



# **Low Carbon Food Production**

**How farmers and food businesses can profit from  
decarbonizing the food industry**

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## **Authors:**

Martin Gooch, PhD (Lead)  
Benjamin Dent, PhD  
Jon Morgan BSc. (Hons)  
Delia Bucknell, MSc

## **Key Contact:**

Martin Gooch, PhD  
CEO, Value Chain Management International  
[martin@vcm-international.com](mailto:martin@vcm-international.com)  
+1 416.977.7779

## **Editor:**

S. Caroline Glasbey

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## **The crux of the matter and the point of this paper ...**

- ❖ The global food industry represents one-third of anthropogenic (human caused) greenhouse gas (GHG) emissions.
  - To prevent catastrophic climate change, almost 200 countries and states have committed to massively reduce GHGs.
- ❖ International commitments are placing the food industry under increasing pressure to adopt low carbon approaches to business.
  - Many businesses see this as a threat and an added cost, leading to defensive postures and few meaningful strategies.
- ❖ This paper takes a positive approach:
  - It positions the adoption of low carbon strategies as a commercial opportunity, and describes the best ways for businesses to successfully adapt and profit from environmental initiatives.

## Executive Summary

Climate change represents the greatest environmental challenge facing farmers and the overall food industry. **It also represents one of the greatest opportunities facing farmers and downstream food businesses who have prepared for the broad changes that will surely come.**

Historically, the primary focus of supplier/buyer interactions has been product standards, service levels and cost reduction. Going forward, environmental performance will become an equally important determinant of supplier/buyer interactions. This will occur because **the majority of carbon reduction commitments being announced by retailers and other food corporations will be achieved by farmers and other vendors, not by the corporations themselves.**

Farmers and businesses operating in the food industry must position themselves for the future to ensure that they do not become price takers by having to meet commitments made by corporations who do not have their best interests at heart.

Based on the decades of experience possessed by the authors, this paper addresses a question that lies at the heart of ensuring the future economic and environmental sustainability of nations' agricultural sectors: **How can farmers and other businesses operating in the food industry future-proof themselves by playing a leading role in driving the creation of a low-carbon food industry?**

Establishing and maintaining the collaborative relationships required to enable members of a value chain to achieve outcomes that would be impossible if acting autonomously, regardless of their size and scale, rests on addressing the restricting transactional trading relationships that have defined the food industry since its industrialization in the 1700s.

The term value chain management (VCM) describes the purposeful decision by businesses operating along a value chain to create and retain superior value-generating capabilities by **collaborating as a cohesive unit from strategic, tactical and operational perspectives.** This paper describes how VCM assists farmers and food businesses to monetize low carbon strategies by providing unique forms of agility, robustness and nimbleness. In so doing, **it provides the ability to optimize the utilization of resources and create sustainable competitive advantages, resulting in resilient food chains.**

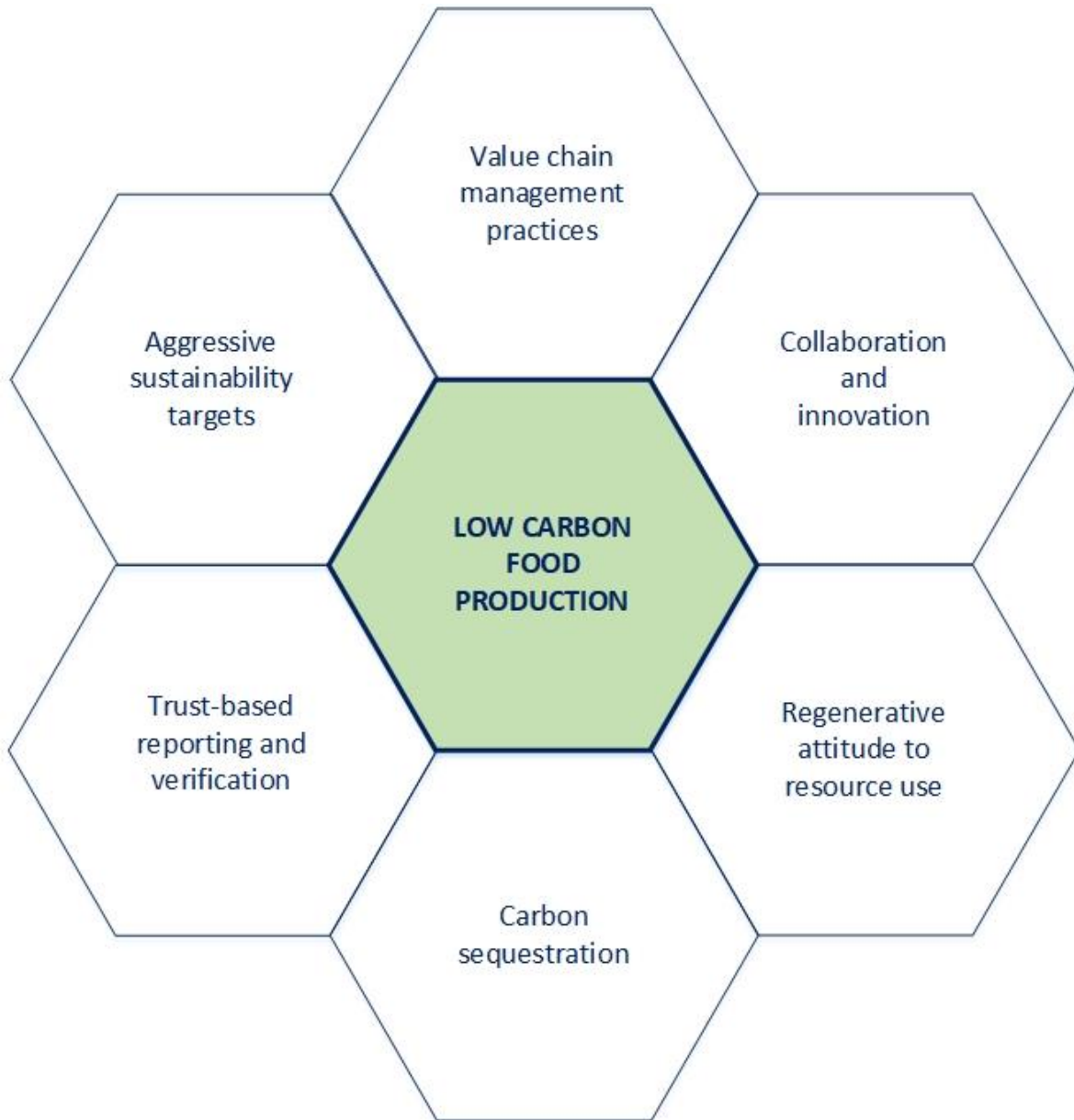
The challenge for farmers and other members of the value chain is to determine the carbon strategy that best suits their operations in the long run, and how they will implement that preferred carbon strategy to greatest effect by partnering with likeminded enterprises. **In reducing carbon, farmers can reduce costs and potentially increase revenue — leading to higher margins, increased profitability and preferential access to high value markets.**

