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Building up resilience in agricultural supply chains: towards an integrated approach

Anne Tallontire, Bob Doherty,
Chee Yew Wong, William Young, Mike Tse,
Severine Saintier, Zoe Ollerenshaw,
Mina Said-Allsopp, Corrado Topi, David Oglethorpe

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Sustainability Research Institute (SRI), School of Earth and Environment,
The University of Leeds, Leeds, LS2 9JT, United Kingdom

Tel: +44 (0)113 3436461
Fax: +44 (0)113 3436716

Email: SRI-papers@see.leeds.ac.uk
Web-site: http://www.see.leeds.ac.uk/sri

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Building up resilience in agricultural supply chains: towards an integrated approach

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Email: a.m.tallontire@leeds.ac.uk

Contents

Abstract

There is a growing interest in the resilience of agri-food supply chains. Questions are emerging regarding the features of a resilient supply chain and how one can enhance resilience, particularly with respect to food production and supply given the 'perfect storm' facing the nexus between food, climate, energy and water. As with many buzz words, it is apparent that the term "resilient supply chain" is used in different ways, with different assumptions, scopes and objectives, and in ways that potentially may be incompatible.

This paper is based on both a systematic literature review (SLR) and a multi-stakeholder workshop. Our analysis of the academic literature highlighted a gulf in understanding of resilience in the context of agri-food supply chains between academic disciplines, especially between the social-ecological and the supply chain literatures in terms of what resilience along a whole supply chain may mean, suggesting a large research gap. Moreover, our engagement with practitioners has highlighted a gap between the academic literature and thinking and practice among various stakeholders (companies, NGOs etc.) at different parts of the food supply chain. We aim to build up a shared understanding of resilience in agricultural supply chains and set an agenda for inter-disciplinary research that enhances the ability to build up resilience in this context.

Future research on resilience needs to consider the appropriate focus of analysis (resilience for whom, incorporating views and needs both upstream and downstream in the supply chain), to adopt a dynamic approach that engages with non-linear processes of environmental and societal change and should also incorporate governance as well as other legal and regulatory tools and understanding of power relations.

Key words: [resilience; supply chains; food; agriculture].

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About the Authors

Anne Tallontire and William Young are in SRI, University of Leeds, Chee Yew Wong and Mina Said are at Leeds University Business School, Bob Doherty and Mike Tse are in York Management School, Corrado Topi is at the Stockholm Environment Institute, York; David Oglethorpe is at Sheffield University Management School, Zoe Ollerenshaw is in the School of Law, University of Sheffield and Severine Santier is at the Law School at the University of Exeter.

1. Introduction

Currently there is a growing interest in the resilience of agri-food supply chains. For example, questions are emerging regarding the features of a resilient supply chain and how one can enhance resilience, particularly with respect to food production and supply given the 'perfect storm' facing the nexus between food, climate, energy and water (Beddington, 2009). The new UN Sustainable Development goals state in goal 2 (of 17) the need for resilient agricultural supply chains to aid in achieving food security and sustainable agriculture (United Nations 2014). As with many buzz words, people use the term resilience differently, with different assumptions, scopes and objectives, and in ways that potentially may be incompatible. Furthermore, it seems to us that the evolution of the concept of resilience has involved a series of refinements, even within individual disciplines. As such, resilience can be regarded as an important 'boundary object': a concept that can be used to bridge across different academic communities to address a common problem (Wenger 1988).

Our analysis of the academic literature on resilience, food and supply chains has highlighted a diversity of understanding regarding resilience in a supply chain context (e.g. logistics and supply chain management compared to social-ecological studies). Moreover, our engagement with practitioners, particularly through a multi-stakeholder workshop, has highlighted a gap between published academic literature and both commercial and NGO thinking and practice. Through our analysis of the literature and stakeholder engagement we aim to build up a more integrated understanding of resilience in the context of agricultural supply chains and set an agenda for inter- and /or multi-disciplinary research that enhances our ability to build up resilience in agricultural supply chains.

In this paper we explore the ways in which resilience with respect to agricultural supply chains has been addressed in the academic literature, and also relate this to emerging policy and practitioner debates. The key questions that we address include: Which disciplines have something to say about resilience, especially in the context of agri-food supply chains? How do they conceptualise resilience? Is there some consensus across disciplines? How has resilience in the context of supply chains been addressed in the academic literature? Based on our responses to these questions we highlight the need for an integrated approach to better understand the characteristics of resilience in the context of supply chains and how resilience can be built up in agri-food supply chains.

The paper is structured as follows. First we discuss the method and overall approach, including the use of both a systematic literature review (SLR) and multi-stakeholder workshop. Secondly, we provide an overview of the concept of resilience. Thirdly, the papers identified via the SLR are discussed under two broad headings: business

and political economy. Before evaluating the findings of the SLR, we present a brief summary of the workshop, reflecting on the differences between what we found in the literature compared to the practitioner perspectives. Our conclusions reflect on the large gulf between literatures that engage with resilience in a supply chain context and consider some ways that may bridge these gaps, including literatures that, to date, have had little to say about resilience but provide broad and critical perspectives on supply chains. As part of this bridge, we introduce a legal perspective that was absent from the literature review which, together with revisiting resilience definitions, helps bridge some of the differences between, for example, the broad global value chains perspective and the rather narrow confines of supply chain management. This approach could help engage minds on resilience challenges and provide ways forward in developing an integrated approach.

2. Methods and approach

The method used to construct this paper comprises of four different stages. The first involved an inter-disciplinary team coming together from three different UK universities (York, Leeds and Sheffield) and six different departments/schools (two Earth and Environment Schools, two Business and Management schools and two Law Schools) to secure funding from the White Rose consortium (http://www.whiterose.ac.uk/about/) to investigate resilience and sustainability in agri-food supply chains.

After initial meetings, a second stage of research based on SLR of titles and abstracts using bibliographic databases, EBSCO Host & PROQUEST focusing on key search terms: resilience, food and supply chains was carried out. This stage identified a total of 251 relevant articles, the majority of which were in business journals, particularly in the areas of logistics/supply chain management, but also in sustainable business and food systems, as well as papers that engaged with resilience from a social-ecological perspective (see figure 1 below). There were also articles from development, policy and agricultural journals. The search started with resilience and supply/value chains, and was further refined, specifying agriculture and food (and then some categories of food, including tea and coffee). The articles found were concentrated in the disciplines of; supply chain management/ logistics/production, sustainable business and sustainable agricultural systems including; international development, political ecology, and rural development, sociology, food and economics. Figure 1 below shows the number of articles reviewed by subject type.

