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Effective Life Cycle Management in SMEs: Use of a Sector-Based Approach to Overcome Barriers

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Abstract: One approach to incorporate sustainability in organisations is the implementation of life cycle management (LCM). LCM involves sharing responsibility for addressing environmental impacts across the entire supply chain of products and services, extending from raw material extraction to end-of-life of the product. The New Zealand primary sector relies heavily on natural resources and provides about 70% of the country's export revenue. Most companies in primary industry sectors in New Zealand are small and medium-sized enterprises (SMEs). Successful sector-wide uptake of LCM can potentially facilitate effective measurement and management of environmental impacts caused by this sector. The aim of this research was to identify the barriers and enablers to successful LCM uptake by New Zealand primary sector SMEs within a sector-based context. An extensive review of the literature was undertaken in the areas of change management for SMEs and supply chain management. The main factors influencing successful LCM uptake include owner/manager influence, environmental culture, resource availability, future orientation, knowledge of environmental issues, market requirements, geographical separation of production and consumption, awareness of own environmental issues and communication/information sharing. This paper forms the basis for future research and development of tools for the effective implementation of sector based approaches to LCM in the primary industry. The results of this research include a capability maturity model and the development of a cloud based platform for collaboration and communication around LCM.

Keywords: life cycle management (LCM); sector-based approach (SBA); sustainability; agriculture; small and medium sized enterprise (SME); supply chain management (SCM)

1. Introduction

There is a rising awareness of environmental problems and wider sustainability issues amongst governments, industries and consumers both in New Zealand and elsewhere [1–8]. As a result, many companies have implemented environmental sustainability initiatives in their business activities [9–14]. This trend is particularly apparent in Europe where it has been driven by strict environmental legislation and financial instruments to encourage more efficient management of energy and other resources, and waste, in companies [15–19].

However, many organisations are still not active in this area—and many of these organisations are SMEs [20–28]. SMEs find it particularly challenging to develop and implement environmental sustainability initiatives due to their specific characteristics e.g., limited financial and human resources, lack of expertise in sustainability, and lack of awareness about their own sustainability impacts [29,30].

New Zealand has a reputation for being "clean and green", and this is often used as a marketing attribute by New Zealand-based companies. However, in order to maintain and reinforce this

reputation in global markets, companies need to be able to demonstrate their environmental sustainability credentials [31–36]. In particular, the New Zealand economy relies heavily on export of primary products with over 70% of New Zealand's merchandise exports coming from primary industries [37]. The New Zealand primary industry sector is largely run by SMEs [38]. Therefore, demonstration of environmental sustainability credentials is particularly relevant in this sector.

One approach to implementing environmental sustainability is the use of life cycle management (LCM). LCM is the application of life cycle thinking (LCT) to business practice, with the aim of managing the total life cycle of an organisation's products and services in order to move towards more sustainable consumption and production systems. According to UNEP, "LCM has been defined as the application of LCT in modern business practice" [39]. However, so far, only a small number of New Zealand companies have actually integrated a life cycle approach into their environmental sustainability initiatives [40,41]. This raises the question of why so many NZ SMEs have not engaged with LCM, and what is required to change this situation. This paper therefore focuses on the underlying factors that can facilitate or impede implementation of LCM in SMEs in New Zealand, and particularly in the primary sector given its importance to New Zealand's economy.

The factors affecting the uptake of LCM can be viewed from an internal as well as external perspective. The internal perspective considers the unique characteristics of SMEs including their resources, strategy and organisational structure. The external view considers the wider supply chain and its influence on the organisation in terms of its ability to take up LCM initiatives.

The first part of this paper (Sections 2–4) focuses on the use of LCM in SMEs and supply chains. Section 2 provides an overview of LCM and its relevance to the New Zealand primary industries, and Section 3 identifies the specific characteristics of SMEs that can limit uptake of environmental management practices including LCM more specifically (internal view). Section 4 draws on the supply chain management literature to identify enablers and barriers that are relevant to LCM uptake (external view).

The second part of the paper (Section 5) integrates the findings from the literature-based research to provide a compiled overview of enablers and barriers to LCM implementation on a sector-wide level, and discusses the idea of the sector-based approach as a means of supporting sectors with large numbers of SMEs. The paper concludes with a summary of how these results can be used in future empirical research on LCM uptake in the New Zealand primary sectors (Section 6).

2. Life Cycle Management

2.1. The Relevance of Life Cycle Management for the New Zealand Primary Industry Sectors

The purpose of LCM is to improve the overall sustainability of products and services. It is the systematic application of LCT in business practice to integrate considerations of environmental (as well as social and economic) issues into decision-making and support the development of more sustainable products and production systems. From an LCM perspective, the environmental responsibilities of companies include not only their own production sites, but also up- and downstream entities in the supply chain throughout the entire life cycle from raw material extraction to end-of-life of a product [42].

This concept was summarised in the definition provided by the Society of Environmental Toxicology and Chemistry (SETAC) Working Group, which stated that the goal of LCM is to address environmental, economic, technological and social aspects of products and organisations to achieve continuous environmental improvement from a life cycle perspective [43]. Sonnemann et al. [44] further note that LCM is the systematic application of LCT in business practice in order to integrate environmental issues into decision-making and support the development of more sustainable products and production systems [44].

In summary, it can be said that the purpose of LCM is to facilitate the reduction of environmental (and social and economic) impacts by addressing the entire life cycle of a product/service. To achieve

this, it is important to consider management aspects as well as quantifying flows of materials and products—with their associated environmental impacts—along supply chains.

New Zealand has an image of being "clean and green" due in part to its low population density and its beautiful natural environment [32,33,45]. To maintain this positive reputation, there is a need to proactively—and continuously—manage and improve economic activities in order to minimise their impacts on the environment [34,46].

Due to New Zealand economy's dependence on exports (27.9% of GDP is derived from exports [47], it is important to anticipate trends in overseas markets that may affect the sales of New Zealand exports, and pro-actively prepare for these trends in case they become "the new normal". A past example of a trend in overseas markets that created a significant challenge for New Zealand exports was the food miles concept which was first articulated in the 1990s in the United Kingdom [48]. The term "food miles" refers to the distance the food is transported from the producer through the various stages of production, processing, packaging and distribution until it reaches the consumer [49]. It had previously been suggested that the environmental impacts of food products, as well as other negative social impacts, are linked to the distances travelled by these products to markets [50]. The potential risk for New Zealand exports associated with the food miles concept was significant given the country is located a long way away from its main export markets [51,52]. The issue particularly affected New Zealand between 2007 and 2010 [53] However, during that same period and subsequently, various environmental life cycle-based assessment studies were undertaken to quantify the environmental impacts of products (e.g., carbon, water and biodiversity footprints as well as the complementary and more comprehensive life cycle assessment (LCA) studies). Many of these studies provided evidence that counteracted the proposed link between distances travelled and environmental impacts [53–55].

Therefore, it is important that New Zealand exporters frame their environmental management activities using a life cycle perspective, in order to proactively prepare for future trends. LCM provides the approach and set of analytical tools to make this a reality.

2.2. Guidance on Uptake of Life Cycle Management

Three main guides have been produced on LCM uptake to date: the first one was produced in 2003 [56] and was followed by another guide published by the UNEP-SETAC Life Cycle Initiative in 2007 [57].

The Remmen [56] guide was aligned with the approach taken in ISO 14001 [58] on how to measure, manage and improve the environmental performance in a business. Although the guide took a life cycle perspective, and highlighted the focus on other supply chain activities outside the core activities of an organisation, it did not suggest specific initiatives to enable wide uptake of LCM-oriented improvement projects.

The second guide by Remmen and co-authors, "Life Cycle Management—A business guide to sustainability" [57], provided detailed information of what sustainability, LCM and LCT are, and why those topics are relevant to organisations. The first part of the guide provided examples of LCM implementation for typical supply chain stages (production and distribution, product development and design, economy and finance, purchasing, sales and marketing and stakeholder relations). It then went on to provide guidance on how to implement LCM initiatives in those different areas. The guide provided generic ideas, almost a checklist approach, on how to expand the focus of environmental management outside an organisation's core operations.

The third guide, "Life Cycle Management—how business uses it to decrease footprint, create opportunities and make value chains more sustainable" [59], presented a capability maturity model consisting of five maturity levels for organisations. The different maturity levels were related to the extent of control the organisation had over the various levels of supply chain activities. These were identified as extending from the individual, to the project, organisation, supply chain and society levels. The guide also presented case studies and examples of LCM implementation in different

organisations. In a similar way to Remmen et al. [57], this guide provided the user with a checklist approach of considerations in order to improve the life cycle-based environmental performance of an organisation [59].

As well as these guides, the ISO Technical Specification on Organisational LCA (ISO/TS 14072) has more recently been published (ISO, 2014). It provides additional requirements and guidance for applying LCA to organisations.

3. Challenges for Uptake of Environmental Management amongst Small and Medium Sized Enterprises

3.1. Defining SMEs and Their Relevance for Environmental Management Research

Definitions and criteria for what constitutes an "SME" vary widely around the world. They are often based on the number of employees, industry classification or the turnover of an organisation. Many definitions use the number of employees as the most important criterion to distinguish between SMEs and large enterprises:

- In the European Union, enterprises up to 10 employees are called micro, up to 50 employees small and up to 250 employees medium-sized enterprises [60];
- In the United States, SMEs are characterised as organisations having less than 500 employees [61];
- The Ministry of Economic Development (MED) of New Zealand defines SMEs as having less than 20 employees [62].

Alternatively, Massey and Cameron (1999) provided a definition that does not refer to the number of employees but to differences in decision-making compared with large companies (Cameron et al., 1999):

> *"A small business can be defined as a business that is independently managed by the owners, who own most of the shares, provide most of the finance and make most of the principal decisions."*

Using the New Zealand definition provided by the MED, 97% of all New Zealand companies are SMEs [63]. SMEs accounts for approximately 30% of New Zealand's GDP and employ 584,000 people [63].

