

Consumer Driven Sustainable Supply Networks

Katya Yatskovskaya *, Jagjit Singh Srail

Department of Engineering, University of Cambridge, Cambridge, UK

*ey232@cam.ac.uk, jss46@cam.ac.uk

Abstract

Supply chain sustainability is determined by various factors. Conventional drivers that promote sustainability in supply chains are determined by supply network stakeholders, including investors, regulators, and NGOs. In recent years consumers have been expressing increasing product traceability concerns, particularly in the food industry that has been influenced by food scandals. Consumer purchasing decisions become highly influenced by the environmentally responsible behaviour of the organisation (Crain, 2000). In order to satisfy customer environmental concerns, some organisations have started to adopt environmentally sustainable production and marketing standards (Polonsky et al., 2006). Thus, currently “consumers have a crucial role” (p. 2, Grunert, 2011) in developing sustainable food supply chains. This study explores the relationships between consumer sustainability demands and sustainable supply network design. The work incorporates extensive literature review to propose a conceptual framework. The latter has been tested through multiple case studies.

Keywords: Sustainable Supply Network; Food supply Chain; Consumer Behaviour

1. Introduction

During the last century, food production practices experienced major transformation. Growing urbanisation, industrialisation, and globalisation accompanied mass food production. Agricultural production significantly “increased through industrial upscaling and associated technological developments” (p.2, Coff et al., 2008). This brought about rapid long-distance transportation of food products utilising refrigeration and canning. The face-to-face buyer-supplier relationship declined. Currently food is grown in one region, processed in another, and sold to the consumer elsewhere. The number of intermediaries, such as shippers, wholesalers, processors, repackers, brokers, importers, and exporters that are involved in the process rapidly increased. Industrialisation and globalisation fundamentally changed product design, food processing practices, and brought new risks into the food production chain (Coff et al., 2008). The outbreak of bovine spongiform encephalopathy (‘mad-cow’ disease) in the UK (1990s), contamination of Perrier water with benzene (1990s), the alte Fleisch Skandal (2005) relating to the waste from slaughter houses only intended for animal feed that instead reached the human population, the baby formula scandal in China (2008), and the horsemeat scandal in the UK (2013) are some examples that show how food production systems become obscure. Such scandals create mistrust in modern food systems and increase the importance of food supply chain (FSC) traceability and transparency (Plonsky et al., 2006).

Current studies indicate that consumers in countries such as the USA and the EU are becoming more aware of environmental behaviour of food producers (Polonsky et al., 2006). A recent attitudinal survey by the European commission (2006) shows that 60 % of the population in Europe is concerned about animal welfare. 78 % of the respondents in the US are worried about pesticides and hormones in food products. 57 % of respondents showed concerns over wasted fuel (Zepeda and Deal, 2009). Organic and local food consumer choices have grown significantly in the last few decades. For instance, organic production in the UK has risen dramatically from 100,000 ha (1998) to 741,000 ha (2003) (OF&G, 2017). Food traceability has become not only driven by regulatory frameworks - since 2005 EU law has required certain traceability levels in all food operations - but also by consumer behaviour. Consumers have now acquired a leading role in influencing food supply chain (FSC) sustainability, rewarding more sustainable food production and similarly punishing less sustainable alternatives by the choices they make when buying food (Grunert, 2011). FSC actors started voluntarily implementing traceability schemes, such as quality assurance in their business strategies through sufficient labelling, reporting, and marketing (Coff et al., 2008). Some food producers went further, reconfiguring their FSCs by shortening their SCs, implementing new technologies and information systems, and changing their product structures.

This work argues that whilst there are a great number of studies aimed at explaining sustainable consumer choices and sustainable SC development separately, there is still a lack of conceptual work encapsulating both of these aspects. The current work makes an attempt to bridge this gap proposing a framework that links upstream and downstream FSCs, including consumer sustainability choices and barriers and producer sustainable actions responding to such enquires. The study is organised as follows: section 2 discusses current theories deployed in studying consumer and producer sustainable behaviour; section 3 focuses on conceptual framework development; in section 4 empirical work has been conducted to test how multinational organisations respond to consumer

pressures through sustainable supply network configuration; section 5 outlines the main findings of the study for academic and practitioner communities.