Perhaps unsurprisingly, the literature review was dominated by logistics, supply chain and production management literatures. Nonetheless, resilience is touched upon in some ways by a wide variety of other disciplines, although the utility of such articles was questioned, given the limited way in which they captured supply chains, or even markets.

Furthermore, despite our expectations that it would form a bridge between the business and ecological literature, resilience played a peripheral role in the sustainable business or sustainable supply chains literature.

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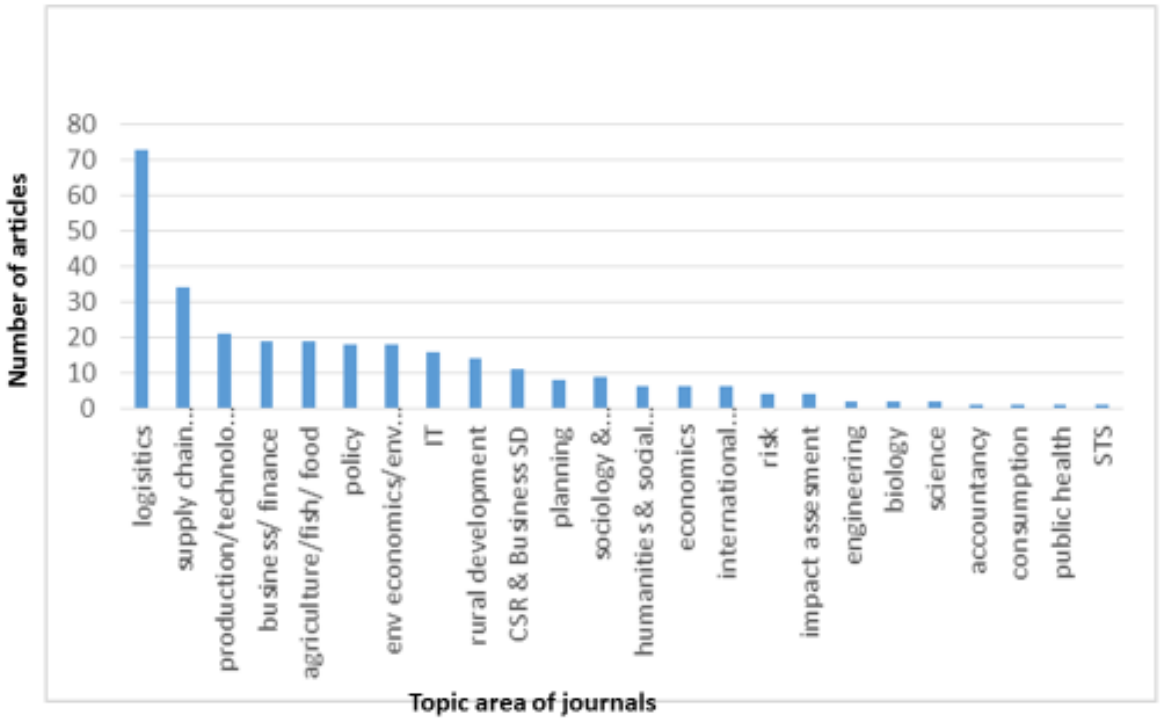
Figure 1- Number of articles by subject type from the Systematic Literature Review (SLR)



The third stage was to explore the definitions of resilience adopted in the articles and to consider how they approached this topic. Examination of the abstracts revealed that fewer explicitly addressed resilience than may be expected given the large number of articles overall. Amongst those that did, a number of key themes emerged from this closer analysis of the articles and it became clear the literature related to the review was focused on two main contrasting bodies of literature, specifically:

a) Business (logistics/supply chain and sustainable business) and

b) A Political Economy view of sustainable agricultural systems which incorporates global value chain analysis and commodity chains or networks and food systems.

The business literature articles cover resilience in some depth, whereas in most of the political economy literature articles resilience was less central and in some cases how resilience was defined was not clear. The approach to resilience in the business literature can be broadly characterised as reactive, focused on efficiency and returning the supply chain to equilibrium. In contrast, the body of literature that drew on a political economy approach tended to be more centred on social and environmental justice (including ethics,

the value of local ecosystems and rights of different groups, such as workers, producers or communities). There were also some articles that drew on a social-ecological systems approach, which did not speak to supply chains, but helped us better appreciate distinctions between the business and political economy approaches, and which we incorporated into the section on definitions of resilience.

Stage four of our approach was to test the ideas and themes emerging from the SLR in a multi-stakeholder workshop. This took place in March 2014 with 28 stakeholder participants including:

- Four major UK supermarket representatives in supply chain management roles;
- Five global brand food manufacturers and supplier representatives;
- Two farmer producer leaders from East Africa who manage tea cooperatives in Kenya and Tanzania;
- Eight non-governmental organisations with interest in agricultural supply chains;
- Six academics and government researchers, two consultants and a lawyer.

The supermarkets were chosen based on their leading market position in the UK and contrasting approaches to managing supply chains. The manufacturers were chosen to represent a number of sectors but to also provide an international perspective. The producer leaders were invited to offer the small-holder farmers' perspective and their presence was facilitated by the research team's industry contacts. The NGOs were selected based on their previous interest in supply chains and associated issues and the academics due to their international reputations for research in this area.

The aim of the multi-stakeholder workshop was to firstly present the results of the SLR, thus sharing current academic knowledge on the resilience of food supply chains. This workshop also involved discussion sessions on the challenges and tensions of developing resilience in supply chains, how to build-up resilience, properties of resilience and future areas for joint research projects.

Before discussing the literature that engages with resilience, specifically in a supply chain context, we explore some key definitions of resilience which we then use to consider how these different definitions are applied in the context of agricultural supply chains.

3. Definitions of resilience

The term resilience is used in an increasing number of disciplines, but two approaches have emerged as most significant to framing our discussions: classical and dynamic interpretations.

The first approach has been described as the classical interpretation of the concept, or the engineering perspective. In this interpretation, resilience refers to how quickly a

material or system returns to a steady state, or equilibrium, after a stress or disturbance.[1] This has been influential in logistics and also disaster preparedness, and tends to emphasise the importance of protecting infrastructure against extreme manmade, (e.g. terrorist attacks), or natural events, (e.g. climate related events), or 'the need to develop resistance and foster recovery in response to extreme events' (Béné et al. 2014a). This approach has often become mainstream, particularly in international policy making circles. For example, the literature refers to resilience to climate change of the economy of a city or a nation as the ability of their economic system to work as before under changed climatic conditions, (i.e. as if it was unaffected by changes in the external conditions). This approach could be considered to be about resistance or robustness, and offers few opportunities for transformation.