It is usually true that the environmental impacts of large companies are higher (in absolute terms) than those of smaller companies in any given industry sector. However, on the other hand, the cumulative environmental impacts of all SMEs may be greater than those of the larger companies in that sector. Indeed, in the UK it has been estimated that SMEs contribute up to 70% of all industrial pollution [64–68]. This suggests that research should focus on implementation of environmental management in these smaller companies as well as in the larger companies [25,69–71].

3.2. Enablers and Barriers for SMEs to Implement Environmental Management

SMEs face several difficulties in the implementation of environmental management (and LCM more specifically) in their business practices, and these barriers are often closely related to the specific characteristics of SMEs. These characteristics have been investigated by a number of researchers and it is recognised that they should not be treated as smaller versions of large companies ([72], Mandl et al., 2007; Seidel et al., 2009, Seidel et al., 2012).

Eight characteristics were identified as relevant in relation to uptake of LCM. These characteristics range from the widely recognised influence of the owner/manager, through to less commonly identified aspects such as the geographical distance between production site and markets, and ability to identify emerging trends. Some are relevant to uptake of environmental management more generally and others are more relevant to uptake of LCM specifically. The following paragraphs briefly summarise these characteristics and how they influence uptake of environmental management in SMEs.

3.2.1. Owner/Manager Influence

According to [73], commitment from senior managers to environmental management is a prerequisite for providing an organisation with a clear direction in this area. In large companies, the power base is usually evenly distributed amongst managers in different departments, so there are several people involved in decision-making processes. This means there is a higher likelihood that environmental issues will be raised for consideration by at least one person. In SMEs, on the other hand, one owner/manager usually controls most strategic decisions; therefore the background, values and education of just this one person will have a significant impact on the strategic direction of the organisation [74,75]. The owner/manager of an SME thus has a significant influence on the uptake of environmental management in the organisation.

Some owner/managers see environmental issues as a threat and associate it with financial costs and other negative consequences [76,77]. They may also have a lack of knowledge of environmental issues and the advantages associated with implementing environmental management [78,79]. Also, often managers hesitate to invest in environmental practices that may only pay back in the longer term (after five years) [77]. For this reason, SMEs may not consider LCM as an appropriate environmental management approach.

On the other hand, given the influence of the owner/manager in SMEs, a positive attitude towards the environment and sustainability can result in the decision to implement and integrate approaches such as LCM into the organisation [80]. It has been argued that due to the hierarchy and decision-making characteristics of SMEs, smaller companies may be in a better position than larger organisations to innovate for sustainability [24].

3.2.2. Environmental Culture

Culture can be described as "the sum total of the knowledge, attitudes and habitual behaviour patterns shared and transmitted by the members of a particular society" [81]. The definition by Altman et al. [82] also includes "beliefs, perceptions, values and norms [. . .] of a group or society". The specific type of culture that describes how humans treat the natural environment is called environmental culture [83] and, according to Schumacher [83], environmental culture plays an important role in shaping how individuals view, value and subsequently treat trade-offs that affect the environment. If the culture of a company is not based on the beliefs, values, norms and perceptions that support environmental initiatives, then this will hinder uptake of environmental management.

This characteristic is closely related to the "knowledge of environmental issues" characteristic (see below), since people in organisations, supply chains and relevant stakeholders need to be aware about the relevance of environmental topics in order to foster a culture that supports uptake of environmental initiatives [78,84–90]. It is also related to the "owner/manager influence" characteristic as the support of senior managers can significantly aid the process of developing an environmental culture.

3.2.3. Resource Availability

SMEs are characterised by having limited financial, technical and staff resources [77,91–93]. The most critical barrier to any new activity for an SME is cost [65,76,94].

Linnanen et al. (1995) highlighted that reduced costs can be realised by environmental initiatives focused on more efficient use of resources, a reduced need for pollution control equipment, and/or reduced hazardous waste disposal. This finding is shared amongst other researchers [95,96]. Furthermore, KPMG (2005) noted that reduced energy and resource consumption, associated with improved brand reputation, could lead to an increase in sales and higher profits for companies.

However, there may be a perception that costs for environmental management training, and the purchase of software programmes and tools, cannot be outweighed by the benefits [97–100].

Consequently, investments need to have significant short-term financial benefits for them to be considered [101].

For environmental management, the cost barrier is also closely related to the availability of technical resources that are necessary in order to achieve improvements. It might be necessary to upgrade technology to reduce emissions, and purchase software products to conduct LCAs or that support the implementation and maintenance of an effective environmental management system (EMS). Biondi et al. (2002), Tilley (1999), Singh [102] and Graafland, et al. [90] claim that SMEs need strategies, tools and approaches that can easily be implemented into the existing business strategy, incorporated into day-to-day activities, and that are easy to understand and use.

Resource availability is closely related to perceived trade-offs between environmental sustainability and other business objectives. The implementation of environmental management usually requires investment, change of processes, and change of supply chain partners or supplier development. Usually companies prioritise projects according to time, cost and quality. However, prioritisation in terms of environmental issues is often difficult for decision makers in companies, when they do not have the knowledge to evaluate all the implications. Instead, uncertainties in decision-making are usually solved by application of simple rules that are based on the decision maker's interpretation of norms and information [103].

3.2.4. Strategy

Investments with long-term payback periods are usually not considered by SMEs. This is closely related to the fact that SMEs usually pursue short-term rather than long-term goals [100,104,105]. Eriksson et al. [106] conducted a study in Sweden on the uptake of management systems in organisations; the results showed that large organisations were more proactive in that area. They considered potential trends and changes in the future in their decisions and were able to address them earlier than SMEs. Redmond et al. [107] suggested that SMEs might be less proactive in uptake of voluntary programmes for improving environmental performance due to organisational habits that are hard to break; as a result, SMEs often stayed stuck in a "business as usual" modus operandi.

3.2.5. Knowledge of Environmental Issues

Lee et al. (2011) pointed out that a limited awareness of environmental issues might lead to a limited commitment to environmental management in SMEs [108]. Murillo-Luna et al. (2011) conducted a study that concluded that scarcity of information and lack of understanding about environmental legislation presents one of the main barriers for SMEs in the uptake of environmental improvement practices [109]. Condon (2004) highlighted that insufficient information on the real costs and potential benefits of environmental initiatives are a key barrier to improving the environmental performance of organisations. Often SME owner/managers believe that national and local government should take a lead on environmental issues and that these issues are more relevant to larger companies [67].

Collin et al. (2007) suggested that decision makers in SMEs tend to ignore the environmental impacts associated with their companies' activities. As SMEs are smaller than large companies, they think that the environmental impacts of their own business are negligible compared to the impacts of large companies [110]. As a result, they do not feel that they have to act to reduce their environmental impacts [94].

3.2.6. Market Requirements

Market requirements differ significantly between industrial sectors and countries [111]. In some markets, companies are exposed to less market and regulatory pressures to adopt life cycle approaches than others [111].

Market pressures may arise from stakeholders such as environmental groups, supply chain partners and customers. If the organisation/supply chain providing the product/service does not

align with the stakeholders' values and expectations, then this is something that needs to be taken into consideration by the supply chain partners/industry sector [110,112].

Regarding regulatory pressures, as an example the European Parliament has many legislative requirements relating to sustainability. Well-known examples include hazardous substances in electronic and electrical equipment [113] and REACH (registration, evaluation, authorisation and restriction of chemicals) [114]. Since this legislation has come into force, there has been a significant increase in the uptake of environmental initiatives in Europe [23,66,115–117]. Indeed, Salimzadeh et al. (2015) suggest that environmental legislation is one of the most important reasons why SMEs invest in environmental management initiatives.

3.2.7. Geographical Separation of Production and Consumption

In the past, SMEs tended to operate within a specific region, and suppliers and consumers were based close to the organisation [30]. Due to globalization, this has changed and not only large companies but also SMEs have suppliers, distributors and customers located all over the world. This leads to a diffused responsibility for the environmental impacts of products. It is more likely that each company in the supply chain will primarily work on improving its own environmental performance rather than communicating and collaborating with supply chain parties all over the globe [118], and it is more of a challenge for supply chain partners to communicate about environmental improvement projects [119–121]. Another aspect is the lack of consumer awareness of environmental impacts during the production. This is intensified by larger distances between consumption and production [122].

4. Enablers and Barriers in Supply Chain Management

4.1. Defining Supply Chain Management

The subject of supply chain management (SCM) is recognised as closely related to both the practice and the theory of LCM [118,123–125].

A *supply chain* can be defined as, "[. . .] the sum of all activities associated with the flow and transformation of materials starting at the point of original supply and continuing through to the end customer or consumer" [126]. In its simplest form, a supply chain comprises at least three entities: an organisation, a supplier and a customer (Gardiner, 2010).

In general, definitions of SCM focus on the management of flows of information, resources and money along supply chains, and place different emphasis upon these flows and upon the management aspects [127–130]. Two definitions of SCM that are the most relevant in the context of using SCM to support LCM are

- " . . . an integrated approach to obtaining, producing and delivering products and services to customers" [131];
- " . . . to synchronise the requirements of the customer with the flow of material from suppliers in order to affect a balance between what are often seen as the conflicting goals of high customer service, low inventory investment and low unit cost" (Stevens, 1989, p. 3).

The term green supply chain management (GSCM) has been developed by those focusing on environmental sustainability in the context of SCM [100,132–135]. Some researchers address social as well as environmental sustainability aspects in their work, and in these cases the term "sustainable supply chains" is sometimes used to describe the research area [136]. Definitions of GSCM include:

- "The management of supply chain operations, resources, information and funds in order to maximize the supply chain profitability while at the same time minimising the environmental impacts and maximising the social well-being" [136];
- "Integrating environmental concerns into the inter-organisational practices of SCM including reverse logistics" (Sarkis et al., 2011, p. 3);

- "Integrating environmental thinking into supply-chain, including product design, material sourcing and selection, manufacturing processes, delivery of the final product to the consumers as well as end-of-life management of the product after its useful life" [137];
- " . . . the management of material, information and capital flows as well as cooperation among companies along the supply chain while integrating goals from all three dimensions of sustainable development: economic, environmental and social, which are derived from customer and stakeholder requirements. In sustainable supply chains, environmental and social criteria need to be fulfilled by the members to remain within the supply chain, while it is expected that competitiveness would be maintained through meeting customer needs and related economic criteria "(Seuring et al., 2008).