2. Literature review

SC sustainability has become a prominent topic in industrial countries in the last few decades. “As global awareness of environmental problems has grown, consumers have become the crucial factor in promoting green designs” (p. 381, Bask et al., 2013). Consumers have become more aware regarding product offerings. They are no longer concerned about the physical features of the product but are rather interested in the raw materials origin and where and how production processes take place.

According to Padel and Foster (2005) the retail market of organic produce in the EU is currently experiencing growing consumer demand. This trend is attributed to a response to widespread food security concerns, including the introduction of genetically modified products, utilisation of pesticides and hormones when growing crops, and obscure food supply chains (Zepeda and Deal, 2009). The studies by Zepeda and Deal (2009) and Coff et al., (2008) are focused on identification of the main elements influencing sustainable consumer behaviours in FSCs. These include avoidance of soil degradation, promotion of animal and farmer welfare (fair trade), reduction of the fuel associated with transportation, guarantees of product quality and flavour, support of the local economy / producers, and guaranteed product traceability. These works also examine barriers for the adoption of sustainable behaviours by consumers, including price, a lack of knowledge / reliable information / trust regarding food systems, cynical attitudes towards labels, a large number of intermediaries, long transportation distances of food that can change its quality significantly, and anti-corporate behaviour. Evidently, social and environmental aspects associated with the entire product value chain becomes increasingly important for consumers and for producers to address (Bask et al., 2013).

A number of studies focus on the importance of the product’s sustainability aspects that determine consumer purchase decisions. The study by Lamming and Hampson (1996) shows that the purchasing decision of 75 % of surveyed consumers in the USA is directly affected by a company’s environmental reputation. In the UK 87 % of respondents cited the importance of the product environmental impact disclosure, of which 88 % emphasised the importance of better environmental labelling to enable more informed purchasing decisions. The study by Moon et al. (2002) shows that 28-45 % of consumers are ready to pay premium for eco-food. 13-18 % of Danish consumers are happy to pay for sustainable eco-label toilet paper and 30 % extra for sustainable washing machine (Bask et al., 2013). A recent study shows that 43 % of consumers prefer retailers with sustainable delivery options and 53 % of the respondents “are planning to use less direct home delivery in the near future” (CILT, 2019). According to a retail and e-commerce delivery study conducted by YouGov in the UK, 43 % of consumers said that they are more likely to shop with a rival retailer if they offer a wider range of sustainable delivery options and 26% of British consumers claimed that they are likely to buy from a retailer that uses electric vehicles (Parcelhub, 2019). 59 % of respondents utilise trip chain delivery option that combines multiple tasks in a single journey. In order to address such sustainability inquiries from consumers, retailers increasingly adopt software such as Microlise allowing them to optimise factors such as speed, location, and road traffic levels in real time coordinating the delivery. For instance, Yodel has already reached a 7 % improvement in fuel efficiency since the adoption of such technology. Going forward with sustainable delivery options Royal Mail have introduced electro-trikes (e-Trikes) that offer pedal and battery power for their greener delivery options, while Yodel is expanding its urban bicycle delivery offering (Parcelhub, 2019). Industrial examples and recent academic studies show that there has been a growing interest in such sustainable supply chain (SSC) design with an emphasis on addressing social and ecological effects in the business environment (Yatskovskaya and Srai, 2017). SSC management helps organisations to adjust to the constantly changing corporate environment leading to long-term or short-term sustainable competitive advantages (Beske et al., 2014). Conventionally, a firm’s motivation for introducing sustainability into SCs was driven by pressure from its stakeholders and investors. Later, realisation that production processes are highly dispersed around the globe made businesses aware that the product often comes with the environmental and social burden incurred during different stages of production. Consumers increasingly became a driver for organisations to mitigate such burdens by adopting SSC management practices.

Scholars have developed different terms to describe environmental sustainability. Green supply chain was used by Srivastava (2008). Close-loop and reverse close-loop supply chain systems were defined by Defee et al. (2009). Studies has been focusing on sustainable product design, sourcing and material management, resources and waste reduction, life-cycle assessment, product traceability, and end-of-life management (Bask et al., 2013). A number of studies focused on informed consumer choices in relation to consumer education regarding the source of their food, the impacts of different production, and sustainable actions the firm takes through packaging, labelling, and marketing campaigns (Agi and Nishant, 2016). Some of the studies suggest that SSC design starts with the customer. However, there is still a lack of research that tries to incorporate consumer perception of sustainability into an operational set of features (Bask et al., 2013). There is also a gap in understanding of how SC design can respond to consumer sustainability requests. In the next section of this work a conceptual framework that links consumer sustainability perception and supplier sustainability response is developed.

