Washington University: 1999.
30. Hu, S.; Dai, Y.; Ma, Z.-J.; Ye, Y.-S. Designing contracts for a reverse supply chain with strategic recycling behavior of consumers. International Journal of Production Economics 2016, 180, 16-24.
31. Kaipia, R.; Dukovska-Popovska, I.; Loikkanen, L. Creating sustainable fresh food supply chains through waste reduction. International Journal of Physical Distribution & Logistics Management 2013, 43.3, 262-276.
32. Hasani, A.; Zegordi, S.H.; Nikbakhsh, E. Robust closed-loop supply chain network design for perishable goods in agile manufacturing under uncertainty. International Journal of Production Research 2012, 50.16, 4649-4669.
33. VCMC. Cut waste , grow profit; Value Chain Management Centre, Canada, 2012.
34. Gustavsson, J.; Stage, J. Retail waste of horticultural products in sweden. Resources, Conservation and Recycling 2011, 55.5, 554-556.
35. Weeks, K.; Gao, H.; Alidaeec, B.; Rana, D.S. An empirical study of impacts of production mix, product route efficiencies on operations performance and profitability: A reverse logistics approach. International Journal of Production Research 2010, 48.4, 1087-1104.

36. Mottner, S.; Smith, S. Wal-mart: Supplier performance and market power. Journal of Business Research 2009, 62.5, 535-541.
37. DEFRA. Report of the food industry sustainability strategy champions' group on waste; Department for Environment, Food and Rural Affairs, London, 2007.
38. Rogers, D.S.; Tibben-Lembke, R. An examination of reverse logistics practices. Journal of Business Logistics 2001, 22.2, 129-148.
39. Stock, J.R.; Mulki, J.P. Product returns processing: An examination of practices of manufacturers, wholesalers/distributors, and retailers. Journal of Business Logistics 2009, 30.1, 33-62.
40. Priefer, C.; Jörissen, J.; Bräutigam, K. Technology options for feeding 10 billion people-options for cutting food waste. Institute for Technology Assessment and Systems Analysis 2013.
41. Buzby, J.C.; Hyman, J. Total and per capita value of food loss in the united states. Food Policy 2012, 37.5, 561-570.
42. Dillard, J.; Pullman, M.E.; Rogers, D.S.; Rogers, Z.S.; Lembke, R. Creating value through product stewardship and take-back. Sustainability Accounting, Management and Policy Journal 2010, 1.2, 133-160.
43. Tansey, G.; Worsley, T.; Dye Gussow, J. The food system. Food Policy-Economics Planning and Politics of Food and Agriculture 1996, 21.3, 337.
44. Anders, S.M. Imperfect competition in german food retailing: Evidence from state level data. Atlantic Economic Journal 2008, 36.4, 441-454.
45. Fofana, A.; Jaffry, S. Measuring oligopsony power of uk salmon retailers. Marine Resource Economics 2008, 23, 485-506.
46. Tretyak, O.; Radaev, V. Market power and relational conflicts in russian retailing. Journal of Business & Industrial Marketing 2013, 28.3, 167-177.
47. Peitz, M.; Shin, D. Upstream market power and wasteful retailers. The Scandinavian Journal of Economics 2013, 115.1, 234-253.
48. Strid, I.; Eriksson, M. Valorization of meat waste from retail stores - experiences from a pilot test. The 6th International Conference on Life Cycle Management, Gothenburg 2013.
49. Bakas, B.I.; Herczeg, M. Food waste; CORPUS, 2010.
50. Scholz, K.; Eriksson, M.; Strid, I. Carbon footprint of supermarket food waste. Resources, Conservation and Recycling 2015, 94, 56-65.
51. Willy:s. Concept hand book; Willy:s AB, Gothenburg, 2010.
52. SEPA. Food waste volumes in sweden, swedish environmental protection agency, stockholm; 2013.
53. Eriksson, M. Retail food wastage: A case study approach to quantities and causes. 2012.
54. Tromp, S.-O.; Haijema, R.; Rijgersberg, H.; van der Vorst, J.G.A.J. A systematic approach to preventing chilled-food waste at the retail outlet. International Journal of Production Economics 2016, 182, 508-518.
55. Ingram, J. A food systems approach to researching food security and its interactions with global environmental change. Food Security 2011, 3.4, 417-431.
56. Eriksson, M.; Pano, N.; Ghosh, R. Food chain sustainability in sweden; 1401-405X; Report No. 168, Department of Economics, Swedish University of Agricultural Sciences, 2016.
57. Ismatov, A. The sustainability implications of "product take-back clause" in supplier/retailer interface. 2015.
58. El-Ansary, A.I.; Stern, L.W. Power measurement in the distribution channel. Journal of Marketing Research 1972, 9.1, 47-52.
59. Cox, A.; Ireland, P.; Lonsdale, C.; Sanderson, J.; Watson, G. Supply chains, markets and power: Mapping buyer and supplier power regimes. Routledge, London: 2002.
60. Belaya, V.; Hanf, J.H. Managing russian agri-food supply chain networks with power. Journal on Chain and Network Science 2012, 12.3, 215-230.
61. Yeung, J.H.Y.; Selen, W.; Zhang, M.; Huo, B. The effects of trust and coercive power on supplier integration. International Journal of Production Economics 2009, 120.1, 66-78.
62. He, Q.; Ghobadian, A.; Gallear, D. Knowledge acquisition in supply chain partnerships: The role of power. International Journal of Production Economics 2013, 141.2, 605-618.
63. French, J.R.; Raven, B.; Cartwright, D. The bases of social power. Classics of Organization Theory 1959, 311-320.
64. Benton, W.; Maloni, M. The influence of power driven buyer/seller relationships on supply chain satisfaction. Journal of Operations Management 2005, 23.1, 1-22.

65. Maloni, M.; Benton, W.C. Power influences in the supply chain. Journal of Business Logistics 2000, 21.1, 49-74.
66. Williamson, O. Markets and hierarchies: Analysis and antitrust implications. New York: Free Press: 1975.
67. Granovetter, M. Economic action and social structure: The problem of embeddedness. American Journal of Sociology 1985, 91.3, 481-510.
68. Gulati, R. Does familiarity breed trust? The implications of repeated ties for contractual choice in alliances. Academy of Management Journal 1995, 38.1, 85-112.
69. Gulati, R.; Sytch, M. Exploring the effects of organizational interdependence on performance: The role of embeddedness and power. Research paper, Kellogg School of Management, Northwestern University, Evanston, IL 2005.
70. Kogut, B.; Zander, U. What firms do? Coordination, identity, and learning. Organization science 1996, 7.5, 502-518.
71. Cox, A. Understanding buyer and supplier power: A framework for procurement and supply competence. Journal of Supply Chain Management 2001, 37.1, 8-15.
72. Tokatli, N. Asymmetrical power relations and upgrading among suppliers of global clothing brands: Hugo boss in turkey. Journal of Economic Geography 2007, 7.1, 67-92.
73. Yaqub, M.Z. Antecedents, consequences and control of opportunistic behavior in strategic networks. Journal of Business & Economics Research (JBER) 2011, 7.2, 15-31.
74. Brown, J.R.; Lusch, R.F.; Nicholson, C.Y. Power and relationship commitment: Their impact on marketing channel member performance. Journal of Retailing 1996, 71.4, 363-392.