As these definitions show, SCM and GSCM are focused on ensuring (environmental) initiatives are considered throughout the entire life cycle of a product/service. In this respect, they share the same objective as LCM. It is therefore appropriate to identify the enablers and barriers in the literature to uptake of SCM and GSCM.

4.2. Enablers and Barriers to Uptake of Supply Chain Management

Synthesizing the literature, the main factors contributing to successful supply chain management include seven components of interconnection: information exchange, goal congruence, decision synchronisation, incentive alignment, resources sharing, communication and joint knowledge creation [138]. Since these seven components are interrelated, this research groups them into three broader categories: resources, communication/information sharing between supply chain entities, and culture. Research has shown that these factors add value to supply chains by reducing costs and response time, leveraging resources and improving innovation [138].

4.2.1. Resources

Several articles have identified the disproportionate power held by large companies in supply chain activities due to their relatively higher expert knowledge levels and greater financial resources [118,139]. This can be contrasted with SMEs with their generally limited human and financial resources, lack of formal structures and processes [140], and focus on day-to-day business rather than long-term objectives and strategic decisions [75]. As a result, SMEs find it more difficult to effectively manage and interact with their supply chains. According to Stock and Boyer [141], SCM functions best if resources are shared, underlining the relevance of collaboration for SCM.

4.2.2. Communication/Information Sharing between Supply Chain Entities

"Communication is the contact and the process of message transmission between the partners of the supply chain in terms of frequency, direction, mode and strategy influence" [138]. Communication between supply chain entities is important to align incentives, goals and priorities of the individual companies that collaborate in the supply chain [131]. If supply chain entities have misaligned incentives, goals and priorities, then it can be very hard to keep up a good relationship and effective communication in the supply chain [131,142]. In particular, it is important to communicate customer needs back up the supply chain so that every supply chain entity can adapt processes accordingly and create the best possible added-value product for the customer [143]. At the same time, it is important to ensure two-way communication, which means each supply chain entity proactively communicates with other supply chain partners both up and down the supply chain, to ensure feedback, information and knowledge is shared effectively [144]. According to Parody et al. [138], communication can be evaluated by looking at the following five characteristics. The company and customers of the supply chain

- Have frequent contact;
- Have an open bidirectional communication;

- Maintain informal communication;
- Have different channels of communication;
- Influence the decisions of each one through the dialogue or debate.

Apart from sharing existing information, supply chain entities should also team up to create knowledge [145].

4.2.3. Culture

SCM can be a key competitive advance for organisations and supply chains, if cooperation between supply chain entities is done in a way where organisations not just focus on their individual improvements and opportunities, but also think outside of their own boundaries, viewing improvements more holistically from one end of the supply chain to the other [141]. In order to embed this open-minded approach, it is crucial to have leadership teams in place that encourage this way of thinking and a culture of collaboration [119]. Trust between supply chain entities creates momentum and supports suppliers to share innovative ideas with other supply chain entities [146–148]. Trust is important when supply chain entities collaborate as it facilitates commitment and emergence of a common vision of participants [147]. Trust grows between supply chain entities when they successfully collaborate together [129,149].

4.3. Factors Affecting Uptake of Life Cycle Management in SMEs

The identified characteristics of SMEs (Section 3.2) and supply chain management factors (Section 4.2) affecting the uptake of LCM can be summarised as

1. SMEs: the characteristics that affect the effectiveness of environmental management (including LCM) implementation by SMEs include owner/manager influence, environmental culture, resources availability, future orientation, knowledge of environmental issues, market requirements, geographical separation of production and consumption, and awareness of own environmental impacts (Section 3.2);
2. SCM: the factors that influence the effectiveness of SCM include resources, communication/information sharing between supply chain partners and culture (Section 4.2).

Mortimer [150] provides a model for organisational change for sustainability and associated adoption factors. The model has four categories, which include the individual, the organisation, the organisational field (supply chain) and the broader environment (e.g., market, government). On this basis, the characteristics and factors identified in this research that can potentially act as enablers or barriers for LCM uptake can be condensed into four views (Figure 1).

Figure 1 summarises the different lenses that can be applied depending on the position and/or view of the stakeholder. Some factors are present in multiple views whereas others are specific to a particular group. This approach can provide the basis for understanding and addressing relevant issues at the appropriate level. For example, certain enablers and barriers can be influenced at the individual or organisation level whereas it can be more efficient and effective to address other issues at the level of the industry sector or broader context.

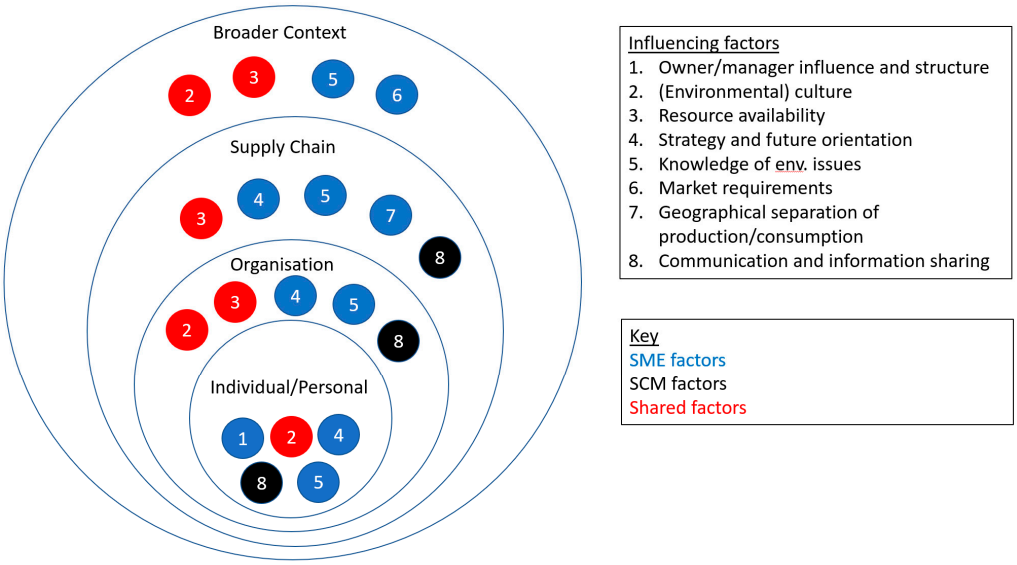

Figure 1. Enablers and barriers to successful life cycle management (LCM) uptake based on four views.

5. The Sector-Based Approach as a Way of Increasing the Uptake of LCM in SMEs

The previous sections provided a summary of the factors that affect the successful implementation of LCM initiatives in SMEs. The challenges are often related to internal characteristics of the SMEs themselves, but some are also due to external factors arising along the supply chains and due to the broader context in which SMEs are situated.

Based on their situation it is argued that SMEs find it challenging to implement LCM initiatives by themselves. To drive effective and meaningful change at scale, it may be beneficial to use a sector-based approach. This section investigates the use of a sector-based approach as a way of overcoming both the internal and external barriers to facilitate more effective implementation of LCM amongst SMEs.

The section provides a definition for the term "sector-based approach" (Section 5.1), which is then followed by New Zealand and international examples of sector-based approaches (Section 5.2). Finally, the benefits and shortcomings of a sector-based LCM approach—as opposed to individual organisations pursuing their own LCM programmes are discussed (Sections 5.3 and 5.4).

5.1. Defining Sector-Based LCM Approaches

There is very little published research on sector-based approaches for environmental management that addresses both vertical and horizontal cooperation within sectors. Indeed, Seuring [151] in his work on green supply chain management (GSCM) highlights this lack of research on reducing environmental impacts using sector-wide initiatives and calls "on the imagination of other researchers to develop new research projects and hypotheses" to drive sustainable SCM further. For the three guides to LCM uptake discussed in Section 2.2, the focus is on the individual organisation rather than uptake across an industry sector. Also, the guides focus on providing guidance and ideas on areas of improvement to reduce environmental impacts and how to support management decisions that facilitate LCM uptake within the organisation, as opposed to addressing the underlying key factors that must be in place to facilitate LCM uptake (such as those identified in Section 4). However, there are some examples of sector-based environmental management approaches, and a selection are reviewed in Section 5.2.

The lack of definition means there is no commonly used basis that can be used to determine the elements which constitute an industry sector-based approach. This gap needs to be filled in order to provide a common foundation for researchers and practitioners to design and implement an industry sector-based approach for LCM. In this paper, we adopt a working definition of an

industry sector-based approach to LCM as "a planned and systematic programme driven centrally by a sector body or other relevant accepted and knowledgeable organisation, covering both horizontal and vertical supply chain organisations that has the goal of continually improving the collective life cycle environmental performance of the industry sector".

Based on this definition, a sector-based LCM approach is envisaged as having several key requirements. Firstly, it must be a planned and systematic programme as opposed to ad hoc, discrete or one-off initiatives. The programme should be driven by a relevant, focal organisation which has relationships and trust with stakeholders as well as the appropriate industry sector and LCM specific knowledge. An industry sector-based approach must be concerned with the supply chain of a product or a service, i.e., the organisations that are vertically linked in a supply chain to produce a particular product or service (for example, the grower, post-harvest operator, distributor, and retailer in the kiwifruit supply chain). An industry sector-based LCM approach also needs to include the horizontal links between organisations in an industry sector i.e., the organisations that are in the same life cycle stage (for example, kiwifruit growers in the kiwifruit supply chain). Finally, the focus is on the environmental life cycle improvement of the industry sectors overall performance ideally based on an understanding of the hotspots and taking into account the need to avoid shifting the burden.