The second approach offers a more complex and nuanced definition of the term resilience, which integrates the idea of dynamic systems which move between pseudo equilibrium states. This novel approach emerged from ecology, and latterly social-ecological thinking and refers not to a single equilibrium or state but to multiple equilibria and puts an emphasis on non-linear, complex systems thinking. Analysts of social-ecological systems (SES) see resilience as a dynamic process; the system may change when certain thresholds or tipping points are reached, creating a new equilibria and resilience is the ability of the system to return not to the original state, but a new equilibrium where the key functions of the system are still delivered (Béné et al., 2014b). This definition emerged from efforts to manage systems that were dynamic and did not respond as predicted to 'command and control' approaches. For example, the 'maximum sustained yield' approach to fisheries and conventional forest management in the face of certain pests was found wanting, leading to calls for more adaptive management processes (Leach et al., 2010).

When applied to a community, this approach to resilience refers to the ability, capability or capacity of individuals, social groups and social–ecological systems to live with disturbances, adversities or disasters. The focus on adaptive capacity highlights the importance of learning to thinking in resilience terms, and also the importance of enhancing diversity (Obsrist et al., 2010; Robinson and Berkes, 2011). Whilst there are a number of shared principles within SES resilience thinking, there are at least three ways in which the concept is used in this field, as identified by Domptail et al., (2013).

The first way is to see resilience as opposite to vulnerability, whereby to become resilient is to overcome vulnerability. Whilst reducing vulnerability is an important part of resilience, Domptail et al. (2013) suggest this approach is too simple and linear and neglects

[1] A dictionary definition from Merriam-Webster (2007) of the engineering understanding of resilience is provided by Petit, Fiksel and Croxton (2010: 3): "the tendency of a material to return to its original shape after the removal of a stress that has produced elastic strain".

the systems dimension of resilience; moreover Obrist et al. (2010) suggest that vulnerability and resilience are complementary concepts rather than part of the same process. The second definition focuses more on the system and relates to the capacity to 'experience shocks while retaining essentially the same function, feedbacks and therefore identity' (Domptail et al., 2013: 31). In this view, resilience is the 'ability to tolerate disturbance without shifting into a qualitatively different state that is controlled by a different set of processes' (Robinson and Berkes, 2011: 1186), an approach typified by the Resilience Alliance[2]. The third, stricter definition is where the system is able to maintain both structure and function (Holling, 1973; Gunderson and Holling, 2002), in a way that is not dissimilar from the engineering definition of resilience we discussed earlier.

Before engaging more fully with the literature on resilience in the context of agricultural supply chains it is important to create a distinction between the concept of resilience and the concept of sustainability, and to clarify the importance of the concept of spatial and temporal scale in a working definition of resilience. The World Commission on Environment and Development (1987) defines sustainable development as 'meeting the needs of the present without compromising the ability of future generations to meet their own needs'. Within business circles, 'sustainable development' tends to be translated into the metaphor of the triple bottom line (TBL), linking the three dimensions: (i) Environmental Sustainability, (ii) Economic Sustainability, and (iii) Social Sustainability (Elkington 1999). The idea of focusing on balancing economic, social and environmental outcomes, whilst dominant, is limited, as it fails to consider future generations or engage with the concept of 'sufficiency' (Dyllick and Hockerts 2002; Young and Tilley 2006) and in the context of discussions on resilience seems unduly static, lacking dynamism and a time dimension.

Indeed, there is an active and ongoing debate about how the concepts of sustainability and resilience are related (Derissen et al., 2011). A key issue is that resilience can be applied to the global eco-system as a whole, with or without particular species, including humans; that is one can talk about the a resilient, dynamic trajectory for the biosphere as a whole but in which humankind becomes progressively extinct. Similarly, it is possible for there to be a resilient pathway that does take into account humans, but that does not consider social justice.

On the other hand, sustainability intrinsically refers to choices that make human activities environmentally socially and economically sustainable. For example, for some authors, resilience is a necessary, but not sufficient condition for sustainability, hence building up resilience can facilitate sustainability (for example, Domptail et al., 2013; Leach et al., 2010). Another distinction relates to the temporal timescale: if resilience is about

[2] http://www.resalliance.org/, accessed 23 May 2014

changes in relation to particular stresses, sustainability is a longer term issue. Resilience can be part of a pathway or trajectory to sustainability. Indeed, a resilient pathway would be one that is adaptable and flexible, which does not close off some options, or in the language of Leach et al. (2010), does not lead to 'lock-ins'. Adaptive capacity is central to resilience; it is 'that component of resilience that reflects the learning aspect of system behaviour' (Robinson and Berkes, 2011: 1186).

However, it is important to recognise that some forms of adaptation of structure or function to ensure resilience may actually preclude sustainability, what is known as mal-adaption (Grothmann and Patt, 2005). So, this suggests, that systems that mal-adapt are not necessarily resilient, as it has been suggested that 'social–ecological systems with higher levels of resilience have the potential to sustain development by responding to and shaping change in a manner that does not lead to loss of future options' (Obrist et al, 2010: 285). However, what may be mal-adaptation compared to adaptation is not clear, and probably subjective.

SES resilience writers tend to emphasise the need to consider various scales simultaneously, both temporal and spatial. Indeed Robinson and Berkes (2011: 1186) report that 'no single spatial or temporal level of analysis is appropriate for governing social–ecological systems, and that the multi-level nature of such problems needs to be recognized'; the interplay between actors connected vertically and horizontally in the same system needs to be considered from an ecological and governance perspective. However, some argue that whilst the rhetoric of resilience is about the system, the prescriptions are often at the level of the individual unit, how it may adapt on the basis of improved risk assessment and information sharing (Joseph 2013). This critique highlights the need to bear in mind the unit of analysis – what is it that we wish to be resilient, and resilient to what? In the context of supply chains, are we talking about individual nodes of the chain, and if so, which, noting that in conventional supply chain management the concern is the 'focal company', usually the buyer rather than the supplier, as opposed to the whole chain.

Moreover, politically informed critiques of resilience question the potential of transformation within resilience thinking, particularly transformation of the system or structures of society. They argue that the focus of resilience on individual coping or adapting to a permanent process of change suggests that one cannot change the system, and its fluxes, but must accommodate them (Evans and Reid 2013). Others however suggest that transformation is indeed possible, but one may need to look outside the social-ecological systems literature to consider political processes that affect vulnerability (Pelling 2011).

The review will now focus on the two main bodies of work identified in the SLR, namely the business and political economy literatures in order to identify any gaps and potential areas for integration and further research.

4. Business literature

4.1 Logistics research on resilience

This section reviews the largest category of our SLR namely; Logistics/supply chain and production, which included 72 papers (see figure 1). Here we attempt to clarify the definitions of resilience used by the logistics literature and the theories and findings from the studies of resilience in the logistics field.