The paper concludes with two appendixes that form a dashboard of options to assist farmers, regardless of the sector in which they operate, and other members of the food industry to determine the low carbon strategy(ies) that best suits them, and subsequently plan, then implement, strategies from a value chain perspective.

## Key Takeaways

#1	The ability to adapt to environmental and market-driven change is an increasingly important determinant of sustainable competitive advantage.
#2	Corporations are causing changes to occur, though they are not the primary enabler in decarbonizing the food system. The primary enabler is farmers.
#3	Corporations' need to set then attain aggressive sustainability targets will drive significant changes in buyer/supplier interactions and how "preferred suppliers" are defined.
#4	The adoption of value chain management (VCM) practices provides unique forms of agility, robustness and nimbleness, resulting in resilient low-carbon food systems.
#5	The primary factor in decarbonizing the food system is farmers' and downstream businesses' willingness and commitment to collaborate and innovate; it is not technology.
#6	A "dash for cash" could place farmers at a considerable disadvantage compared to farmers who take a strategic approach in how they monetize low-carbon initiatives.
#7	The gold standard for monetizing low carbon initiatives is trust-based reporting and verification, tied to continual improvement programs. This relies on businesses sharing strong strategically- and operationally-aligned relationships.
#8	The success of low carbon initiatives is dependent on the adoption of mindsets and practices that reflect a regenerative, not extractive, attitude to resource use.
#9	The adoption of low carbon strategies offers farmers the opportunity to transition from a source of carbon emissions to a means of sequestering carbon.

## Key Components of Low Carbon Food Production



# 1 Background

Climate change represents the greatest environmental challenge facing farming<sup>i</sup> and the overall food industry. Agriculture is “extremely vulnerable”<sup>1</sup> to environmental challenges, such as rising temperatures, weather variability, more frequent and increasingly extreme weather events, shifting agroecosystem boundaries, and invasive crops and pests. In crops, these challenges are reducing yields and nutritional quality; in livestock, they are reducing productivity.

*Climate change represents one of the greatest opportunities facing farmers and food businesses who have prepared for the broad changes that will surely come.*

Climate change also represents one of the greatest opportunities facing farmers and food businesses who have prepared for the broad changes that will surely come. Farmers and downstream businesses who possess the ability to adapt to environmental and market-driven change have the opportunity to establish unique sustainable competitive advantages that will become increasingly

powerful determinants of success.

Appendix A illustrates specific examples of how and why environmentally sustainable practices, including carbon<sup>ii</sup> reduction and carbon sequestration initiatives, lead to competitive advantage.

For farmers in particular, the ability to capture value from carbon reduction initiatives will be determined by the relationships that they share with their customers and other farmers involved in the same initiatives.

Establishing and maintaining the collaborative relationships required to enable members of a value chain<sup>iii</sup> to achieve outcomes that would be impossible if acting autonomously, regardless of their size and scale, rests on the adoption of mindsets and practices that are the antithesis of the transactional trading relationships that have defined the food industry since its industrialization in the 1700s.

*Considerable opportunities exist to reduce emissions by establishing collaborative relationships along the entire value chain.*

Considerable opportunities exist to reduce Scope 1, 2 and 3 emissions<sup>iv</sup> by establishing collaborative relationships along the entire value chain.<sup>2</sup> The unique agility, robustness and nimbleness that stem from operating as a cohesive unit enables businesses to reduce emissions and costs, and increase margins, in ways that are

potentially impossible for their competitors to replicate.<sup>3</sup> See Section 6 and Appendix B for more details on establishing resilient food systems.

The reduction in emissions that can be achieved by food processors and food businesses that have invested in energy-efficient equipment is typically minor compared to the reductions that can be achieved in primary production; for example, through the adoption of regenerative agricultural practices.

Improving soil health not only significantly reduces GHG emissions and increases carbon sequestration, it also enhances soil’s moisture holding capacity and crop’s resistance to drought.<sup>4</sup> [Rehydrate California](#), [New Zealand’s Our Land and Water](#) and [Australia’s Regen Farmers Mutual](#) are examples of initiatives that prove

<sup>i</sup> The terms “farming” and “farmers” are used to describe all forms of agricultural and horticultural production. The concepts described in this paper also apply to aquaculture.

<sup>ii</sup> The term “carbon” encompasses greenhouse gases in general, e.g. methane and nitrous oxide.

<sup>iii</sup> The term “value chain” is used in place of supply chain.

<sup>iv</sup> Scope 1 and 2 emissions stem from a company’s operations and decisions over which it has direct control. Scope 3 emissions are beyond a company’s direct control. They relate to vendors’ operations, transport and consumers.



the wide-ranging environmental and economic benefits that result from agricultural sustainability initiatives.<sup>5</sup>

The success of many such initiatives relies on farmers collaborating with other members of the value chain. This can be in the form of horizontal or vertical collaboration.

Examples of horizontal collaboration include: 1) one farmer's livestock grazing on a solar farm or in another farmer's orchard to improve soil health and reduce overall GHG emissions; and 2) industry associations working with a sector to develop, test and implement best practice low carbon solutions.

Examples of vertical collaboration include farmers working with a processor to identify genetics and production practices that result in attributes for which consumers are willing to pay or to reduce costs, which are then reflected in a pricing system that is structured to incentivize continual improvement and market-driven innovation.