5.2. Examples of Sector-Based Approaches

This section provides examples of initiatives using sector-based approaches in New Zealand and around the world. The New Zealand initiatives are the Greenhouse Gas Footprinting Strategy and Sustainable Winegrowing New Zealand, and the overseas initiatives are the Australian Dairy Industry Sustainability Framework and the European Plastic and Steel Sector programmes. Each initiative is explained briefly, in particular highlighting whether it meets the requirements for a sector-based LCM approach as identified in Section 5.1. The European Plastics and Steel Sector programmes are included, even though they are not primary sector initiatives, because they are two of the most established and longest-running environmental LCM programmes.

5.2.1. Greenhouse Gas Footprinting Strategy of the Ministry for Primary Industries (New Zealand)

In 2006, the Ministry of Foreign Affairs and Trade identified an emerging threat to New Zealand's primary exports due to the popularity of the "food miles" concept that advocated consumption of more locally grown food [152,153]. That created the need to respond to increasing pressure in key export markets for carbon footprint information of primary products.

In response, the New Zealand Government developed the Greenhouse Gas Footprinting Strategy, a programme that worked with 70% of primary industry exports [152] including the kiwifruit [154], pipfruit [155], wine [156] and berryfruit [157] sectors. The projects involved undertaking carbon footprint studies of products in each sector and developing standardised ways for measuring and managing greenhouse gas emissions across the life cycle of these agricultural products (Ministry for Primary Industries, 2011). The results of the studies were intended to provide a basis for defining improvement projects for each of the industry sectors.

The Greenhouse Gas Footprinting Strategy did not meet all three requirements of the definition for a sector-based LCM approach. It did not actively encourage and facilitate the horizontal and vertical cooperation between supply chain partners. It was not a programme that put ongoing processes and strategies in place to foster exchange of ideas and knowledge between entities in the supply chain. However, it did generate an extensive body of knowledge about the environmental performance of the different industry sectors as carbon footprint studies were undertaken covering each life cycle stage of the different industry sectors. To further this programme, it would be important to put processes in place to encourage active communication between the entities up and down the supply chain as well as communication between organisations at the same point in the supply chain, to exchange ideas, knowledge and experiences about implementation of LCM initiatives.

5.2.2. Sustainable Winegrowing New Zealand

The Sustainable Winegrowing New Zealand (SWNZ) programme was introduced in 2002 with the aim of reducing environmental impacts occurring during viticulture and winemaking [158]. An important driver for the programme was the increasing demand by customers for environmental credentials, as well as the justification of the "clean and green" image of New Zealand [159]. The SWNZ programme uses a scorecard approach to monitor the environmental performance of activities including irrigation, weed control, soil management, fertilisers, and pest and disease management [158,160,161]. It also provides a platform for technology transfer through networking events and information on the website, so vineyards and winegrowers can keep up to date regarding new technology and its implementation and use, and use it as a forum to exchange knowledge and ideas. SWNZ also incorporates an audit structure to ensure compliance with market expectations.

The SWNZ programme is a sector-based approach as it provides a shared environmental management system for both grape growers and wine makers in New Zealand, i.e., it involves both horizontal and vertical entities in the supply chain of wine through a coordinated initiative. All of the organisations can make use of this programme and use it to reduce their environmental impacts. Since many vineyards and wineries take part in the programme, environmental improvements can be realised on a large scale and benefit the whole industry sector. Therefore, it can be regarded as a sector-based approach.

5.2.3. Australian Dairy Industry Sustainability Framework

The Australian Dairy Industry Sustainability Framework was established in 2012 by the Australian Dairy Industry Council to enhance livelihoods across the industry, improve community and animal wellbeing, and reduce environmental impacts [162]. It is managed by an industry Steering Committee and supported by Dairy Australia [163]. Recently, the focus has been expanded from 11 targets to 41 performance measures to also include other challenges that the industry faces. Improvements include environmental enhancements such as waste to landfill reductions, as well as trade agreements that benefit the farmers and allow for better competitiveness and profitability as well as health and safety indicators. The targets and performance indicators are reviewed and updated on a regular basis to ensure that the framework responds to the industry's challenges.

Currently, the framework supports the industry in understanding the common issues and areas for improvement, as well as areas where further collaboration, research and knowledge sharing is required. It also provides a basis for discussion with other global dairy industry organisations. The Australian dairy industry wants to share their information and insights with global partners and thereby speed up the research for improvement actions [164].

However, missing elements in this approach are the facilitation of communication and information sharing between supply chain partners in this industry. This could include information sharing amongst farmers, and amongst dairy manufacturers, as well as knowledge sharing and information sharing between these two supply chain entities. Additionally, since farmers and organisations need to become members of the framework, there may be a lack of representative data as most likely only proactive farmers/organisations will invest in becoming members [164].

5.2.4. European Plastics Sector

PlasticsEurope supports the use of LCA to calculate and assess environmental impacts associated with a product, process or service [165]. The first eco-profile-reports, which include LCA results, were published in 1993 and comprise environmental information about processes operated by members of PlasticsEurope. During the last two decades, more than 70 Eco-profile reports were made freely available through PlasticsEurope. Additionally, in 2006 PlasticsEurope started a complementary Environmental Product Declaration (EPD) programme. Together, Eco-profiles and EPDs cover a large number of polymers that are widely used in engineering plastics and several common plastics

conversion processes [165]. Through the publication of average data, PlasticsEurope ensures that there are scientifically sound data in the public domain for use in LCAs without compromising confidentiality. Moreover, the published data serve as environmental benchmarks for other companies.

The initiative by the European Plastics sector qualifies as a sector-based approach as organisations at the same life cycle stage, i.e., plastic producers, share information and knowledge about the environmental performance of their business practices.

5.2.5. European Steel Sector

The European Steel Association, called EUROFER, was established in 1976 with the aim to improve cooperation between steel companies and steel federations throughout the European Union. It supports the development of the European steel industry and represents the common interests of its members. The EUROFER Sustainability for Steel Construction Products Committee (ESSCPC) is a committee with a key focus on sustainability and corporate responsibility. As a part of its role, the ESSCPC develops, manages and promotes a certification system (called the Mark) related to sustainability and corporate responsibility in the steel construction products sector. Companies producing steel products for the construction sector can get certified with regards to the requirements for sustainability aspects and get granted the Mark [166].

The initiative by the European Steel sector qualifies as a sector-based approach as members share common goals towards sustainability improvements in their sector. They have a certification system in place to ensure third-party audits.

5.3. Benefits of Sector-Based Approaches to LCM

Based upon the examples in the previous section, a number of benefits can be identified that are associated with a sector-based approach to LCM as opposed to organisations individually implementing LCM. They include economies of scale for LCM research to support implementation, ease of administration, streamlined collection and management of data, improved reputation of the product, knowledge sharing, and creating momentum for LCM.

Economies of scale for LCM research to support implementation refers to the cost and results of LCM studies being shared amongst many organisations who carry out similar activities in a specific sector. This benefit of sector-based LCM addresses the resource availability factor identified in Section 4, and was shown to be present in all five case studies above. For example, the Greenhouse Gas Footprinting Strategy involved undertaking one LCA study on behalf of all the organisations in each sector, and including data ranges where activities varied across different organisations (e.g., quantities of fertilizer, irrigation activities and use of refrigerants). It was not necessary to carry out a separate LCA for each organisation in the supply chain because averages and ranges were sufficient to identify environmental hotspots for the sector.

Ease of administration is a benefit of using a sector-based approach. SWNZ, for example, implemented one framework applicable to all growers in the wine sector and managed it centrally through New Zealand Winegrowers. This meant that individual growers did not have to develop their own strategies and key objectives, and reporting systems. It can also be easier to monitor, audit, and certify organisations in a sector when there is a common system. In industry sectors with a small number of players, in particular, this is usually easier than in sectors with a high degree of diversity or a large number of players [167].

The accompanying collection and management of data is also streamlined when using a centralised system, and this facilitates an industry sector to more accurately communicate and market its generic environmental credentials [167]. Related to this, if the majority of companies from any one life cycle stage act together to reduce the environmental impacts associated with their activities and their supply chains, it is likely that the subsequent improved reputation of the product will benefit the entire industry sector rather than individual companies. Implementation of sector-based LCM will help to counteract the increasing focus on sustainability "weak links" in supply chains [168]. For New

Zealand, this approach can be particularly important in order to reinforce the country's "clean and green" image and to improve positioning of New Zealand products in overseas marketplace [32,33]. Thus, a sector-based approach can more effectively address the factors identified in Section 4 regarding meeting market requirements, geographical separation of production and consumption, trust between supply chain entities, and communication/information sharing between supply chain partners.

Finally, sector-based approaches facilitate knowledge sharing and experiences (thus addressing the knowledge of environmental issues, awareness of own environmental issues, and future orientation factors identified in Section 4). For example, all New Zealand wine growers have access to a network of knowledge around environmental management implementation and strategies to reduce environmental impacts effectively in their operations. SWNZ acts as a platform for knowledge exchange and transfer, through access to an online platform for all SWNZ members. This has the potential to create momentum that increases participation in LCM. If an individual organisation at one life cycle stage sees another organisation implementing LCM, this can build confidence that LCM works or competitiveness that can motivate that other organisation to implement LCM [169]. This is one way of gaining support from owner/managers and developing an environmental culture, identified as relevant factors for LCM implementation in Section 4.

5.4. Disadvantages of Sector-Based Approaches to LCM

The disadvantages of implementing a sector-based approach to LCM as opposed to individual organisations implementing LCM include loss of first-mover advantage, and time-consuming cooperation processes.

If an organisation makes improvements to its processes and environmental performance in cooperation with other supply chain entities in its sector, it loses the first mover advantage. Its efforts will not result in the organisation differentiating itself from its competitors in the same industry sector. However, on the other hand, proactive companies that drive sector-based change in an industry sector are likely to be more advanced than their competitors and thus benefit from a reputation for being proactive in change management. The New Zealand wine industry shows that this first mover advantage is not necessarily lost when a sector-based approach is implemented. Certain individual wineries and vineyards have implemented additional LCM initiatives and thereby built a reputation of being particularly proactive in the area of LCM. For example, Yealands and Villa Maria are winemakers that regularly win awards for their success in reducing environmental impacts [170,171].