Though there are some variants, overall the logistics and supply chain literature defines “resilience” as the capability of a system to return to its original state or move to a new, more desirable state after being disturbed (Christopher and Peck, 2004), which seems to encompass both the engineering view of return to equilibrium, but also the possibility of a new equilibrium. In practice, however much of the literature relates to the recovery or resistance view. Such a recovery has to be achieved within an acceptable time period and at an acceptable cost (Azevedo et al., 2013). Other scholars prefer a more specific definition, which involves the capability to survive, adapt and grow in the face of turbulent change (Fiksel, 2006; Pettit et al., 2010). For example, one may develop a resilient system to reduce the impact of disturbances by minimizing the negative effect of a potential threat, by having several alterative suppliers of a key input or building in some redundancy (Azevedo et al., 2013).

The logistics and supply chain literature has identified the typical sources of vulnerabilities (or risks) facing a supply chain as: turbulence (including extreme weather events), deliberate threats (e.g. terrorism), external pressure, resource limits, sensitivity and connectivity of the supply chain and supplier/customer disruptions (Pettit et al., 2010). The logistics literature generally considers “robustness” as a superior capability to “resilience”. “Robustness” generally means the ability of a system to carry out its main functions under various disruptions (Christopher and Peck, 2004; Klibi et al., 2010).

Until 2010, the logistics literature on resilience was still very much conceptual in nature. There was a lack of in-depth case studies or large-scale empirical theory testing. The logistics literature considers redundancy, flexibility, agility, adaptability, responsiveness (lead time reduction), visibility, provocativeness, collaboration, integration, network design and so on, as means to achieve resilient logistics or supply chains (Christopher and Peck, 2004; Sheffi and Rice, 2005; Datta et al., 2007; Pettit et al., 2010; Azevedo et al., 2013). From a systems perspective, Fiksel (2003) argues that a product system, enterprise system, ecosystem and socio-economic system can become resilient by being diverse (e.g. existence of multiple forms and behaviours), efficient (performance with modest resource consumption), adaptable (flexibility to change in response to new pressures), and cohesive

(existence of unifying forces or linkages); the key here is to simplify the system and focus on system behaviours, exploratory scenario building and interventions that may build resilience.

The empirical work of Pettit et al. (2013) has further verified most of the above vulnerabilities and capabilities based on a focus-group study of seven manufacturers of either consumer products, chemicals or transport vehicles. A recent empirical study confirms that flexibility and redundancy were not enough to moderate the links between supply-side risk and disruption occurrence (Zsidisin and Wagner, 2010). More detailed research has started to identify resilience enhancer and reducer factors (Blackhurst et al., 2011).

After a decade of research, the logistics and supply chain literature has started to move away from clarifying the concepts of resilience (and robustness), to measuring their characteristics or capabilities. While "robustness" has been identified as a more desirable capability, it is still unclear how it may be achieved. While there are attempts to categorise different sources of vulnerabilities, the logistics literature does not clearly identify the possible differences in their impacts and the needs for different risk management strategies. There tends to be a lack of emphasis on the management of crises, especially during the disruptions.

Finally, despite the growing importance of food security the lack of academic work on resilience in agricultural food supply chains is surprising. In contrast, there is a growing body of work on climate change adaption for agricultural sectors in the climate change literature, as opposed to the logistics literature. Though, as we mentioned previously, this tends not to include an understanding of supply chain linkages.

4.2 Sustainable Supply Chain literature

The sustainable supply chain literature considers issues beyond logistics. It considers mainly "sustainability" rather than "resilience", with a strong focus on focal firms within a supply chain. Academics and practitioners have become more aware of the increasing impact of sustainable development to firms and their stakeholders (Hutchins and Sutherland, 2008). Sustainable development has become one of the important missions of a wide range of organizations from local to global levels (Kate et al., 2005; Hutchins and Sutherland, 2008).

Sustainable supply chain management has been defined as "the management of material, information and capital flows as well as cooperation among companies along the supply chain while taking goals from all three dimensions of sustainable development, i.e., economic, environmental and social, into account which are derived from customer and stakeholder requirements" (Seuring and Müller 2008: 1700). Linton (2007) also states that sustainability must integrate into management issues and extend beyond the core of supply chain management.

Seuring and Müller (2008) state that a sustainable supply chain should be managed according to a wider set of performance objectives, including both environmental and social dimensions. However, current studies often focus on the development of sustainability in supply chains from an environmental perspective. The social science areas related to cultural norms, organizational behaviours, role of government and community, and the relationship with the natural environment are still underdeveloped. In short, the social dimension, which is important when defining and implementing a sustainable supply chain, is one of the gaps in supply chain sustainability research (Linton et al., 2007).

Even though the sustainable supply chain literature and resilient supply chain literature have in the past not been linked together, some recent studies have attempted to establish connections between them. Recently, an Ecosilient index has been developed drawing on empirical analysis of the automotive sector to take into account both environment and resilience (Azevedo et al., 2013). Interestingly they compare current practices to enhance supply chain resilience with their view of 'green supply chain practices', which say little about resilience per se, but focus on environmental management, material use and certification. In doing so they argue that resilience for a company is focused on continuation of business while still being competitive.

This section illustrates a gap in the academic business supply chain literature in work attempting to integrate resilience with sustainability. This is even more surprising bearing in mind there combined use in the UN Sustainable Development Goals (UN Sustainable Development Goals 2014, see goal 2.4: 8)

4.3 Sustainable Business literature

A small number of studies from our SLR under the broad business heading could be classed as sustainable business as opposed to sustainable supply chains. The studies mentioned here were of interest because of their engagement with the concept of ecological resilience in a business context, but tended to focus on single or clusters of businesses rather than a supply chain.

Gaudreau and Gibson (2010: 236) have developed and piloted an integrated sustainability and resilience based assessment tool that assesses the resilience of an organisation but also its impact on social, economic and ecosystem resilience. It starts with the criteria that resilient societies should include; promotion of biological understanding, landscape, cultural, social and economic diversity; work with rather than against ecological variability; focus on modules/ self-reliant systems rather than 'over-connectedness'; maintenance of feedbacks that can enable detection of imminent thresholds; promotion of social capital; promotion of a mix of governance types and players; and recognition of eco-system services. Gaudreau and Gibson (2010) pilot their assessment on a small-scale

biodiesel project in Barbados. They conclude that the generic resilience criteria have to be supplemented by context specific ones for each assessment to be successful. Interestingly this study refers to resilient societies, in which business is a part, rather than simply resilient businesses or supply chains

Another study from the vast area of sustainable business that emerged from our SLR was an analysis of the resilience of enterprises specialising in coral reef tourism to natural disasters (Biggs et al., 2012). They found that informal and formal enterprises were only able to survive following a tsunami by cost cutting, down-sizing or temporarily closing down and relying on alternate income or subsistence. As a result they advise that a key role for government is to enhance the operating environment, including market protection, finance and promotional activities, thereby increasing the industry's resilience.