*“Significant opportunity exists to reduce greenhouse gas emissions through the implementation of currently available and proven approaches.”*

It is not all about creating new technologies. “Significant opportunity exists to reduce greenhouse gas emissions through the implementation of currently available and proven approaches.”<sup>6</sup> Science has confirmed that age-old practices, such as the Norfolk four-course system,<sup>v</sup> play a crucial role in the establishment and sustaining of healthy soils.<sup>7</sup> In committing to

soil improvement practices, producers can make an enormous contribution to decarbonizing the food system, while simultaneously profiting from using sustainability initiatives to capture new market opportunities and drive economic performance.<sup>8</sup>

*How can farmers future-proof themselves by playing a strategic and tactical role in the creation of a low-carbon food industry?*

This paper seeks to address a question that lies at the heart of ensuring the future economic and environmental sustainability of Canada and other nations' agricultural sectors: How can farmers future-proof themselves by playing a strategic and tactical role in the creation of a low-carbon food industry? The same question

applies to all other members of the food value chain.

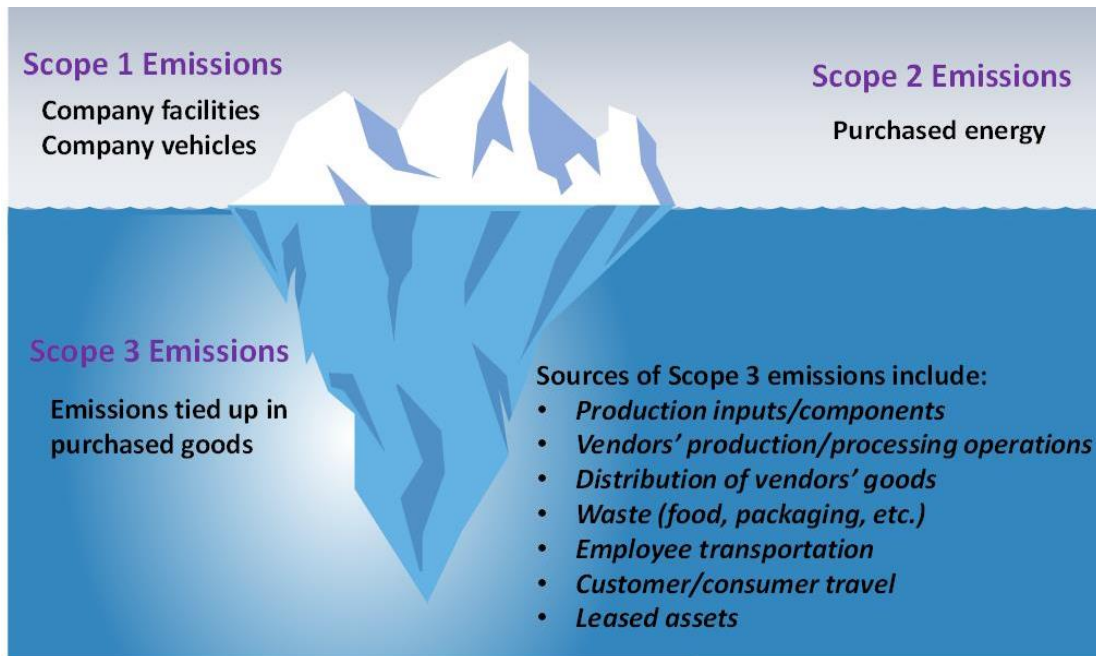
## 2 Drivers of Corporate-Driven Change

The majority of carbon reduction commitments being announced by retailers and other food corporations<sup>9</sup> will be achieved by their suppliers, not by the corporations themselves. This is because, as illustrated by Figure 2-1, vendor-related (Scope 3) emissions can account for 80 percent or more of retailers' total carbon footprint.<sup>10</sup> A not dissimilar situation applies to Scope 3 emissions associated with the foodservice and food processing/manufacturing sectors.

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<sup>v</sup> The Norfolk four-course system is a method of agriculture that involves crop rotation. Unlike earlier methods, such as the three-field system, the Norfolk system is marked by an absence of a fallow year. (Wikipedia)

**Figure 2-1: Categorization of Retailers' Carbon Emissions**



Source of iceberg graphic: Showeet.com

*The primary enabler of change will be farmers' and other enterprises' willingness and ability to collaborate on carbon reduction and sequestration initiatives.*

Corporations will cause change, though have limited scope to reduce carbon emissions. They will therefore not be the enabler of change. The primary enabler of change will be farmers' and other enterprises' willingness and ability to collaborate on carbon reduction and sequestration initiatives.<sup>11</sup>

Why retail and other food corporations will be such powerful drivers of change is that environmental sustainability is a credence attribute, and busy consumers rely on directional signals when trying to do the right thing. The verification on which these signals rest will rely on formal and expensive certification schemes or inexpensive trust-based assurances.<sup>12</sup> The latter includes retailers' sourcing eco-claims and private label initiatives, enabled by establishing collaborative relationships with suppliers. Retailers and foodservice corporations will therefore seek to source from low carbon producers, regardless of whether they are currently considered preferred suppliers.

The desire of non-food corporations (such as financial institutions) to profit from carbon trading practices, and of corporations seeking ways to greenwash their own environmental efforts through the purchasing of carbon offset, will also become an increasingly powerful driver of change.

### 3 Monetizing Corporate-Driven Change

Farmers and downstream businesses must position themselves for the future to ensure that they do not become price takers by having made commitments that end up providing greater benefits to powerful corporations who do not have their best interests at heart.<sup>13</sup>

*For farmers, the environmental challenges and market opportunities associated with climate change are particularly acute.*

For farmers, the environmental challenges and market opportunities associated with climate change are particularly acute. Traditionally, they possess the least ability to profit from corporations' business decisions, yet have an enormous opportunity to monetize sustainability efforts — including carbon reduction and carbon sequestration.

In countries including Canada, the United States and the UK, ruminant livestock account for approximately half of total agricultural emissions. A substantial proportion of the remaining emissions stem from the nitrous oxide associated with crop production.<sup>14</sup> Significantly reducing these emissions will require farmers to balance optimized performance with the optimized use of natural and human resources. This is very different from the historical practice of maximizing yield (e.g. animal weight, bushels per acre). The success of such practices is dependent on the adoption of mindsets and activities that reflect a regenerative, not extractive, attitude to resource use.