3. Method

3.1. Framework development

This work adopts Value-Belief-Norm (VBN) theory (Stern et al., 2000) that explains consumer sustainability behaviour and includes elements of value theory, the new ecological paradigm (NEP), and norm-activation theory that are all rooted within the context of environmentalism within the field of consumer psychology (Zepeda and Deal, 2009). Value theory states that values underline actions, while NEP theory suggests that limited growth should be balanced with nature. Norm activation theory argues that moral norms are activated when individuals become aware of the consequences of their actions and that these consequences can be averted by their responsible actions. As such VBN theory states that values determine beliefs, which in turn affect norms, and as a result this determines the behaviour of an individual. For instance, a study by Zepeda and Deal (2009) shows how health and environmental belief explains organic food purchase. Following these theoretical underpinnings, the current study explores consumer perception of sustainability that is further incorporated in the FSC design. The current work integrates VBN with sustainable supply chain (SSC) configuration theory.

Sustainable supply chain (SSC) configuration theory is focused on the SSC strategies adopted by the firm in order to address social and environmental pressures (Yatskovskaya and Srail, 2017). SSC are complex and interdependent groupings of entities and the relationships between these entities. These entities involve a network of suppliers and customers (Chopra and Meindl, 2004). Adapting to the continuously changing environment, elements such as system structure, dynamic design, and coordination and interaction among entities should be considered together with organisational strategy when adapted to the external environment (Srail and Gregory, 2008).

The current work adopts the SSC strategies proposed in the Organic farmers and growers policy study (2017), which include: (1) **avoidance strategy** that incorporates the spacial and temporal placement of infrastructural elements and production activities that avoid certain environmental or social impacts; (2) **minimisation strategy** that reduces the duration and intensity of the environmental and social impacts that cannot be completely avoided; (3) **rehabilitation/conservation strategy** that ensures that measures are taken to improve degraded ecosystems after/when avoidance and minimisation strategies are not possible. These strategies include restoration of degraded habitat and protection of scarce resources.

Further, in order to support SSC strategy, the firm develops SSC configuration strategies (Morash, 2001) that incorporate combinations of various SSC configurational attributes. Configurational attributes are referred to as the structural unit of the SC that undergoes changes leading to the whole SSC system reconfiguration. The SC configuration concept originates in the strategic management field and has been applied to firm strategy level (e.g., market and resources) and in the organisation structure (e.g. levels of centralisation, co-ordination mechanisms, matrix structures), process, and context (Srail and Gregory, 2008). Configuration is seen as part of strategy formation (Srail and Gregory, 2008). Generally, configurations can be described as a tight constellation of mutually supportive elements that can be calibrated and permuted in order to meet a revised set of organisational objectives (Srail and Gregory, 2008). The increased role of consumers has resulted in changes in product characteristics, specifications, and structure and process designs (Chandra and Grabis, 2007). Influenced by consumer sustainability demand the firms improve and reform existing design and develop new designs of organisational processes (Chandra and Grabis, 2007) by creating new short distribution channels for organic produce, re-localising SCs, developing connections between consumers and growers, acquiring new information channels, and adopting new technological advancements (OF&G, 2017; Seyfang, 2006). Hence, a comprehensive perspective of SSC configuration driven by consumers has not been addressed in the operations management field yet (Srail et al., 2013).