4.4 Overview of business literature and resilience

As we have seen from the above sections, the discipline that dominates the analysis of resilience in a supply chain context is, perhaps not surprisingly, supply chain management and logistics. We found very little that considered resilience with respect to environmental change, as opposed to specific disasters (e.g. earthquakes or outbreaks of disease) and little that engaged with climate change.

Within the business literature (and particularly logistics and supply chain management), the focus is from the perspective of a particular set of actors – the focal company – rather than a broader range of actors within the chain, or an integrated approach, which may be necessary if one is to consider resilience along a whole chain. It should be noted that this discipline is concerned with supply chain management, not supply chain *analysis*, hence its focus on actors that seek to manage the supply chain. Our initial impression was that articles that cover sustainable supply chains would be a possible bridge between the two views, particularly to the extent that they embody a broad definition of sustainability, but these papers still focus on a dyadic view of supply chains and are centred on the needs of a focal firm and are often dominated by western values. As such supply chain management and logistics has a different central concern from 'value chain analysis', particularly 'global value chain' (GVC) analysis, which we discuss below under the heading of political economy.

5. Political economy literature

The second broad heading under which we have organised our literature with respect to resilience and (food) supply chains is political economy. The literature we uncovered in our SLR was not as extensive as that under the business heading and moreover does not often refer to resilience in supply chains per se, but rather refers to resilience of systems, particularly food systems, and communities, from the global to the local. This discussion on the political economy literature is divided into two areas, namely: literature on sustainable food systems and work on global value chains.

5.1 Sustainable food system literature

Resilience in food or agricultural supply chains has a resonance or significance that goes beyond that of other supply chains that are not so central to our very existence as human beings, or at least have not been constructed as a human right. Access to affordable food is

politically charged (as demonstrated by the food riots of 2007 and the burgeoning food sovereignty movement); and also at the centre of core environmental debates (such as the 'Perfect Storm', Beddington 2009).

Whilst the sustainable food system literature often speaks of resilience, it does not relate this specifically to resilient supply chains, rather it is about resilient food systems. Food systems cover a greater variety of actors compared to a food supply chain, and analysis of food systems embraces a wider range of issues compared to the food supply chain literature. Nevertheless, much of the material has a localised focus, contrasting the benefits of the local with a problematic global system (but with some exceptions as we discuss below). Indeed some of this literature, particularly that badged 'alternative agro-food networks' (AFN), regards extensive food supply chains as a key contributing factor to problems in the food system with regards to the availability of safe and healthy food, and indeed food security. They further contribute to the disconnection between producers and consumers, such that food systems become 'disembedded from the communities and societies that they serve' (Harris 2010: 357). The disconnection between the production and consumption of food, 'as food chains become stretched further and in more complex ways across space' is associated with 'loss of rural agricultural resilience and diversity, degradation of the environment, dislocation of community, loss of identity and place…" (Feagan 2007: 38).

This eroding of resilience of particular communities (agricultural or rural) is often linked to a critique of the commodification of food and in some cases explores issues of food security or sovereignty. An interesting example of this from our SLR comes from Kelly and Schulschenk (2011) who discuss food security in the Stellenbosch region of South Africa. They examine the potential for local food production; creation of a local food economy in a region where the economy is concentrated on the export of agricultural production (specifically wine and grapes) but where there is extensive food insecurity, poverty and inequality. Local food production and consumption, it is argued 'promotes greater sustainability by building community networks and embeddedness that strengthen community resilience and accountability and that it allows for the social and environmental costs of the food system to be considered and included in the prices of food' (Kelly and Schulschenk, 2011: 567).

However there were some exceptions to this 'local' focus, including papers that look at food regimes. Campbell (2009) examines resilience in food systems in the context of green capitalism. For Campbell (2009: 314), the key to resilience of a food regime is the 'centrality of strong ecological signals and feedbacks in enabling positive social adaptive responses to shocks and threats'. For him the current global food system is characterised by uniformity and commodification, as a system of 'food from nowhere', a system of food

relations that ‘operates on invisibility: obscuring the social, geographical, economic and technical bases of its production regime’, in which corporate supply chains harmonise production standards, ‘rendering supply chains endlessly substitutable, creating limits to the extent and power of national food regulation, and moving against regional identities to foods’ (2009: 311, 310). In the food systems literature, this is contrasted with the ‘Food from Somewhere’ regime initially as a counter to the globalising or invisibilising tendencies of the ‘food from nowhere regime’ i.e. local food, slow food etc. Interestingly Campbell’s analysis of food regimes suggests that ‘new forms of environmental governance in agri-food systems are emerging (involving negotiations between private sector firms, state, citizens and social movements) that provide the underpinnings of a new form of organization in high value food systems’ (2009: 314). He suggests that ‘food from somewhere’ is not just a feature of local or civil society led initiatives but also part of ‘the new corporate greening’ particularly through the ‘emergence of audits as a new form of global governance in food relations’ (ibid: 315).

For Campbell (2009: 314), the key to resilience of a food regime is the ‘centrality of strong ecological signals and feedbacks in enabling positive social adaptive responses to shocks and threats’. He is positive about the role of corporate initiatives such as GlobalGAP in driving sustainable production, including social and environmental audits within the supply chain that can enhance ‘eco-social feedbacks at a global scale’, which are critical for sustainable food systems. However, he does acknowledge that an audit culture driving change through ‘feedbacks’ is ‘only one dynamic in resilient systems’. The system may not be resilient to ‘sudden shocks to the system’ and the global audit systems he acknowledges may lack ‘flexibility and adaptability’, and rather they may ‘potentially re-solidify arrangements in a rather brittle form’ (Campbell 2009: 317). This suggests that audit cultures in the food system may promote an engineering view of resilience rather than one that is more about adaption or transformation.

Moreover Campbell suggests that ‘food from somewhere’ can only exist where there is also food from nowhere, the two are connected by ‘a powerful binary dynamic’ such that ‘the flight to the quality end of the world food market is partly premised on the ability of wealthy consumers to purchase foods that are demonstrably different from mainstream industrial foods’ (Campbell 2009: 317). That is we may have some part of the market with some aspects of resilience for supplier and consumer, but this growth of the food from somewhere regime is dependent on the persistence of cheap commodified food, dominated by supermarket power (Lawrence and Burch 2007).