Examples of farmers and farming initiatives that are profiting from having adopted practices that lead to lower — potentially zero or better — carbon emissions include: Puffin Produce, Southern Pastures, VG Meats, Pasture for Life, Zespri, Oxford Landing Winery, Maple Leaf Foods, White Oak Pastures, Blade Farming, and Stabiliser/Beef Improvement Group.<sup>15</sup>

*Greenhouse growers and operators are keenly aware of the benefits that efficiency brings, both to the climate and their bottom line.*

Greenhouse growers and operators are keenly aware of the benefits that efficiency brings, both to the climate and their bottom line. An example of sector-level innovation is the industry association Ontario Greenhouse Vegetable Growers (OGVG) having worked with growers to 1) develop best practices for

utilizing flue gases from natural gas boilers to feed CO<sub>2</sub> to their plants; 2) apply energy curtains to increase energy efficiency and reduce natural gas usage; and 3) rely on climate control systems to manage optimal heating, cooling and environmental inputs. All these measures, along with increased electrification and more, minimize environmental impact, minimize input costs, and drive the path towards net zero carbon in greenhouse production.<sup>16</sup>

A combination of regenerative farming practices, select genetics and good management practices enable total carbon emissions to be significantly reduced — to the point that food systems can transition to net zero or better. The described approaches and comparative scale of opportunities apply to all forms of farming, not only livestock.

## 4 The Minefield of Carbon Credits and Trading

The sale of carbon credits and the trading of offsets represent a minefield for the food industry — particularly farmers — from strategic and operational perspectives. Reasons for this include the lack of common offset regulations and compliance practices, a “dash for cash” that either distracts or prevents farmers from capturing more rewarding longer-term opportunities, and carbon trading leading to artificially inflated land values.<sup>17</sup>

Data and knowledge is key. Any farmer who wishes to establish a strong negotiating position in the value chain must understand their carbon position, then use or develop farming practices that entirely offset their own environmental footprint. Only then should farmers consider selling their carbon credits.

*Long-term carbon credit or trading commitments can place farmers in a weak negotiating position, because carbon credits can only be accounted for once.*

Entering into a long-term carbon credit or trading commitment can inadvertently place farmers in a weak negotiating position with their customers, who will always represent their greatest and most important source of revenue. This is because carbon credits, regardless of whether monetized through offset trading or contributed to their customers’ carbon reduction targets, can only

be accounted for once.<sup>18</sup>

If a retailer replaces the “over and above” payments charged to vendors with a carbon offset requirement, or adds carbon offsets to current trading practices, those vendors who have offset trading commitments will find themselves at a disadvantage compared to those who have not. The same applies to farmers supplying a processor or other intermediary, who (in turn) is required to contribute their and their suppliers’ offsets to the retailer’s carbon emission targets.

Additionality, those reductions in emissions that would occur anyway, due to changes made prior to the offset benchmark having been established, cannot be included in carbon offset trading arrangements. Depending on the nature of the scheme established by their customers, farmers could benefit from the inclusion of both future and prior (additional) reductions in their contribution to retailers’ and other food corporations’ GHG reduction targets.

## 5 Moving Beyond Monitoring and Reporting

*One of the greatest challenges facing the food industry is how to decouple GHG emissions from productivity without negatively impacting economic performance.*

One of the greatest challenges facing the food industry is how to decouple GHG emissions from productivity without negatively impacting economic performance. The primary focus of supplier/buyer interactions has historically been product standards, service levels and cost reduction. The introduction of increasingly stringent legislation and regulations focused on

driving reductions in carbon emissions, combined with corporation and consumer-driven change, will invariably lead to the adoption of supplier/buyer interactions that centre on both environmental sustainability and financial performance.

While multiple sustainability-related standards and reporting initiatives exist, with further initiatives in development, the implementation of low carbon initiatives will occur at the enterprise level.<sup>19</sup> The pooling

of resources and expertise from across the value chain enables enterprises to achieve transformative changes that are otherwise not possible if working in isolation.

Key determinants of success are therefore: 1) collectively prioritizing where to reduce GHG emissions based on the most attractive return on investment, 2) coordinating the implementation of practices and processes that transcend multiple points along the value chain, and 3) retaining business partners' commitment by equitably sharing the resulting financial benefits.<sup>20</sup>

## 6 Value Chain Management (Systems Thinking)

Securing the financial benefits achievable from having adopted low carbon business strategies is best achieved by managing on-farm and downstream operations from a systems perspective. In possessing the

*Adopting a systems approach to innovation offers distinct and sustainable competitive advantages.*

ability to implement practices that transcend the boundaries of individual enterprises, businesses achieve outcomes that are harder (potentially impossible) for competitors to replicate. Adopting a systems approach to innovation therefore offers distinct and sustainable competitive advantages.

All value chains can be categorized into one of four types: fragmented, cooperative, coordinated, and collaborative.<sup>21</sup> Appendix B provides examples of the opportunities that each of the four types of value chains have to capture competitive advantage by adopting carbon reduction practices.

The interactions and business practices that occur within a fragmented chain are those associated with adversarial supply chains. Each business acts out of self-interest. Ultimately, however, this approach ends in a zero sum game, where even the most powerful actors can only achieve suboptimal outcomes.