Sector-based approaches require the supply chain entities/players to work together, exchange knowledge and ideas, and discuss initiatives to increase uptake of environmental activities. In particular, in long and complex supply chains, it can be hard to agree on approaches for LCM implementation at a sector-level. This can make sector-based LCM a time-consuming process. However, this time commitment needs to be balanced against the time that would be taken for an individual company to develop its own LCM programme without the economies of scale associated with developing a sector-wide programme.

5.5. Summary of the Effectiveness of Using a Sector-Based Approach for LCM

Based on the discussions in Sections 5.3 and 5.4, the sector-based approach seems to be a viable and practical way to implement LCM in organisations. In particular, supply chains that have a large number of SMEs and that operate in the same economic sector, can potentially benefit from this approach. Since these SMEs have similar day-to-day activities, and inputs and outputs, the sector-based approach allows them to share information in order to identify environmental impacts as well as improvement opportunities, and learn from each other's experiences. If the sector has strong communication tools in place, this can lead to momentum which facilitates other organisations in the sector to take up LCM initiatives, leading to an improvement in the overall sector's performance, which subsequently has a positive effect on the sector's reputation, consumer perceptions about the sector, and overall environmental performance.

6. Conclusions

The development of a sector-based LCM programme can facilitate overcoming the barriers that many SMEs face when implementing LCM. A sector-based approach allows SMEs to share resources and collectively benefit from the results. For example, they may share the cost for consultants to undertake LCAs that will help the sector identify areas for improvements. Additionally, the SMEs can share knowledge and expertise, and can develop and implement strategies together, which may lead to greater momentum, more regular updates and improvements, and subsequently a better reputation of the product/service.

This paper has presented a summary of the SME and SCM literature research culminating in the identified eight factors that can act as either enablers or barriers for individual SMEs considering uptake of LCM. The factors are owner/manager influence, culture, resources, strategy, knowledge, market requirements, geography and communication.

Further research is needed to identify where different companies and sectors are situated vis-a-vis whether each factor is acting as an enabler or barrier to uptake of LCM. A capability maturity model will be developed that can be used by individual organisations and industry sectors to evaluate their maturity with respect to the eight influencing factors. Once this is done, LCM programmes can be developed that are tailored to maintain and strengthen the enablers, and address the barriers, for the different companies in a sector.

Future research will focus on the development of collaboration tools such as a cloud-based platform to facilitate effective LCM at the industry sector level by providing solutions to the barriers identified in this research.

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References

1. World Business Council For Sustainable Development (WBCSD). COP22 Low-Emission Solutions Conference Emphasizes Need for Strong Leadership, Sound Climate Policies and Effective Economic Mechanisms. Available online: http://www.wbcsd.org/Clusters/Climate-Energy/News/Low-Emission-Solution-Conference-calls-for-strong-leadership-on-climate-change (accessed on 19 November 2016).
2. World Business Council For Sustainable Development (WBCSD). Global Network Brochure. Available online: http://www.wbcsd.org/Overview/Global-Network/Resources/Global-Network-Brochure (accessed on 19 November 2016).
3. World Business Council For Sustainable Development (WBCSD). Incubating Sustainable Business Growth—How to Accelerate Corporate Innovation to Drive Sustainable Business Growth. Available online: http://www.wbcsd.org/Projects/Education/Leadership-program/Resources/Incubating-sustainable-business-growth-How-to-accelerate-corporate-innovation-to-drive-sustainable-business-growth (accessed on 19 November 2016).
4. United Nations Environment Programme (UNEP). Urban solutions: Making cities strong, smart, sustainable. *Our Planet*. 2016. Available online: https://europa.eu/capacity4dev/unep/documents/our-planet-october-2016-urban-solutions-making-cities-strong-smart-sustainable (accessed on 19 November 2017).
5. United Nations Environment Programme (UNEP). Sustainable Consumption and Production. Available online: http://www.unep.org/rio20/About/SustainableConsumptionandProduction/tabid/102187/Default.aspx (accessed on 14 January 2017).
6. Pure Advantage. Available online: http://pureadvantage.org/about/ (accessed on 14 January 2017).
7. McLaren, S.J.; Smith, A.; Mithraratne, N.; Cleland, D.; Marquardt, M.; Frater, G.; Barber, A.; Rothmann, M. *Carbon Footprinting for the Kiwifruit Supply Chain—Report on Implementation*; Landcare Research: Wellington, New Zealand, 2008.

8. Green Growth Advisory Group. *Green Growth—Issues for New Zealand*. 2011. Available online: https://www.businessnz.org.nz/__data/assets/pdf_file/0003/67863/111025-BusinessNZ-Submission-to-the-GGAG.pdf (accessed on 14 January 2017).
9. Michaelis, L. The role of business in sustainable consumption. *J. Clean. Prod.* **2003**, *11*, 915–921. [CrossRef]
10. Da Silva, E.; Jabbour, C.J.C.; Santos, F.C.A. Integrating environmental management and manufacturing strategy: An emerging competitive priority. *Int. J. Environ. Technol. Manag.* **2009**, *10*, 397–411. [CrossRef]
11. Esty, D.; Winston, A. *Green to Gold: How Smart Companies Use Environmental Strategy to Innovate, Create Value, and Build Competitive Advantage*; John Wiley & Sons: New York, NY, USA, 2009.
12. Johansson, G.; Winroth, M. Introducing environmental concern in manufacturing strategies: Implications for the decision criteria. *Manag. Res. Rev.* **2010**, *33*, 877–899. [CrossRef]
13. Sarkis, J. Manufacturing's role in corporate environmental sustainability-Concerns for the new millennium. *Int. J. Oper. Prod. Manag.* **2001**, *21*, 666–686. [CrossRef]
14. McLaren, S.; Garnevska, E. Why Practice Life Cycle Management? Case Study of the New Zealand Wine Industry. In Proceedings of the Proceedings of the 9th International Conference on Life Cycle Assessment in the Agri-Food Sector (LCA Food 2014), San Francisco, CA, USA, 8–10 October 2014; pp. 789–796.
15. European Commission Environment. *Being Wise with Waste: The EU's Approach to Waste Management*. 2010. Available online: http://ec.europa.eu/environment/waste/pdf/WASTE%20BROCHURE.pdf (accessed on 13 July 2017).
16. European Commission Environment. Waste Stream. Available online: http://ec.europa.eu/environment/waste/index.htm (accessed on 13 July 2011).
17. European Commission Environment. REACH. Available online: http://ec.europa.eu/environment/chemicals/reach/reach_intro.htm (accessed on 22 August 2011).
18. European Commission Environment. Waste: End of Life Vehicles. Available online: http://ec.europa.eu/environment/waste/elv_index.htm (accessed on 22 August 2011).
19. Gmelin, H.; Seuring, S. Achieving sustainable new product development by integrating product life-cycle management capabilities. *Int. J. Prod. Econ.* **2014**, *154*, 166–177. [CrossRef]
20. Collins, E.; Lawrence, S.; Pavlovich, K.; Ryan, C. Business networks and the uptake of sustainability practices: The case of New Zealand. *J. Clean. Prod.* **2007**, *15*, 729–740. [CrossRef]
21. Aiyub, K.; Jahi, J.; Arifin, K.; Awang, A. Environmental performance in small and medium sized enterprises (SMEs) certified to ISO 14001 in the United Kingdom. *Int. Bus. Manag.* **2009**, *3*, 7–14.
22. Borga, F.; Citterio, A.; Noci, G.; Pizzurno, E. Sustainability report in small enterprises: Case studies in Italian furniture companies. *Bus. Strategy Environ.* **2009**, *18*, 162–176. [CrossRef]
23. Williamson, D.; Lynch-Wood, G.; Ramsay, J. Drivers of environmental behaviour in manufacturing SMEs and the implications for CSR. *J. Bus. Ethics* **2006**, *67*, 317–330. [CrossRef]
24. Klewitz, J.; Hansen, E.G. Sustainability-oriented innovation of SMEs: A systematic review. *J. Clean. Prod.* **2014**, *65*, 57–75. [CrossRef]
25. Johnson, M.P.; Schaltegger, S. Two decades of sustainability management tools for SMEs: How far have we come? *J. Small Bus. Manag.* **2016**, *54*, 481–505. [CrossRef]
26. Henriques, J.; Catarino, J. Sustainable value and cleaner production–research and application in 19 Portuguese SME. *J. Clean. Prod.* **2015**, *96*, 379–386. [CrossRef]
27. Hörisch, J.; Johnson, M.P.; Schaltegger, S. Implementation of Sustainability Management and Company Size: A Knowledge-Based View. *Bus. Strategy Environ.* **2015**, *24*, 765–779. [CrossRef]
28. Bourlakis, M.; Maglaras, G.; Aktas, E.; Gallear, D.; Fotopoulos, C. Firm size and sustainable performance in food supply chains: Insights from Greek SMEs. *Int. J. Prod. Econ.* **2014**, *152*, 112–130. [CrossRef]
29. Seidel, M. Towards Environmentally Sustainable Manufacturing: A Strategic Framework for Small and Medium sized Enterprises. Ph.D. Thesis, The University of Auckland, Auckland, New Zealand, 2011.
30. Hillary, R. *Small and Medium-Sized Enterprises and the Environment: Business Imperatives*; Greenleaf Publishing: Santa Monica, CA, USA, 2000.
31. Sterzik, H.; McLaren, S.J.; Hume, A.; Garnevska, E.; McDevitt, J.E. Challenges and enablers for successful LCM uptake in the New Zealand kiwifruit industry. In Proceedings of the 8th Life Cycle Conference, Pathways to Greening Global Markets, Sydney, Australia, 16–18 July 2013.
32. Gnoth, J. Leveraging export brands through a tourism destination brand. *J. Brand Manag.* **2002**, *9*, 262–280. [CrossRef]