Campbell’s discussion of ‘food from somewhere’ as adopted by corporate initiatives suggests that some resilience thinking has been absorbed into food systems literature. Similarly the ecological and dynamic aspects of resilience are a feature of the discussion on food security at a regional level. Supply chains are mentioned and discussed to differing

levels, however, we would argue that whilst there are some interesting insights, and implicit critiques of supply chain management, often broadening the scope of analysis, the concept of resilience (in a supply chain context) is not developed systematically.

5.2 Global Value Chain analysis

There were a limited number of academic studies in our SLR that used a Global Value Chain (GVC) perspective that engaged with resilience. In this literature, supply chains are the focus of attention, but it was surprising to us that this literature had little to say about resilience given its ability to 'move across spatial scales and for its effectiveness in highlighting the importance of cross-border forms of organization [and collaboration] in the global economy' (Bair 2008, 355). Moreover, GVC terminology (of buyer-led chains, governance of chains and the opportunities and challenges for suppliers to 'upgrade') is frequently adopted by NGOs keen to enhance supply chains from the perspective of producers (see Twin 2012, Raworth 2005, and as was demonstrated in our mutli-stakeholder workshop, see below). However it should be acknowledged, that application of GVC thinking to environmental issues as opposed to economic issues of supply chain inclusion and exclusion (see Gibbon and Ponte 2005, Dolan and Humphrey 2000) or promotion of labour rights (Barrientos et al., 2003) is still in its early stages (Bolwig et al. 2010).

GVC analysis focuses on how the value chain is driven, or governed, how 'some firms in the chain set and/or enforce the parameters under which others in the chain operate' (Dolan and Humphrey, 2000, Humphrey and Schmitz 2000: 2, Neilson and Pritchard, 2009).

From the literature review, a paper by Challies and Murray (2011) uses GVC analysis, combined with livelihoods analysis to explore the raspberry value chain, focusing on small-scale raspberry producers in Chile. They highlight the importance of the institutional context and the incorporation of small producers in the export chain on beneficial terms. They stress the key role that state bodies play in ensuring that producers can meet quality standards, gain and importantly retain access to markets, noting that GVC analysis tends to ignore the role of public sector actors in this regard. Their case illustrates that the impact of GVCs on the livelihoods of smallholders 'is strongly mediated and partly determined by the nature, intervention and quality of institutions in the value chain' (2011: 55). In particular they stress that the state has an important role to play 'in sustaining viability because of important changes in quality demands that appear to be universal in buyer-driven agri-food GVCs. As such, the survival of small-scale growers can be a political question rather than a technical one. Such a question is answerable only via a discussion of development priorities linked inherently to the question of whether it is important or not to reduce rural poverty and inequality' (2011: 56).

6. Outcomes from the multi-stakeholder workshop

As noted in section 2, the preliminary findings of our systematic literature review were presented at a multi-stakeholder workshop and we encouraged participants to reflect on the findings and report on their understanding and experience of resilience in the context of agri-food supply chains. This focused attention on the particular challenges in achieving resilience in food supply chains in the UK context, especially if you consider the increasing reliance on imports, partly due to the global sourcing strategies of retailers. It was acknowledged that some companies have started to use the language of resilient supply chains, e.g. ASDA. Conversely, it was noted that not all buyers are pushing for greater sustainability or have even engaged wit the concept of resilience. For a number of participants, a key concern was the producer context, particularly those producers from poorer countries exporting cash crops, for whom short-term benefits from participation in supply chains to feed the UK population may conflict with their ability to enhance the resilience of their own livelihoods, and where ecological resilience was already being eroded (e.g. lower altitude coffee losing productivity). It was suggested that the immediate issue was not resilience of the supply chain but vulnerability of producers, and that this was missing from the academic literature, especially within supply chain management which is dominated by focal company thinking.

It was immediately apparent from the discussions that in order to build up resilience in supply chains, there are a number of tensions including:

- Retailers' price competitiveness versus producer economic efficiency and resilience;
- Consumers' stated desires versus their purchasing behaviour, given the consumer has a responsibility to enhance resilience and share the risk; and
- Internal tensions within buying firms between sustainability teams and buyers.

Several examples of current efforts to enhance resilience in the context of supply chains were presented by the participants. There was a focus on both activities by producers in multi-stakeholder partnerships at a particular node of the chain and those initiated by buyers to assist producers. Many of these examples had an agro-ecological focus e.g. drought-tolerant or pest- resistant crop varieties and planting techniques, environmental protection (e.g. watersheds, forests and biodiversity), but others focused on building up the economic and organisational capacity of producers.

Workshop participants proposed the following potential features of a resilient agricultural supply chain: *information sharing and education along the supply chain from consumer to producer; diversifying or sharing out production to a wide number and geographically diverse suppliers rather than relying on a few large producers; risk sharing;*

diverse forms of ownership of production; co-operation; flexibility and adaptability; improved regulation (on water, forests and other eco-system services) and on prices and wages; applying technology to enhance risk prediction.

A key question the workshop raised was on whom current approaches to resilience in supply chains were focused? In particular, the practice-oriented nature of the workshop highlighted the dearth of academic literature that brought together an integrated understanding of both the challenges faced by smallholder producers with the analysis of global supply chains. There was also a need to bring an understanding of ecological and community resilience into supply chain management thinking. Indeed there is a need for more systems -as opposed to chain- thinking that deals with the dynamic nature of environmental change. It was also suggested that there was a need to reconsider governance mechanisms, including adaptive governance.

7. Discussion

7.1 Linking the SLR and workshop findings

The outcomes of the multi-stakeholder workshop led to us to revaluate the academic literature from the SLR in order to assess the potential for the development of a framework that could advance thinking about whole supply chain resilience. Our starting point was to characterise the different viewpoints that emerged from the SLR and following this we reflected on some of the themes that emerged from the workshop to consider which if any could act as both bridges between the often conflicting areas of literature and the identified gaps in the literature.

The first outcome of this revaluation process is represented by the summary of themes in Figure 2. The blocks in the centre (within the rectangle outline) represent the dominant areas of the SLR. The business-focused literature on the left hand side of the rectangle (supply chain management and logistics, sustainable supply chain and sustainable business) shares a concern with efficiency (and effectiveness) with respect to the (focal) firm or a specific supply chain. Relations are governed 'vertically' and usually focus on bilateral relations (with or without contracts) and regulations focused on the private sphere. The concern is with sustainability/ resilience within the context of the supply chain. The literature on the right hand side of the rectangle (food systems and GVC) in Figure 2 is concerned with social and environmental justice and rather than focusing on the firm or supply chain, it operates at multiple levels, from the local to the global. As noted earlier in Figure 1 there is less literature in this area compared to the business focused literature (hence the smaller boxes). Also if we analyse the discussions from the stakeholder workshop some of these