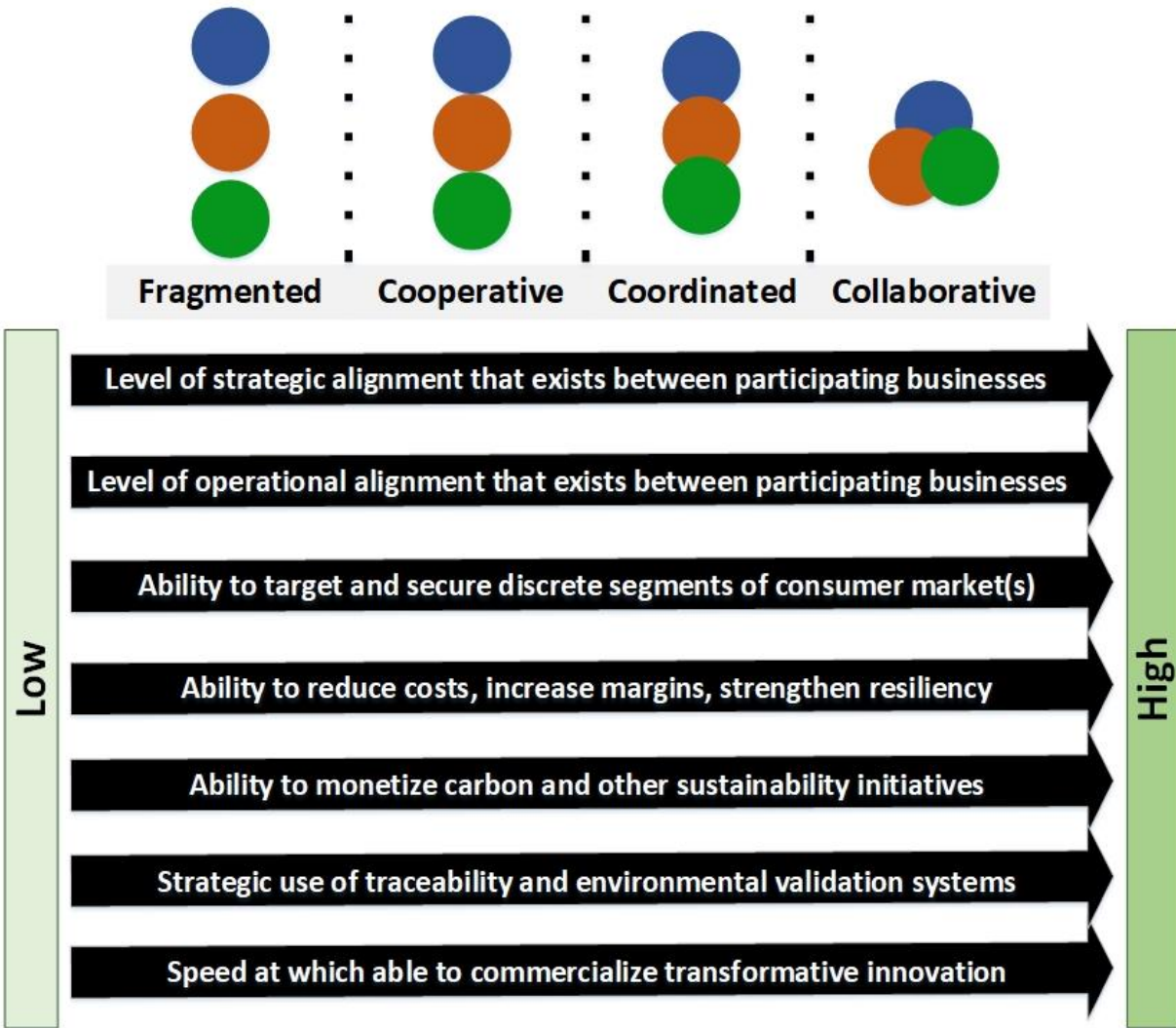
The interactions and business practices that occur within the three other types of value chain reflect different levels of collaboration, cohesion and resilience. The more collaborative and cohesive the value chain, the more opportunities exist for inter-business innovation to occur. This translates into resilience.

As shown in Figure 6-1, the unique agility, robustness, nimbleness, and resilience that stem from multiple businesses operating as a cohesive unit<sup>vi</sup> produces benefits and opportunities that go far beyond those which can be achieved by an individual enterprise having only adopted new technologies. This is particularly the case where those businesses' strategic business model rests on the retaining market power through the continuation of transactional trading relationships.<sup>22</sup>

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<sup>vi</sup> The term cohesive unit is used to describe a group of likeminded businesses who, by establishing strategically aligned relationships with other farmers and/or processors, retailers, etc., are able to form a micro economic environment that enables them to achieve outcomes that the wider sector or industry cannot.

**Figure 6-1: Characteristics and Benefits Associated with Each Type of Value Chain Structure**



Determining the type of chain(s) in which farming and downstream businesses operate enables them to conclude what is possible, how to optimize their commercial opportunities, and how to optimize their return on investments. In so doing, they can future proof their operations by possessing the ability to adapt to transformational changes that occur, including those that could not have been foreseen when the initiative was originally developed.

To ensure superior return on investment by engaging in complementary relationship-driven business practices, we argue that businesses’ strategic decisions need to acknowledge and incorporate the following four considerations.

1. Transformational changes in requirements and expectations will occur. Even if the precise timing and nature of these are uncertain, and new ways of responding will emerge, the scale of inevitable change is not in doubt.
2. Improving a value chain’s environmental performance offers multiple opportunities to improve its competitiveness, and thus should not always be considered an inconvenient cost.

3. In identifying sources of competitive advantage, businesses should adopt both a whole-of-chain life cycle analysis perspective and a forward-looking perspective using scenario analysis.
4. Prioritizing how to reduce emissions and other environmental impacts will depend on a value chain's collaborative capacity, and thus needs to be viewed through a value chain analysis lens.

Expanded upon in Appendix B, these considerations reflect the practice of value chain management (VCM). VCM describes the purposeful decision by businesses operating along a value chain to create and retain superior value-generating capabilities and resilience by collaborating as a cohesive unit from strategic, tactical and operational perspectives.

## 7 Decarbonization Begins with Soil Health

The improvement of soil health is integral to decarbonizing agriculture and the food system.<sup>23</sup> Farmers and the wider food industry have a crucial role to play in, and can benefit from, sequestering carbon by implementing practices that lead to improved soil health.

Although there is variability among regions in the magnitude of improvements that can be achieved, the effect of healthy soil and grassland on carbon sequestration is a key reason why grassland and forage-based livestock can have an estimated 40-50 percent lower carbon footprint than grain-based livestock

*A direct link exists between healthy soils and carbon sequestration.*

production. This is in part due to the crucial role that livestock (including poultry) plays in the creation of healthy soils.

Prioritizing soil health and soil building in agricultural production systems generates a carbon sink.<sup>24</sup> Add the cumulative effects of genetic selection,<sup>vii</sup> health programs and technology, along with aligned practices having been implemented along the entire value chain, and the opportunities increase exponentially.

Building upon the examples and concepts presented in this paper, Appendixes A and B provide a range of distinct opportunities for agriculture and the agri-food industry to profit from low-carbon initiatives.<sup>25</sup>

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<sup>vii</sup> Genetics influence mortality, growth rate, production efficiency, finishing age, natural health, climatic suitability, dam and sire related emissions, and the naturally occurring organoleptic qualities of meat, just to name a few.