33. Brown, G.; Stone, L. Cleaner production in New Zealand: Taking stock. *J. Clean. Prod.* **2007**, *15*, 716–728. [CrossRef]
34. Stern, N. *Green Growth: Opportunities for New Zealand*; The University of Auckland: Auckland, New Zealand, 2012.
35. Jones, G.; Mowatt, S. National image as a competitive disadvantage: The case of the New Zealand organic food industry. *Bus. Hist.* **2016**, *58*, 1262–1288. [CrossRef]
36. Sustainable Business Council. *Annual Snapshot 2016/17*. 2017. Available online: http://www.wbcsd.org/Overview/Global-Network/News/Sustainable-Business-Council-publishes-Annual-Snapshot-2016-2017 (accessed on 5 January 2018).
37. Ministry for Primary Industries. Growing Exports. Available online: https://mpi.govt.nz/exporting/overview/growing-exports/ (accessed on 8 January 2017).
38. Whitman, Z.; Seville, E.; Wilson, T.; Vargo, J. *The Canterbury Earthquakes: The Impact on Farming Organisations*; APEC: New York, NY, USA, 2012.
39. United Nations Environment Programme (UNEP). *Background Report for a UNEP Guide to Life Cycle Management—A Bridge to Sustainable Products*; UNEP: Paris, France, 2006.
40. Collins, E.; Roper, J.; Lawrence, S. Sustainability practices: Trends in New Zealand businesses. *Bus. Strategy Environ.* **2010**, *19*, 479–494. [CrossRef]
41. Collins, E.; Dickie, C.; Weber, P. New Zealand & Australia: A New Zealand and Australian Overview of Ethics and Sustainability in SMEs. In *Ethics in Small and Medium Sized Enterprises*; Springer: Dordrecht, The Netherlands, 2011; pp. 85–97.
42. Jüttner, U.; Ziegenbein, A. Supply Chain Risk Management for Small and Medium-Sized Businesses. *Supply Chain Risk: A Handbook of Assessment, Management and Performance*; Springer: Dordrecht, The Netherlands, 2009. Available online: https://link.springer.com/chapter/10.1007/978-0-387-79934-6_13 (accessed on 14 January 2017).
43. Saur, K.; Donato, G.; Cobas Flores, E.; Frankl, P.; Jensen, A.A.; Kituyi, E.; Lee, K.M.; Swarr, T.; Tawfic, M.; Tukker, A. *Draft Final Report of the LCM Definition Study*; UNEP/SETAC Life Cycle Initiative: Paris, France, 2003.
44. Sonnemann, G.; Gemechu, E.D.; Remmen, A.; Frydendal, J.; Jensen, A.A. Life Cycle Management: Implementing Sustainability in Business Practice. In *Life Cycle Management*; Springer: Dordrecht, The Netherlands, 2015; pp. 7–21.
45. Frame, B.; Newton, B. Promoting sustainability through social marketing: Examples from New Zealand. *Int. J. Consum. Stud.* **2007**, *31*, 571–581. [CrossRef]
46. Sterzik, H.; McLaren, S.J.; Garnevska, E.; Hume, A. Implementation of LCM in NZ Primary Industries Using a Sector-Based Approach. In Proceedings of the 3rd New Zealand Life Cycle Thinking and Policy: Towards a Sustainable Society, Wellington, New Zealand, 2–3 September 2014.
47. Bank, W. Exports of Goods and Services (% of GDP). Available online: http://data.worldbank.org/indicator/NE.EXP.GNFS.ZS (accessed on 14 January 2017).
48. Paxton, A. *Food Miles Report*; Safe Alliance: Montreal, QC, Canada, 1994.
49. Smith, A.; Watkiss, P.; Tweddle, G.; McKinnon, A.; Browne, M.; Hunt, A.; Treleven, C.; Nash, C.; Cross, S. *The Validity of Food Miles as an Indicator of Sustainable Development*; AEA Technology: London, UK, 2005.
50. Alliance, S. *The Food Miles Report: The Dangers of Long Distance Food Transport*; SAFE Alliance: London, UK, 1994.
51. Saunders, C.; Barber, A.; Taylor, G. *Food Miles—Comparative Energy/Emissions Performance of New Zealand's Agriculture Industry*; Research Report No. 285; Lincoln University: Lincoln, UK, 2006.
52. Smith, A.; Stancu, C.; McKenzie, S. *Food Miles—Practical Steps for New Zealand Exporters*; Landcare Research: Lincoln, New Zealand, 2006.
53. McLaren, S.J. Food miles: Fact or fiction. Hatched. In *The Capacity for Sustainable Development*; Landcare Research: Lincoln, New Zealand, 2009; Available online: http://www.landcareresearch.co.nz/services/sustainablesoc/hatched (accessed on 5 January 2018).
54. Nemecek, T.; Jungbluth, N.; i Canals, L.M.; Schenck, R. Environmental impacts of food consumption and nutrition: Where are we and what is next? *Int. J. Life Cycle Assess.* **2016**, *21*, 607–620. [CrossRef]
55. Notarnicola, B.; Sala, S.; Anton, A.; McLaren, S.J.; Saouter, E.; Sonesson, U. The role of life cycle assessment in supporting sustainable agri-food systems: A review of the challenges. *J. Clean. Prod.* **2017**, *140*, 399–409. [CrossRef]

56. Remmen, A. *An Introduction to Life-Cycle Thinking and Management*; The Danish Ministry of the Environment: Copenhagen, Denmark, 2003. Available online: https://www2.mst.dk/Udgiv/publications/2003/87-7972-458-2/html/default_eng.htm (accessed on 5 January 2018).
57. Remmen, A.; Jensen, A.A.; Frydendal, J. A Business Guide to Sustainability. In *Life Cycle Management*; United Nations Environment Programme: Paris, France, 2007.
58. International Organisation for Standardisation (ISO). *ISO 14001 Environmental Management System Standard*; ISO: Geneve, Switzerland, 2004.
59. United Nations Environment Programme (UNEP); Society of Environmental Toxicology and Chemistry (SETAC). *Life Cycle Management: A Business Guide to Sustainability*; UNEP: Paris, France, 2007.
60. European Commission. What Is an SME? Available online: http://ec.europa.eu/growth/smes/business-friendly-environment/sme-definition_en (accessed on 19 November 2016).
61. US International Trade Commission. *Small and Medium-Sized Enterprises: Overview of Participation in U.S. Exports*; US International Trade Commission: Washington, DC, USA, 2010.
62. Ministry of Economic Development (MED). *SMEs in New Zealand: Structure and Dynamics 2011*; 2011; p. 10. Available online: http://www.mbie.govt.nz/info-services/business/business-growth-and-internationalisation/documents-image-library/Structure-and-Dynamics-2011.pdf (accessed on 5 January 2018).
63. Ministry of Business, Innovation & Employment. The Small Business Sector Report. Available online: http://www.mbie.govt.nz/info-services/business/business-growth-agenda/pdf-and-image-library/2014/The%20Small%20Business%20Sector%20Report%202014%20-PDF%208.8%20MB-1.pdf (accessed on 14 January 2017).
64. Groundwork. *Small Firms and the Environment*; Groundwork Foundation: Birmingham, UK, 2005.
65. Parker, C.M.; Redmond, J.; Simpson, M. A review of interventions to encourage SMEs to make environmental improvements. *Environ. Plan. C Gov. Policy* **2009**, *27*, 279–301. [CrossRef]
66. Agan, Y.; Acar, M.F.; Borodin, A. Drivers of environmental processes and their impact on performance: A study of Turkish SMEs. *J. Clean. Prod.* **2013**, *51*, 23–33. [CrossRef]
67. Halila, F.; Tell, J. Creating synergies between SMEs and universities for ISO 14001 certification. *J. Clean. Prod.* **2013**, *48*, 85–92. [CrossRef]
68. Arvizu-Piña, V.A.; Burgos, A.C. Promoting sustainability in Mexico's building sector via environmental product declarations. *Int. J. Life Cycle Assess.* **2017**, *22*, 1744–1759. [CrossRef]
69. Schaper, M. The challenge of environmental responsibility and sustainable development: Implications for SME and entrepreneurship academics. In *Radical Changes in the World: Will SMEs Soar or Crash?* Füglistaller, U., Pleitner, H.J., Volery, T., Weber, W., Eds.; University of St. Gallen: St. Gallen, Switzerland, 2002; pp. 541–553.
70. ECOTEC Research & Consulting Ltd. *Report on SMEs and the Environment*; Final Report Prepared for the European Commission; DG Environment: Luxembourg, 2000; pp. 44–48.
71. Al Zaabi, S.; Al Dhaheri, N.; Diabat, A. Analysis of interaction between the barriers for the implementation of sustainable supply chain management. *Int. J. Adv. Manuf. Technol.* **2013**, *68*, 895–905. [CrossRef]
72. O'Regan, N.; Ghobadian, A. *The Need to Rethink Strategy in SMEs*; University of Sheffield: Sheffield, UK, 1998.
73. Papagiannakis, G.; Lioukas, S. Values, attitudes and perceptions of managers as predictors of corporate environmental responsiveness. *J. Environ. Manag.* **2012**, *100*, 41–51. [CrossRef] [PubMed]
74. Mandl, I.; Dorr, A. *CSR and Competitiveness-European SMEs' Good Practice*; Consolidated European Report; Austrian Institute for SME Research: Vienna, Austria, 2007.
75. Seidel, M.; Seidel, R.; Tedford, D.; Cross, R.; Wait, L.; Haemmerle, E. Overcoming Barriers to Implementing Environmentally Benign Manufacturing Practices: Strategic Tools for SMEs. *Environ. Qual. Manag.* **2009**, 37–55. [CrossRef]
76. Giunipero, L.C.; Hooker, R.E.; Denslow, D. Purchasing and supply management sustainability: Drivers and barriers. *J. Purch. Supply Manag.* **2012**, *18*, 258–269. [CrossRef]
77. Cucchiella, F.; Koh, L.; Walker, H.; Jones, N. Sustainable supply chain management across the UK private sector. *Supply Chain Manag.* **2012**, *17*, 15–28.
78. Muduli, K.; Govindan, K.; Barve, A.; Geng, Y. Barriers to green supply chain management in Indian mining industries: A graph theoretic approach. *J. Clean. Prod.* **2013**, *47*, 335–344. [CrossRef]
79. Massoud, M.; Tabcharani, R.; Nakkash, R.; Jamali, D. Environmental performance improvement and ISO 14001: Case of Lebanon. *Environ. Impact* **2012**, *162*, 109.