This work adopts a categorisation of the SSC configurational attributes proposed by Srail et al. (2013) and Yatskovskaya and Srail (2019). These SSC configurational attributes include:

- **SSC structure** incorporates elements such as tier structure, location, capacity, role of the facility in the SC, and SC members. The identified examples of such attributes in the consumer sustainability driven context include new distribution channels designed to bypass supermarkets, localised sourcing and distribution, and shortening SCs.
- **SSC product** includes dimensions such as product architecture, product modularity, product innovation, product volume, product life cycle, etc. The identified examples of such attributes in the consumer sustainability driven context include adoption of sustainable materials (organic and environmentally friendly ingredients), recyclable packaging, and sustainable product design.
- **SSC unit of operation** incorporates technology enabled elements, such as process design, reuse of resources, remanufacturing, reverse logistics, product recovery, etc. The SSC unit of operation attribute includes the information and resource flows between SC parts. The identified examples of such attributes in the consumer sustainability driven context include information channels that enable consumers to form informed decisions about the product (e.g. eco labelling, sustainability reporting), software systems (e.g. blockchain and RFID technologies) that help to enhance traceability, sustainable delivery options (e.g. electric vehicles, bicycles, postponed deliveries, consolidated deliveries, click and collect and store kiosk

options), sustainable cultivation (e.g. minimisation/avoidance of pesticides and fertilisers, animal welfare, fair-trade, reduction of the emissions associated with production/transportation) and manufacturing processes (e.g. close-loop, reverse osmosis, waste/resource/material minimisation, material efficiency, waste recovery systems).

- **SSC coordination and governance** includes consideration of relational forms of governance, roles of SSC partners, and coordination mechanisms. The identified examples of such attributes in the consumer sustainability driven context include developing buyer-supplier relationships that directly connect food grower with consumer.

The work integrates SSC strategies with SSC attribute categorisation determined by consumer sustainability enquiries within the food supply chain (FSC) context to propose a conceptual framework (Figure 1).

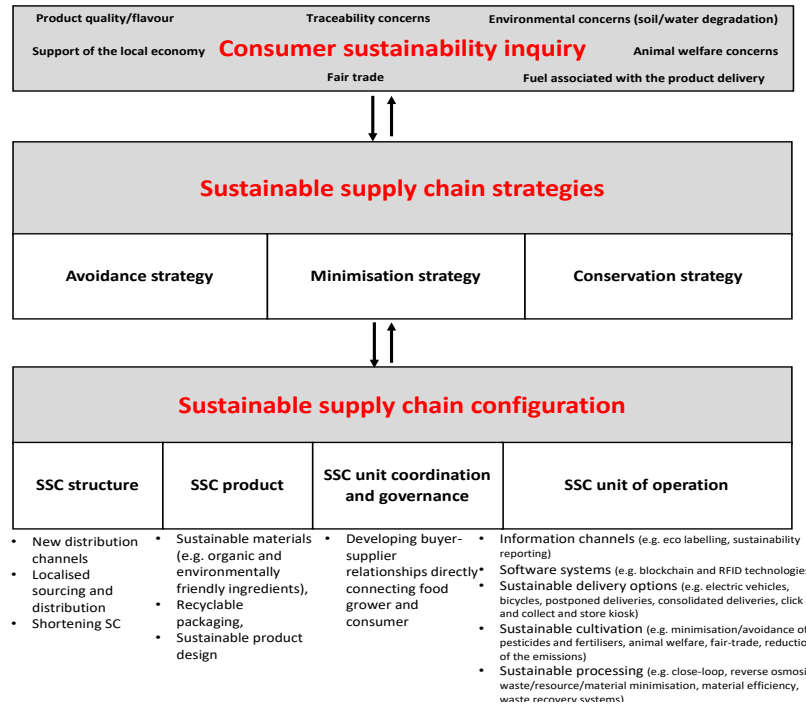


Figure 1. Conceptual framework.

3.2. Framework testing

In order to test the proposed conceptual framework a multiple case study method was utilised. The case study approach was chosen due to the exploratory nature of the study. Five case studies with multinational manufacturing companies from three industry sectors, including food and beverage, apparel, and pharmaceuticals, were selected. The case studies were informed by: (1) the resource constrained environment in which they operate, (2) environmental problems that are associated with their SCs, and (3) sustainability inquiries they make to address environmental challenges, which are further communicated to consumers. All selected firms and their extended SCs operate in water stressed environments. Semi-structured interviews and plant visits with thirteen senior sustainability managers and directors were conducted (Table 1).