## 8 Conclusions / Takeaways

The challenges that will result from investors', consumers' and governments' reactions to climate change represent a tremendous opportunity for those farmers and downstream food businesses who are prepared to respond to the changes that will surely come. While numerous carbon and other environmental measurement, monitoring and benchmarking initiatives exist, decarbonization of the food industry will occur at the enterprise level. Success will be determined by how businesses are managed and how they interact with one another.

*The most effective means of decarbonizing the food industry lies in aligning primary production practices with the entire value chain to forge resilient low-carbon food systems.*

The most effective means of decarbonizing the food industry lies in aligning primary production practices with the entire value chain to forge resilient low-carbon food systems. Supported by international real-world evidence, and based on the authors' extensive experience in developing best practice food systems, this paper describes how farmers and food businesses can future-proof themselves by playing a leading role in the creation

of a low-carbon food industry. The alternative is for farmers and food businesses to become a price taker, by making commitments to powerful corporations who do not have their best interests at heart.

Collaborating to form a cohesive unit comprising likeminded businesses provides farmers and their business partners with unique opportunities to create and retain superior value-generating capabilities that are very difficult (potentially impossible) for competitors to replicate. These value-generating capabilities include the ability to reduce costs and waste, increase margins and profit, and continually improve economic and environmental performance.

Together with the appendixes, this paper provides a dashboard for how farmers and food businesses can determine the low-carbon strategies that best suit them and the value chains in which they operate, then plan and implement chosen strategies from a value chain perspective. The described approaches and techniques are applicable to all sectors of the agri-food industry.

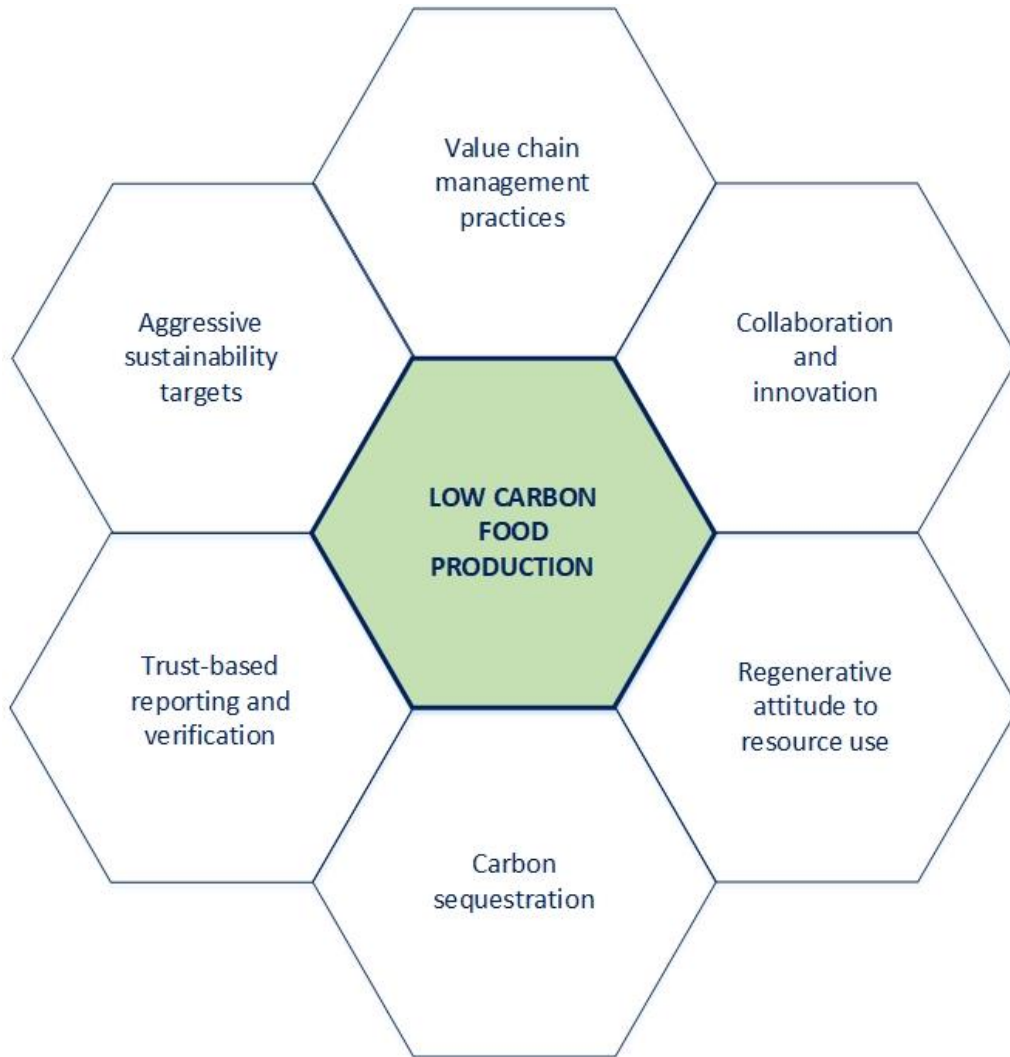
### 8.1 Key Takeaways

#1	The ability to adapt to environmental and market-driven change is an increasingly important determinant of sustainable competitive advantage.
#2	Corporations are causing changes to occur, though they are not the primary enabler in decarbonizing the food system. The primary enabler is farmers.
#3	Corporations' need to set then attain aggressive sustainability targets will drive significant changes in buyer/supplier interactions and how "preferred suppliers" are defined.
#4	The adoption of value chain management (VCM) practices provides unique forms of agility, robustness and nimbleness, resulting in resilient low-carbon food systems.
#5	The primary factor in decarbonizing the food system is farmers' and downstream businesses' willingness and commitment to collaborate and innovate; it is not technology.



#6	A “dash for cash” could place farmers at a considerable disadvantage compared to farmers who take a strategic approach in how they monetize low-carbon initiatives.
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#9	The adoption of low carbon strategies offers farmers the opportunity to transition from a source of carbon emissions to a means of sequestering carbon.