80. Johnson, M.P. Sustainability Management and Small and Medium-Sized Enterprises: Managers' Awareness and Implementation of Innovative Tools. *Corp. Soc. Responsib. Environ. Manag.* **2015**, *22*, 271–285. [CrossRef]
81. Linton, R. *Acculturation in Seven American Indian Tribes*; Wiley: Hoboken, NJ, USA, 1963.
82. Altman, I.; Chemers, M.M. *Culture and Environment*; CUP Archive: Cambridge, UK, 1984; Available online: https://www.cmu.edu/ARIS_3/text/text_rapoport.html (accessed on 5 January 2018).
83. Schumacher, I. The endogenous formation of an environmental culture. *Eur. Econ. Rev.* **2015**, *76*, 200–221. [CrossRef]
84. Thun, J.-H.; Muller, A. An empirical analysis of green supply chain management in the German automotive industry. *Bus. Strategy Environ.* **2010**, *19*, 238–248. [CrossRef]
85. Stoica, M.; Florea, L.; Lukacs, E. The Effect of Organizational Culture on the Responsiveness of Small and Medium-Sized Enterprises to Environmental Change: An Empirical Study in Romania. In *Challenges, Performances and Tendencies in Organisation Management*; World Scientific: Singapore, 2016; pp. 289–296. Available online: http://www.worldscientific.com/doi/abs/10.1142/9789814656023_0031 (accessed on 5 January 2018).
86. Boiral, O.; Baron, C.; Gunnlaugson, O. Environmental leadership and consciousness development: A Case study among Canadian SMEs. *J. Bus. Ethics* **2014**, *123*, 363–383. [CrossRef]
87. Sugita, M.; Takahashi, T. Influence of corporate culture on environmental management performance: An empirical study of japanese firms. *Corp. Soc. Respons. Environ. Manag.* **2015**, *22*, 182–192. [CrossRef]
88. Uhlaner, L.M.; Berent-Braun, M.M.; Jeurissen, R.J.; de Wit, G. Beyond size: Predicting engagement in environmental management practices of Dutch SMEs. *J. Bus. Ethics* **2012**, *109*, 411–429. [CrossRef]
89. Abdelzaher, D.M.; Abdelzaher, A. Beyond environmental regulations: Exploring the potential of "eco-Islam" in boosting environmental ethics within SMEs in Arab markets. *J. Bus. Ethics* **2017**, *145*, 1–15. [CrossRef]
90. Graafland, J.; Smid, H. Environmental impacts of SMEs and the effects of formal management tools: Evidence from EU's largest survey. *Corp. Soc. Respons. Environ. Manag.* **2015**. [CrossRef]
91. Carrillo-Hermosilla, J.; Del Río, P.; Könnölä, T. Diversity of eco-innovations: Reflections from selected case studies. *J. Clean. Prod.* **2010**, *18*, 1073–1083. [CrossRef]
92. Hillary, R. Environmental management systems and the smaller enterprise. *J. Clean. Prod.* **2004**, *12*, 561–569. [CrossRef]
93. Young, G. Opportunities and Challenges Related to SME Implementation of EMSs; Sydney, Australia. 2010. Available online: http://synapsechronicles.com/wp-content/uploads/2010/05/Opportunities-and-challenges-related-to-SME-implementation-of-EMSs.pdf (accessed on 14 January 2017).
94. Lewis, K.; Cassells, S. Barriers and drivers for environmental practice uptake in SMEs: A New Zealand perspective. *Int. J. Bus. Stud.* **2010**, *18*, 7.
95. Comas Martí, J.M.; Seifert, R.W. Assessing the comprehensiveness of supply chain environmental strategies. *Bus. Strategy Environ.* **2013**, *22*, 339–356. [CrossRef]
96. Nilsson-Lindén, H.; Baumann, H.; Rosén, M.; Diedrich, A. Organizing life cycle management in practice: Challenges of a multinational manufacturing corporation. *Int. J. Life Cycle Assess.* **2014**, 1–15. [CrossRef]
97. Cox, J.; Sarkis, J.; Wells, W. Exploring organisational recycling market development: The Texas Mexico border. In *Greener Marketing: A Global Perspective on Greener Marketing Practice*; Polonsky, M.J., Charter, M., Eds.; Greenleaf: Sheffield, UK, 1999; pp. 381–394.
98. Min, H.; Galle, W.P. Green purchasing strategies: Trends and implications. *Int. J. Purch. Mater. Manag.* **1997**, *33*, 10–17. [CrossRef]
99. Linnanen, L.; Bostrom, T.; Meittinen, P. Life Cycle Management: Integrated approach towards corporate environmental issues. *Bus. Strategy Environ.* **1995**, *4*, 117–127. [CrossRef]
100. Ageron, B.; Gunasekaran, A.; Spalanzani, A. Sustainable supply management: An empirical study. *Int. J. Prod. Econ.* **2012**, *140*, 168–182. [CrossRef]
101. Condon, L. Sustainability and small to medium sized enterprises: How to engage them. *Aust. J. Environ. Educ.* **2004**, *20*, 57. [CrossRef]
102. Singh, H.D.B. Achieving environmental sustainability of Small and Medium Enterprises through selective supplier development programs. *Int. J. Adv. Res. Manag. Soc. Sci.* **2015**, *4*, 35–50.
103. Wu, Z.; Pagell, M. Balancing priorities: Decision-making in sustainable supply chain management. *J. Oper. Manag.* **2011**, *29*, 577–590. [CrossRef]

104. Carter, C.R.; Rogers, D.S. A framework of sustainable supply chain management: Moving toward new theory. *Int. J. Phys. Distrib. Logist. Manag.* **2008**, *38*, 360–387. [CrossRef]
105. Pérez-Luño, A.; Saparito, P.; Gopalakrishnan, S. Small and Medium-Sized Enterprise's Entrepreneurial versus Market Orientation and the Creation of Tacit Knowledge. *J. Small Bus. Manag.* **2016**, *54*, 262–278. [CrossRef]
106. Eriksson, H.; Eriksson, H. Outcome of quality management practices: Differences among public and private, manufacturing and service, SME and large organisations. *Int. J. Qual. Reliab. Manag.* **2016**, *33*, 1394–1405. [CrossRef]
107. Redmond, J.; Wolfram Cox, J.; Curtis, J.; Kirk-Brown, A.; Walker, B. Beyond business as usual: How (and why) the habit discontinuity hypothesis can inform SME engagement in environmental sustainability practices. *Australas. J. Environ. Manag.* **2016**, *23*, 426–442. [CrossRef]
108. Lee, K.H.; Kim, J.W. Integrating suppliers into green product innovation development: An empirical case study in the semiconductor industry. *Bus. Strategy Environ.* **2011**, *20*, 527–538. [CrossRef]
109. Murillo-Luna, J.L.; Garcés-Ayerbe, C.; Rivera-Torres, P. Barriers to the adoption of proactive environmental strategies. *J. Clean. Prod.* **2011**, *19*, 1417–1425. [CrossRef]
110. Chan, E.S.; Hon, A.H.; Okumus, F.; Chan, W. An empirical study of environmental practices and employee ecological behavior in the hotel industry. *J. Hosp. Tour. Res.* **2014**. [CrossRef]
111. Sinding, K. Environmental management beyond the boundaries of the firm: Definitions and constraints. *Bus. Strategy Environ.* **2000**, *9*, 79–91. [CrossRef]
112. Chan, E.S.; Okumus, F.; Chan, W. Barriers to environmental technology adoption in hotels. *J. Hosp. Tour. Res.* **2015**. [CrossRef]
113. European Commission Environment. Reviews of the Directive on the Restriction of Certain Hazardous Substances in Electrical and Electronic Equipment. Available online: http://ec.europa.eu/environment/waste/rohs_eee/events_rohs2_en.htm (accessed on 5 January 2018).
114. European Chemicals Agency. REACH. Available online: https://echa.europa.eu/regulations/reach (accessed on 25 February 2017).
115. Biondi, V.; Iraldo, F.; Meredith, S. Achieving sustainability through environmental innovation: The role of SMEs. *Int. J. Technol. Manag.* **2002**, *24*, 612–626. [CrossRef]
116. Rutherfoord, R.; Blackburn, R.A.; Spence, L.J. Environmental management and the small firm: An international comparison. *Int. J. Entrep. Behav. Res.* **2000**, *6*, 310–326. [CrossRef]
117. Hernandez-Pardo, R.J.; Bhamra, T.; Bhamra, R. Exploring SME perceptions of sustainable product service systems. *IEEE Trans. Eng. Manag.* **2013**, *60*, 483–495. [CrossRef]
118. Norrman, A.; Jansson, U. Ericsson's proactive supply chain risk management approach after a serious sub-supplier accident. *Int. J. Phys. Distrib. Logist. Manag.* **2004**, *34*, 434–456. [CrossRef]
119. Kache, F.; Seuring, S. Linking collaboration and integration to risk and performance in supply chains via a review of literature reviews. *Supply Chain Manag.* **2014**, *19*, 664–682. [CrossRef]
120. Arzu Akyuz, G.; Erman Erkan, T. Supply chain performance measurement: A literature review. *Int. J. Prod. Res.* **2010**, *48*, 5137–5155. [CrossRef]
121. Accorsi, R.; Manzini, R.; Pini, C.; Penazzi, S. On the design of closed-loop networks for product life cycle management: Economic, environmental and geography considerations. *J. Transp. Geogr.* **2015**, *48*, 121–134. [CrossRef]
122. Lewis, K.V.; Cassells, S.; Roxas, H. SMEs and the potential for a collaborative path to environmental responsibility. *Bus. Strategy Environ.* **2015**, *24*, 750–764. [CrossRef]
123. Swink, M.; Narasimhan, R.; Wang, C. Managing beyond the factory walls: Effects of four types of strategic integration on manufacturing plant performance. *J. Oper. Manag.* **2007**, *25*, 148–164. [CrossRef]
124. Song, M.; Di Benedetto, C.A. Supplier's involvement and success of radical new product development in new ventures. *J. Oper. Manag.* **2008**, *26*, 1–22. [CrossRef]
125. Martinsuo, M.; Ahola, T. Supplier integration in complex delivery projects: Comparison between different buyer–supplier relationships. *Int. J. Proj. Manag.* **2010**, *28*, 107–116. [CrossRef]
126. Handfield, R.B.; Nichols, E.L.; Ernest, L. *Introduction to Supply Chain Management*; Prentice Hall: Upper Saddle River, NJ, USA, 1999.
127. Christopher, M. *Logistics & Supply Chain Management*; Pearson: Cambridge, UK, 2016.