Table 1. Data collection

Case	Company	Industry	Contacts	Abbreviation
B1	Alcoholic beverage	Food and beverage	<ul style="list-style-type: none"> Sustainability executive. Global senior director corporate responsibility Director, International Water Resources Environmental sustainability plant engineer 	GSDCR DIWR ESPE
F1	Food	Food and beverage	<ul style="list-style-type: none"> Global Sustainability Senior Manager Global sustainability programme manager Health and safety environmental plant manager Global sustainability sourcing manager 	GSM GSPM GSSM HSPM
Ap1	Apparel	Apparel	<ul style="list-style-type: none"> Global sustainability responsible manager Global environmental manager - production 	GSRM GEMP
Ap2	Apparel	Apparel	<ul style="list-style-type: none"> Sustainability academic director 	SAD
Ap3	Apparel	Apparel	<ul style="list-style-type: none"> Head of sustainability and logistics Production sustainability specialist 	HSL PSS
P1	Pharmaceuticals	Pharmaceutical	<ul style="list-style-type: none"> Environmental sustainability manager 	ESM

Due to a non-disclosure agreement, the company and the identity of the interviewee were kept anonymised. Qualitative coding was used to analyse the interviews. Thematic analysis was used to identify relevant topics emerging from the data. Through two iterations of coding, the elements of the framework were refined. The results of the analysis are presented in the following section.

4. Discussion

During the exploratory case studies, the proposed framework testing took place. As a result, consumer sustainability perception was linked to SSC configurational attributes supported by SSC strategies. The case studies were designed to answer the question, “how does engagement with consumers help organisations to mitigate water scarcity?”.

The results of the case studies indicate that food and beverage companies B1 and F1 are adopting a **SSC minimisation strategy** focusing on SSC unit of operation configurational attributes by innovating “sustainability into the most recent marketing campaign and television slots. So, that certainly touches customers and try to keep well-advised of what customers are looking for and are interested in” (GDCR, B1). For instance, this includes commercials talking about solar panels, water reductions, and landscaping changes. F1 promotes its work conducted on rice cultivation and processing through marketing tools such as installation of “*in-store big banners, which indicates how many cups of water are used to grow the rice...[and] we also tried to [educate] consumers how to cook rice using less water*” (GSSM, F1)

All considered apparel manufacturers persuing **minimisation strategy** develop SSN unit of operation configurational attributes, focusing on information channels, informing and engaging consumers in sustainable actions, including smart care labels.

[we calculate] “how much water has been used on each of the pair [of jeans] and disclosing the environmental KPI through transparency for the customer. We will convey those as how much water has been used in this product to the customer” (GSRM, Ap1)

While Ap3 extends this, utilising communication channels with consumers enabled by SSC unit of operation configurational attributes, incorporating consumer sustainability demands into the SSC product design:

“We have interface of designing strategy for consumer communication, with sustainability as an input” (HSL, Ap3)

Influenced by SSC minimisation strategy pharmaceutical company, P1, educate their consumers through a patient information leaflet that details amounts of water required to take with medication.

All analysed companies stated that they also use either internal or external information channels, e.g. sustainability reporting, in order to disclose sustainability actions. For instance, B1 utilises the Dow Jones Sustainability Index and Global Reporting Initiative (GRI). F1 uses its internal reporting system “Principles in Action and annual reporting of how the business performed against our sustainability objectives” (H&SPM, F1). Ap1 and Ap3 disclose their sustainability progress utilising external reporting systems, such as GRI, United Nations Global Compact Index, and Carbon Disclosure Project (CDP). P1 and Ap2 employ a combination of internal and external reporting tools.

The only company that follows **avoidance strategy** is F1. Adopting this strategy, the firm has developed SSC structure configurational attribute localising its SCs in a water abundant region:

“In the UK JD Wetherspoon has a programme about 100% British. [Participating in this programme], all of our growers are [now] 100% British growing 100% British barley” (GSDCR, B1)

The case study shows validity of the proposed framework in linking consumer sustainability inquires to SSC design.

5. Conclusion

The work contributes to Supply Chain Theory development from a consumer driven SSC configurational perspective. A proposed conceptual framework for SSC configuration in order to respond to a consumer sustainability enquiry, provides theoretical and practitioner insights to emerging operational solutions for SSC development.

References

- Agi, M.A.N., Nishant, R., 2017. Understanding influential factors on implementing green supply chain management practices: an interpretive structural modelling analysis. *Journal of Environmental Management*, Vol. 188, pp.351–363.
- Bask, A., Halme, M., Kallio, M., Kuula, M., 2013. Consumer preferences for sustainability and their impact on supply chain management. *International Journal of Physical Distribution and Logistics Management*, Vol. 43, pp. 380–406.
- Beske, P., 2012. Dynamic capabilities and sustainable supply chain management. *International Journal of Physical Distribution and Logistics Management*, Vol. 42, No. 4, pp. 372–387.