**Figure 8-1: Key Components of Low Carbon Food Production**



## 9 End Notes

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- <sup>1</sup> The World Bank, 2021; Rabson, 2022; GHD, 2022; Armstrong Mckay et al., 2022
- <sup>2</sup> AgResearch, 2022; Dent, 2013; DEFRA, 2007; Gooch & Felfel, 2012; Hand, 2022; Soosay et al., 2012; Westfalia, 2021; Gooch & Glasbey, 2014; Ward, 2022; Schulman et al., 2021
- <sup>3</sup> Ashcroft, 2022; Dent, 2013; Bonney et al., 2007; Gooch et al., 2013; Gooch et al., 2012; Gooch & Felfel, 2012; Sterling et al., 2015; Soosay et al., 2012; Taylor, 2013; Gooch & Glasbey, 2014
- <sup>4</sup> Dent, 2013; AgResearch, 2022; Anon, 2020; Ayambire & Pittman, 2021; Johnson et al., 2021; Net Zero, 2022; Guillaume et al., 2016; Rowntree et al., 2020; Wales Farmer, 2021; Thorbecke & Dettling, 2019; Manning et al., 2022
- <sup>5</sup> AgResearch, 2022; Rehydrate California, 2022; Regen Farmers Mutual, 2022
- <sup>6</sup> CIEL, 2021:51; Poore & Nemecek, 2018; Bomgardner & Erickson, 2021
- <sup>7</sup> Hale, 2018; Encyclopedia Britannica, 1998; Jones, 2022
- <sup>8</sup> AgResearch, 2022; Anon, 2020; CIEL, 2021; Elliott et al., 2022; Gooch et al., 2013; Gooch et al., 2012; Hand, 2022; Lezaks, 2022; Meat Promotion Wales, 2022; Oatman, 2020; Parameswaran, 2020; Soosay et al., 2012; Southern Pastures, 2022; Bonney et al., 2007; Johnson et al., 2021; Thorbecke & Dettling, 2019; Ward, 2022; Bomgardner & Erickson, 2021
- <sup>9</sup> Empire Co. 2022a/b; Hogg, 2022; LCL, 2022; Morrison, 2021; Del Monte, 2022; Cargill, 2018
- <sup>10</sup> Ashcroft, 2022; Bhargava et al., 2022; Zero Carbon Business, 2022; Fitzgerald, 2022
- <sup>11</sup> Dent, 2013; Gooch et al., 2013; Gooch et al., 2012; Sterling et al., 2015; Poore & Nemecek, 2018; Bhargava et al., 2022; Jones, 2022; Oryschak & Beltranena, 2020; Ward, 2022; Regen Farmers Mutual, 2022; Costa Jr. et al., 2022; Fitzgerald, 2022; Schulman et al., 2021
- <sup>12</sup> Hand, 2022; Gooch et al., 2013; Dent, 2013; Muddy Boots, 2022; Lezaks, 2022; Gooch & Glasbey, 2014
- <sup>13</sup> Meadley & Jackson, 2022; Dent, 2013; Wales Farmer, 2022; Simchi-Levi & Simchi-Levi, 2020; Gooch & Glasbey, 2014; Bonney et al., 2007; Granskog, 2022; Regen Farmers Mutual, 2022
- <sup>14</sup> BEIS, 2012; ECCC, 2022; Costa Jr. et al., 2022; Crippa et al., 2021
- <sup>15</sup> Southern Pastures, 2022; Jones, 2022; Wales Farmer, 2021; Gooch et al., 2013; Westfalia, 2021; Thompson, S. 2021; Dent, 2013; Thorbecke & Dettling, 2019; Gooch & Glasbey, 2014; VG Meats, 2019; Soosay et al., 2012; Oxford Landing, 2022; MLF, 2022; MLF, 2021
- <sup>16</sup> OGVG, 2021; OGVG, 2022; Hein, 2020; Blom et al, 2002
- <sup>17</sup> Elliott et al., 2022; Meadley & Jackson, 2022; Anon. 2022; Ward, 2022; Regen Farmers Mutual, 2022
- <sup>18</sup> Anon. 2022; Elliott et al., 2022; Prins, 2021
- <sup>19</sup> Dent, 2013; Gooch et al., 2013; Gooch et al., 2012; Simchi-Levi & Simchi-Levi, 2020; Wales Farmer, 2021; Soosay et al., 2012; Hand, 2022; Westfalia, 2021; Quinton et al., 2018; Johnson et al., 2021; Fitzgerald, 2022; Schulman et al., 2021
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## 11 Appendix A: How environmentally sustainable business practices contribute to competitiveness

The following comprises proven means for adopting environmentally sustainable business practices that translate into increased competitiveness and profitability.

- 1) ***Eco-efficiency/‘lean and green’***: reducing ecological impacts and resource intensity, while also lowering operating costs, and reducing/delaying capital investments.
  - These include: waste minimization, beneficial reuse, increased material or energy yields, and substituting fossil fuels with renewable energy.
- 2) ***Access to markets***: contributing to retailer’s environmental commitments, which in turn may affect its shopper footfall.
  - This involves not just size and loyalty of footfall, but also attracting less price sensitive segments.
- 3) ***Valuation premium by investors*** who increasingly factor CSR/ESG performance into their decisions.
- 4) ***Influencing government***: by shaping rather than responding to future policies, regulations, grants, and infrastructure development.
  - Businesses/chains earn the right to be influential by demonstrating best practice.
- 5) ***Eligibility for carbon-offsetting financial instruments*** that reward farmers (and potentially others in value chain) for sequestering carbon.
- 6) ***Achieving preferred supplier status***: downstream businesses will increasingly source from ‘safer’ suppliers.
  - This enables the entire chain to counter environmental groups and social media campaigns that typically target the most visible businesses (e.g. brand owners and retailers).
- 7) ***Influencing consumers’ purchasing decisions*** through product differentiation rather than lowest price.
  - This includes buying product for the first time, willingness to pay more, and buying more frequently and/or establishing deeper brand loyalty. However, for the majority of consumers, sustainability considerations tends to be a tie-breaker — particularly when there is parity in price and other performance requirements.
- 8) ***Positive environmental reputation is important to some employees***, and so assists employee recruitment and retention.
- 9) ***Better relationships with NGOs and civil society***, and hence continued social license to operate, translating in generally greener highly levels of public trust.
- 10) ***More resilient value chains***: resilience requires the same visibility across a value chain, as does understanding and improving sustainability.
  - Accordingly, the same tools required for improving sustainability can support resilience (real-time insights and analysis; predictive problem solving), and provide the data to assess whether any trade-offs are necessary between cost, reliability, sustainability, and resilience.