128. Mangan, J.; Lalwani, C.; Lalwani, C.L. *Global Logistics and Supply Chain Management*; John Wiley & Sons: New York, NY, USA, 2016.
129. Fredendall, L.D.; Hill, E. *Basics of Supply Chain Management*; CRC Press: Boca Raton, FL, USA, 2016.
130. Gilling, R.I.; Ulmer, J.M. Major Challenges in Supply Chain Management. *Insights Chang. World J.* **2016**, *2016*, 35–49.
131. Gardiner, D. *Operations Management for Business Excellence*; Pearson: North Shore, New Zealand, 2010.
132. Green, K.; Morton, B.; New, S. Green purchasing and supply policies: Do they improve companies' environmental performance? *Supply Chain Manag.* **1998**, *3*, 89–95. [CrossRef]
133. Carter, C.R.; Kale, R.; Grimm, C.M. Environmental purchasing and firm performance: An empirical investigation. *Transp. Res. Part E Logist. Transp. Rev.* **2000**, *36*, 219–228. [CrossRef]
134. Zsidisin, G.A.; Siferd, S.P. Environmental purchasing: A framework for theory development. *Eur. J. Purch. Supply Manag.* **2001**, *7*, 61–73. [CrossRef]
135. Hamner, B. Effects of green purchasing strategies on supplier behaviour. In *Greening the Supply Chain*; Springer: Berlin, Germany, 2006; pp. 25–37.
136. Hassini, E.; Surti, C.; Searcy, C. A literature review and a case study of sustainable supply chains with a focus on metrics. *Int. J. Prod. Econ.* **2012**, *140*, 69–82. [CrossRef]
137. Srivastava, S.K. Green supply-chain management: A state-of-the-art literature review. *Int. J. Manag. Rev.* **2007**, *9*, 53–80. [CrossRef]
138. Parody, A.; Viloria, A.; Gonzalez, F. Methodology for Measuring the Level of Collaboration in a Supply Chain by Making Surveys. 2017. Available online: http://hdl.handle.net/11323/920 (accessed on 5 January 2018).
139. Wisner, J.; Tan, K.-C.; Leong, G. *Principles of Supply Chain Management: A Balanced Approach*; Cengage Learning: Clifton Park, NY, USA, 2015.
140. Ritchie, B.; Brindley, C. Disintermediation, disintegration and risk in the SME global supply chain. *Manag. Decis.* **2000**, *38*, 575–583. [CrossRef]
141. Frohlich, M.T.; Westbrook, R. Arcs of integration: An international study of supply chain strategies. *J. Oper. Manag.* **2001**, *19*, 185–200. [CrossRef]
142. Gustavsson, J.; Cederberg, C.; Sonesson, U.; Van Otterdijk, R.; Meybeck, A. *Global Food Losses and Food Waste*; FAO: Rome, Italy, 2011.
143. Fiala, P. Information sharing in supply chains. *Omega* **2005**, *33*, 419–423. [CrossRef]
144. Knemeyer, A.M.; Zinn, W.; Eroglu, C. Proactive planning for catastrophic events in supply chains. *J. Oper. Manag.* **2009**, *27*, 141–153. [CrossRef]
145. Sarkis, J.; Zhu, Q.; Lai, K.-H. An organizational theoretic review of green supply chain management literature. *Int. J. Prod. Econ.* **2011**, *130*, 1–15. [CrossRef]
146. Sharfman, M.P.; Shaft, T.M.; Anex, R.P. The road to cooperative supply-chain environmental management: Trust and uncertainty among pro-active firms. *Bus. Strategy Environ.* **2009**, *18*, 1–13. [CrossRef]
147. Gold, S. Sustainable supply chain management and inter-organizational resources: A literature review. *Corp. Soc. Respons. Environ. Manag.* **2010**, *17*, 230–245. [CrossRef]
148. Hoejmose, S.; Brammer, S.; Millington, A. "Green" supply chain management: The role of trust and top management in B2B and B2C markets. *Ind. Mark. Manag.* **2012**, *41*, 609–620. [CrossRef]
149. Ojha, D.; Shockley, J.; Acharya, C. Supply chain organizational infrastructure for promoting entrepreneurial emphasis and innovativeness: The role of trust and learning. *Int. J. Prod. Econ.* **2016**, *179*, 212–227. [CrossRef]
150. Mortimer, C. *Enablers and Barriers to Adoption of Life Cycle Management*; NZLCM Centre Working Paper Series; NZLCM: Palmerston North, New Zealand, 2011; Volume 1.
151. Seuring, S. Supply chain management for sustainable products–insights from research applying mixed methodologies. *Bus. Strategy Environ.* **2011**, *20*, 471–484. [CrossRef]
152. Landcare Research. Life Cycle Assessments Pay Dividends. Available online: http://www.landcareresearch.co.nz/publications/innovation-stories/earlier2/life-cycle-assessments-pay-dividends (accessed on 5 January 2018).
153. Saunders, C.; Barber, A. *Food Miles—Comparative Energy/Emissions Performance of New Zealand's Agriculture Industry*; Lincoln University: Lincoln, UK, 2006.
154. Mithraratne, N.; McLaren, S.J.; Barber, A. *Carbon Footprinting for the Kiwifruit Supply Chain—Report on Methodology and Scoping Study*. 2008. Available online: https://www.landcareresearch.co.nz/publications/researchpubs/Kiwifruit_Methodology_Report_2010.pdf (accessed on 5 January 2018).

155. Hume, A.; Barber, A.; East, A.; McLaren, S.J.; Deurer, M.; Clothier, B.; Palmer, J. *Carbon Footprinting for the Apple Supply Chain: Methodology and Scoping Study*. 2009. Available online: https://www.landcareresearch.co.nz/publications/researchpubs/Apple_Summary_Report.pdf (accessed on 5 January 2018).
156. Greenhalgh, S.; Mithraratne, N.; Sinclair, R.; Smith, A.; McConachy, E.; Barber, A. *GHG Product Account Guidelines for the Wine Industry*; Ministry of Agriculture and Forestry: Wellington, New Zealand, 2011.
157. Hume, A.; Coelho, C. *Assessment of the Water Footprint of Fresh Kiwifruit—Methods and Scoping Report*. 2010. Available online: http://www.lcanz.org.nz/sites/default/files/17/assessment_of_the_water_footprint_of_fresh_kiwifruit_methods_and_scoping....pdf (accessed on 5 January 2018).
158. NZ Wine. Sustainable Winegrowing. Available online: http://www.nzwine.com/sustainability/towards-100-sustainability-1/ (accessed on 5 January 2018).
159. Garnevska, E.; McLaren, S.; Hiroki, S. Yealands Wine Group: Balancing Business and Sustainability. *Int. Food Agribus. Manag. Rev.* **2014**, *17*, 237.
160. Marshall, R.S.; Akoorie, M.E.; Hamann, R.; Sinha, P. Environmental practices in the wine industry: An empirical application of the theory of reasoned action and stakeholder theory in the United States and New Zealand. *J. World Bus.* **2010**, *45*, 405–414. [CrossRef]
161. Hughey, K.F.; Tait, S.V.; O'Connell, M.J. Qualitative evaluation of three 'environmental management systems' in the New Zealand wine industry. *J. Clean. Prod.* **2005**, *13*, 1175–1187. [CrossRef]
162. Dairy Australia. Australian Dairy Industry. Dairy Australia, 2014. Available online: https://www.dairyaustralia.com.au/about-dairy-australia/about-the-industry (accessed on 25 January 2018).
163. Dairy Australia. Australian Dairy Industry Sustainability Framework. Available online: http://www.dairyaustralia.com.au/Industry-information/Sustainability/Industry-sustainability.aspx (accessed on 21 January 2017).
164. Dairy Sustainability Framework. What Is the Dairy Sustainability Framework. Available online: https://www.youtube.com/watch?v=AyobvGsZmW8 (accessed on 21 January 2017).
165. PlasticsEurope. Life Cycle Thinking. Available online: http://www.plasticseurope.org/plasticssustainability/life-cycle-thinking-1746.aspx (accessed on 5 January 2018).
166. Sustainable Steel. Overview. Available online: https://www.steel-sustainability.org/esust (accessed on 5 January 2018).
167. Schmidt, J.; Helme, N.; Lee, J.; Houdashelt, M. Sector-based approach to the post-2012 climate change policy architecture. *Clim. Policy* **2008**, *8*, 494–515. [CrossRef]
168. Luckman, P. *Sustainability Branding for the New Zealand Wool Industry—A Farmer-Led Approach*; Creative Decisions Ltd.: London, UK, 2012.
169. Bradley, R.; Baumert, K.A.; Childs, B.; Herzog, T.; Pershing, J. *Slicing the Pie: Sector-Based Approaches to International Climate Agreements*; World Resources Institute: Washington, DC, USA, 2007; pp. 1–7.
170. Yealands Family Wines. Sustainability Awards. Available online: http://www.yealands.co.nz/pages/yealands-estate/sustainability-awards (accessed on 5 January 2018).
171. Villa Maria. Most Awarded Winery. Available online: http://www.villamaria.co.nz/about/awards (accessed on 5 January 2018).