- Chandra, C., Grabis, J., 2007. *Supply Chain Configuration-Concepts, Solutions and Applications*. Springer, New York.
- Chopra S., Meindl P., 2004. *Supply Chain Management – Strategy, Planning, and Operation*. Pearson.
- Coff, C., Korthals, M., Barling, D., 2007. Ethical traceability and informed food choice. In: Coff, C., Barling, D., Korthals, M., Nielsen, T. (eds) *Ethical traceability and communicating food*. Springer, Dordrecht.
- Crane, A., 2000. Facing the backlash: Green marketing and strategic reorientation in the 1990's. *Strategic Marketing Journal*, pp. 227–296.
- Defee, C.C., Esper, T. Mollenkopf, D., 2009. Leveraging closed-loop orientation and leadership for environmental sustainability. *Supply Chain Management International Journal*, Vol. 14, No. 2, pp. 87–98.
- Grunert, K., 2011. Sustainability in the food sector: a consumer behaviour perspective. *International Journal on Food System Dynamics*, Vol. 2, No. 3, pp. 207–218.
- Lamming, R., Hampson, J., 1996. The environment as a supply chain management. *British Journal of Management*, Vol. 7, pp. S45–S62.
- Moon, W., Florkowski, W. J., Bruckner, B., Schonhof, I., 2002. Willingness to pay for environmental practices: Implications for eco-labeling. *Land Economics*, Vol. 78, No. 1, pp. 88–102.
- Morash, E.A., 2001. Supply chain strategies, capabilities, and performance. *Transportation Journal*, Vol. 41, pp. 37–54.
- OF&G, 2017. *An Organic Systems Approach to the Provision of Public Goods*. Available at: <<https://assets.ofgorganic.org/of-g-policy-epaper-dec17-systems-and-public-goods.31u3kg.pdf>> (accessed 30.08.2019).
- Padel, S., Foster, C., 2005. Exploring the gap between attitudes and behaviour – understanding why consumers buy or do not buy organic food. *British Food Journal*, Vol. 107, No. 8, pp. 606–25.
- Parcelhub, 2019. Is Sustainability a New Loyalty in Retail and eCommerce Delivery? <Available at: <https://www.parcelhub.co.uk/blog/is-sustainability-the-new-loyalty-in-retail-and-ecommerce-delivery/>> (accessed 30.08.2019).
- Polonsky, M., Bhaskaran, S., Cary, J., Shadwell, F., 2006. Environmentally sustainable food production and marketing: opportunity or hype? *British Food Journal*, Vol. 108, No. 8, pp. 677–690.
- Srai, J.S., Alinaghian, L.S., Kirkwood, D.A., 2013. Understanding sustainable supply network capabilities of multinationals: a capability maturity model approach. *Proc IMechE, Part B: J Engineering Manufacture*, Vol. 227, No. 4, pp. 595–615.
- Srai, J.S., Gregory, M.J., 2008. A supply network configuration perspective on international supply chain development. *International Journal of Operations and Production Management*, Vol. 28, No. 5, pp. 386–411.
- Stern, P.C., 2000. Toward a coherent theory of environmentally significant behaviour. *Journal of Social Issues*, Vol. 56, No. 3, pp. 407–424.
- The Chartered Institute of Logistics and Transport (CILT), 2019. *Half of UK Consumers would only Support Retailers with Sustainable Delivery Options in Future*. Available at: <<https://ciltuk.org.uk/News/LatestNews/ArtMID/6887/ArticleID/22079/Half-of-UK-consumers-would-only-support-retailers-with-sustainable-delivery-options-in-future>> (accessed 30.08.2019).
- Yatskovskaya, E., Srai, J., 2017. Developing a dynamic capabilities approach to risk mitigation strategies driven by water scarcity. In: *Proceedings to the 24th EurOMA Conference*, Edinburgh, UK.
- Zepeda, L., Deal, D., 2009. Organic and local food consumer behaviour. Alphabet theory. *International Journal of Consumer Studies*, Vol. 33, pp. 697–705.