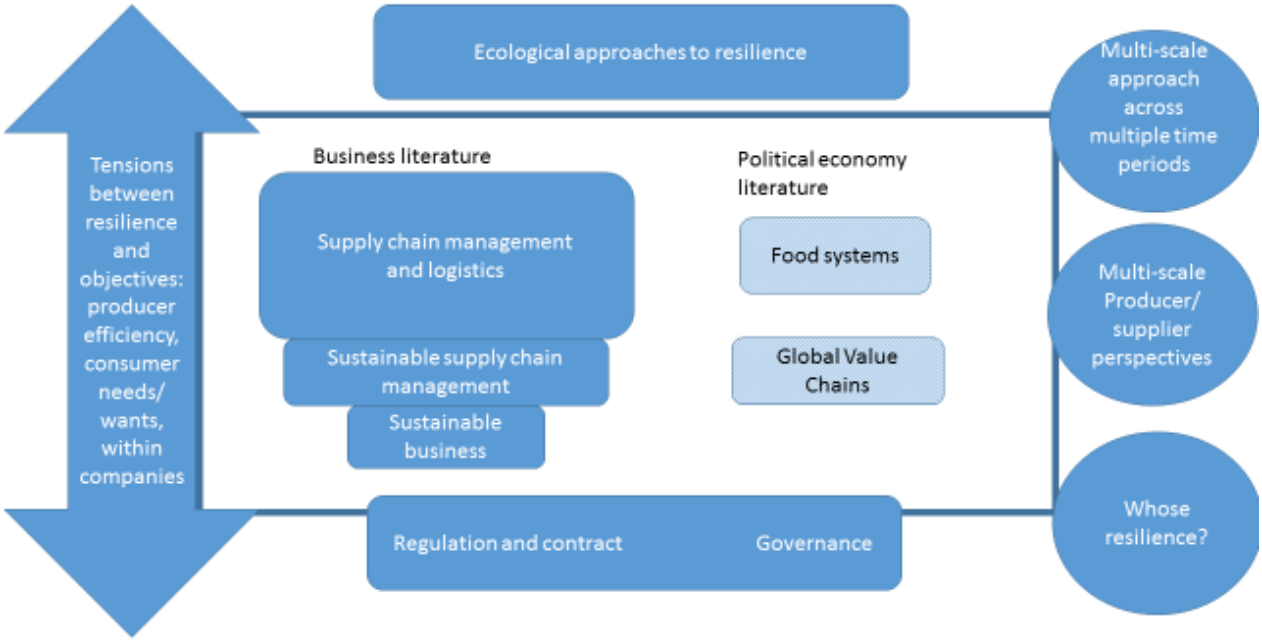
themes appear to be more advanced in practice than in the academic literature, particularly with regard to multi-stakeholder partnerships inclusive of all actors. Moreover, this literature emerged from a wider range of disciplines and were often engaged in different academic debates and did not necessarily to 'speak to' each other.

At the top of the diagram we have a reminder that there are multiple perspectives on resilience, some of which were defined and applied in the SLR, others which were not so well developed in the literature that emerged from the review, but were considered in order to enhance the ecological perspective we felt was vital when thinking about agri-food supply chains. At the bottom of the diagram we have included regulation and contract plus governance. These were implicit in many of the discussions at the workshop, where there was a call for regulation or a concern for better understanding of governance processes, especially as they related to different aspects of justice or in relation to 'horizontal governance' – drawing on processes of accountability, voice and civil society. Whilst there is increasing public concern about the resilience of supply chains, in the political economy literature this tends to be related to the public outcomes of supply chains, e.g. meeting the food, energy and resource needs of the world's population under conditions of increased threats, as opposed to financial success of particular companies or chains. Thus, notwithstanding the neoliberal slant of much public policy, the concerns of literature on the right hand side of Figure 2 are related to resilience at many different scales from the local to the global resilience as opposed to supply chain resilience.

Finally on the outer left and right of the diagram we have summarised the main outcomes of the multi-stakeholder workshop, i.e. the tensions that emerge when looking at agri-food supply chains with respect to resilience on the left hand side, and some of the additional perspectives or questions that emerged from the debates at the workshop on the right.

We develop these themes further below as different aspects of regulation and governance are featured in much of the literature that emerged from the SLR, albeit not always directly connected to resilience. Moreover, if we are to develop a more holistic approach to supply chain resilience that is inclusive of all actors and that recognises the realities of current supply chain structures, it is important to build bridges between the different literatures in order to develop a new research agenda.

Figure 2 Summary of themes from SLR and Workshop



7.2 Towards an integrated approach

In this section we reflect on the potential to build analytical bridges across fields and sub-fields with a view to developing an integrated approach to resilience in agri-food chains. We propose from our analysis three potential approaches including: (1) new approaches to integrating legal, governance and regulatory perspectives; (2) integrating GVC analysis with logistics and supply chain management work and (3) Integrating literatures to develop a more dynamic whole system approach to resilience incorporating multi-stakeholder perspectives.

Firstly, one potential new approach in terms of developing a better understanding of resilience in the context of agricultural supply chains could be to introduce a legal analysis of the role of contracts, governance and regulation in the supply chain. At the practitioner workshop there was a call for greater understanding of the factors that govern supply chains, particularly from a public policy perspective. Moreover, such an analysis could play a part in bridging the gap between the two broad bodies of literature – business and political economy – by providing a contrasting perspective that addresses certain aspects of resilience covered by both bodies of literature. In the supply chain literature, elements of collaboration, co-ordination and cooperation are certainly referred to – often as characteristics of resilience -

but an analysis of the legal status of those behaviours is missing. Similarly, whilst the political economy literature refers more explicitly to matters of governance and state regulation, a legal analysis of them is absent from our SLR. Yet the need for greater governance and regulation was clearly identified by our multi-stakeholder workshop as a key property for resilience and this is further supported by a call for greater regulation and governance by others concerned with resilience in supply chains (World Economic Forum 2013).

For example, both the logistics and sustainable business literatures refer to flexibility, for example to make product or processing changes; the ability to switch to alternative suppliers or products; to accelerate or decelerate production, or to switch between outsourced or in-house production. All or some of these actions may require the parties to ignore existing contractual orders and commitments between them. Similarly, both bodies of literature (business and political economy) recognise the need for visibility and information flows and for collaboration between parties in the supply chain (ibid). This may, for example, require the parties to put in place binding information sharing obligations or practices. At the same time, as the political economy literature reveals, 'new forms of […] governance in agri-food systems are emerging' (Campbell, 2009: 314) and an analysis of how this is achieved reveals contractual mechanisms enforcing private standards rather than state imposed regulation (Islam, 2008).

In undertaking such a legal analysis it is necessary to appreciate the distinction between public and private law that the legal academy traditionally holds. In its broadest terms, private law is taken as governing the relations between citizens (such as in contract law) and public law the relations between the state and its citizens (such as constitutional law, criminal law, environmental law etc.). The distinction reflects the classical view that there are areas where the state can and cannot interfere and 'should' and 'should not' interfere (Horwitz, 1982). In the realm of private law the power of the state to interfere with contractual dealings is traditionally viewed as limited and predominantly non-interventionist, with the state adopting the primarily facilitative role of recognition of contractual obligations and the enforcement of them. Equally in private law contract law's role is generally seen to be 'purely facilitative of horizontal dealings between private parties' (Rosenfield, 1985).

As such, contract law is traditionally viewed as neutral and is not concerned with matters of social or distributive justice, as such normative criteria would interfere with the freedom of the contracting parties (Len 2010). Indeed, market-individualism is a pervading 'ideology' of contract law (Adams and Brownsword, 1987) mirroring the economic efficiency values at the heart of the business-focussed literature. Indeed, one recognised theoretical approach to law which has emerged, is a law and economics analysis which has efficiency and economic incentives at its centre (see Mitchell, 2013). However at the demand end of a supply chain, in business to consumer contracts, the competing ideology of consumer-

welfarism can be seen (Adams and Brownsword, 1987) which 'is concerned with protecting consumers' (Brownsword, 2006: 138).

The dominant legal analysis of supply chains and dealings within them is viewed through the lens of contract law. Supply chains are traditionally viewed in terms of a series of separate and therefore unrelated trading contracts made between independent parties supplying or purchasing goods and/or providing services or adding value at a particular point in a supply chain. However, as some of the logistics literature and sustainable business literature makes clear (Christopher and Peck, 2004:2; Azevedo et al., 2013), links between firms in supply chains are more akin to networks than the traditional bilateral contracting pattern that classical contract theory recognises. Therefore contract law alone is not fit for purpose in delivering resilience in global supply chains/networks. However there are disputed understandings as to the legal construct of networks and, indeed, whether such a construct should be recognised. As such, for the time being, network relations are not legally recognised in contract law. However we would suggest a legal analysis of contracts, governance and regulation in agri-food supply chains could broker new possibilities of meaning (Wenger, 1998). Moreover, the issue of resilience in supply chains could be a case where there is a need for a rethink on where and how to draw the legal lines between public and private (Orts, 2013: 115).

With regard to our second proposed approach, in Figure 2 we have placed supply chain analysis (including sustainable supply chains) on the left hand/ business side and GVC analysis on the right, under the heading of political economy. Nonetheless there are some similarities between GVC and supply chain management, particularly the system approach and chain metaphor as well as the evident concern with the operations of networks of firms on a large, often global, scale (Gereffi and Lee, 2012, van Wijk et al., 2008). However, one key difference is that GVC analysis considers the network of companies rather than a focal company and has roots in world-systems theory and political economy rather than management; overall it is concerned with stakeholder value rather than shareholder value (van Wijk et al., 2008). Compared to literature on supply chain management, GVC analysis is seen by its adherents as 'better equipped to analyse sustainability issues' than supply chain analysis, because of its ability to examine 'a) relationships with non-market parties, b) interdependence among all firms within the chain, c) the influence of governmental trade regulation on the room for manoeuvre in the chain, and d) normative issues related to production processes and the distribution of trade gains' (Van Wijk et al., 2008:6). Hence a more integrated approach here could provide new thinking.

Finally, to return to the concept of resilience, within the SLR it was apparent that it tended to be investigated as an individual component of systems in isolation (e.g. environmental resilience, social resilience or resilience of the supply chain from the

perspective of a limited number of actors) whilst there was reference to adaptive capacity, often the focus was on robustness and there was little said about how capacities could be built up. Moreover, literature considering the integrated social- economic–environmental system as a whole is scarce, indeed it is conspicuous by its absence. Yet, in a context of rapid global change, which heavily affects all three components, considering them in isolation may lead to partial understanding and inappropriate or faulty decision making that undermines sustainable development. Therefore a whole system approach is important.

Furthermore, the spatial and temporal scale at which the system is observed may be relevant: a city that is on a resilient trajectory does not necessarily mean that all the communities within the city are, nor does it mean that there is resilience at a regional level. Alternatively, the resilience of the individual components of the system does not necessarily mean the aggregated system is resilient. We also need to recognise that real world supply chains operate in a globalised and volatile system (e.g. price fluctuations in commodity markets), both as a result of the decisions made by supply chain managers to maximise efficiency and effectiveness, but also because of the changing contexts in which they operate, environmentally and politically. This volatility relates not only to the spatial scale but also the temporal scale: the speed and rate of change depend on time and spatial scale: what happens to be relatively stable on the regional scale over decades may be changing on a daily basis at the community level, and vice versa.

Finally, the opinion of the actor or stakeholder asserting the resilience of the system is key to this definition of resilience, i.e. the definition of resilience depends on the observer. In other words, it is important to understand for whom the system is defined as resilient: for example, the planetary system may not be seen as resilient from the point of view of humankind, but could be described as resilient from the point of view of a virus. This is particularly true for the supply chain: a supply chain may be seen as resilient from the point of view of the purchasing manager in a multinational corporation, but not as resilient from a producer's perspective. Therefore to achieve a truly integrated and dynamic approach to resilience we need to take a multi-stakeholder perspective.

8. Conclusions

As our analysis of the SLR has progressed, we have developed a critique of the literature on agri-food supply chains and resilience, highlighting deficiencies in current approaches and several significant gaps in knowledge. The approaches adopted in the logistics/supply chain management literature with respect to resilience are limited in terms of looking at the entire system related to the supply chain (including environment and society). There is also a dearth of literature that combines resilience and food sustainability. Moreover the other literatures (e.g. GVC) that emerged from our review were relatively underdeveloped with respect to offering the appropriate instruments to understand, predict and enhance the resilience of agri-food supply chains.

We conclude therefore that there is an absence of academic research that considers resilience of the agri-food chain in an integrated way. This is surprising if you consider the frequent use of the term resilience in relation to both food security and sustainability (e.g. UN Sustainable Development Goals 2015). We argue that such an integrated approach should be multi-scale, multi-stakeholder and consider resilience from a dynamic perspective that considers the social-ecological system as well as the supply chain. This is a gap that we propose to fill, starting with the experience of supply chain management and resilience models but also by developing a framework that brings in social-ecological understandings of resilience and that focuses on adaptive capacity and potential for transformation. This should be applied at multiple nodes of the supply chain and consider new legal and governance approaches.

One of the key challenges for future research in this area will be to develop a more integrated dynamic multi-stakeholder framework of resilience in agricultural supply chains which could provide the real transformative thinking required to meet the growing challenge of sustainable food security.

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