## 12 Appendix B: Determining then securing value chain opportunities

The following section builds upon the body of the report. It provides examples of the opportunities that businesses and the value chain(s) in which they operate have to capture competitive advantage by adopting low-carbon strategies and practices.

The reports titled “[Characterizing the Determinants of Successful Value Chains](#)” (Gooch et al, 2012), “[Characterizing the Ideal Model of Value Chain Management and Barriers to its Implementation](#)” (Gooch & Felfel, 2013) “[Value Chain Innovation Forum](#)” (Gooch et al., 2013) “[Assessing Traceability from a Value-Chain Perspective](#)” (Sterling et al., 2015) detail factors that differentiate each type of value chain and how each can secure new commercial opportunities.

The execution of effective value chain management (VCM) strategies commences by quantifying the participating businesses’ capacity to innovate in relation to market-driven opportunities to improve environmental performance. This comes from having conducted three complementary forms of analysis.

- 1) **Life Cycle Analysis:** to build a picture of GHG emissions and other environmental impacts across the entire value chain.
  - This identifies the activities with the greatest GHG reduction potential, regardless of where they are along the chain.
- 2) **Value Chain Analysis:** to reveal collaborative capacity between different first and second tier suppliers and customers.
  - This will reveal how ambitious and committed participants are with regards sharing costs and returns in a particular chain(s), and therefore their capacity to innovate.
- 3) **Scenario Analysis:** to identify at the chain level the greatest opportunities and risks to competitiveness.
  - This should include consequences for natural resources’ availability and cost, public attitudes, competitive environment and nature of global economy, political response, and technological development.

While the three forms of analysis need not be exhaustive, they must be sufficiently robust to enable the prioritization of opportunities and the development then execution of a systems-based continual improvement program. In so doing, the involved enterprises possess the ability to respond to legislative and market-place changes by systemically and systematically

- Identifying opportunities to increase competitiveness from improving environmental sustainability in ways that are extremely difficult for competitors to replicate;
- Identifying where all GHG emissions are created, and then the greatest potential reductions based on volume, cost and speed of each initiative;
- Tracing the value chain’s environmental impacts (emissions, biodiversity, discharges, waste, and disposal) back to their root causes (raw materials/inputs, farming, processing, distribution and retail, consumption, recycling/re-use or disposal); and
- Identifying innovative raw materials, processes, packaging, and product formulations that will increase competitiveness or meet compliance requirements most efficiently.

The determination of what ambitions span multiple enterprises (and/or departments within enterprises) needs to be based on a realistic assessment of the long-term stability of the relationships and, more specifically, the alignment of resources, skills, attitudes, motivations, and expectations, in terms of:

- Investment and required behavioural change,
- What contribution this will make to competitiveness (financial or intangible),
- How quickly this return on investment will be realized, and
- How the return will be distributed.

Without these insights, sustainability initiatives can be too ambitious and fail, or too timid and under-deliver the anticipated improvements in competitiveness. Either may negatively impact the commitment exhibited by the involved businesses, the outcomes achieved, and the initiatives' economic sustainability.

It is possible that insights produced by the three analyses lead a more ambitious business to concentrate efforts on existing suppliers and customers who are equally ambitious, or to switch away from reluctant suppliers or customers. Either outcome provides ambitious businesses with the most competitive advantage.

Presented in the table below are carbon initiatives that businesses operating in each of the four types of value chain (fragmented, cooperative, coordinated, and collaborative) can profit from implementing.

## 12.1 Matching a Chain's Collaborative Capacity to Potential Initiatives

STATE OF CHAIN	TYPES OF SUITABLE INITIATIVES
<b>Fragmented</b>	<ul style="list-style-type: none"> <li>• Exchange information/data</li> <li>• Formal or informal protocols for improving sustainability (e.g., around eco-efficiency where costs and returns arise within a single business along the chain)</li> <li>• Focusing on Scope 1 emissions (generated by business's own operations) and Scope 2 emissions (generated by energy sources that power each business's operations)</li> </ul>
<b>Cooperative</b>	<p>As with fragmented, plus:</p> <ul style="list-style-type: none"> <li>• Agree and implement common objectives and goals for Scope 3 emissions (across supply chain)</li> <li>• Reduce end-of-life impact by designing the product/packaging for easier reuse or recycling</li> </ul>
<b>Coordinated</b>	<p>As with fragmented and cooperative, plus:</p> <ul style="list-style-type: none"> <li>• Reduce carbon embodied in a product by changing raw materials or production systems, or through product reformulation</li> <li>• Share risks and rewards by allocating burdens, costs and benefits of specific investments, (e.g., enrolling in chain-wide certification schemes)</li> <li>• Optimize distribution systems to minimize carbon emissions</li> <li>• Redesign a product to produce less carbon emissions during its use by consumers</li> </ul>
<b>Collaborative</b>	<p>As with fragmented, cooperative and coordinated, plus:</p> <ul style="list-style-type: none"> <li>• Commit to co-investing over longer term, including where returns are less tangible</li> <li>• Technologies are more efficiently deployed at scale (e.g., use of drone or satellite technology to monitor then improve soil health and yield), and continually improving operational performance across vendors</li> </ul>

## 13 VCM and the Authors

### 13.1 VCM

VCM International (VCM) is dedicated to improving the profitability, competitiveness and environmental sustainability of the international food industry by promoting and enabling the management of closely aligned value chains. Our global consulting team is located in Canada, Europe and Australasia, and comprises world leaders in quality management, experiential management training, commercial-focused environmental sustainability, and value chain innovation.

We assist clients to develop closer strategic relationships with customers and suppliers, resulting in their being able to learn and adapt more effectively and to realize greater profits than if operating unilaterally. VCM achieves this by applying specialized value chain diagnostic tools to detect where inefficiencies occur and to determine how to eliminate it. VCM then participates in the implementation of new practices to solve the identified issues and ensure successful outcomes: resulting in highly measurable improved profitability for clients in the agri-food, aeronautical, automotive, pharmaceutical, and service sectors.

### 13.2 Authors

#### **Martin Gooch PhD**

Dr. Martin Gooch has 30 years' international food management experience, working in the UK, New Zealand, Australia, Canada, the United States, Asia, and the Caribbean. Martin co-founded Value Chain Management International, a global consulting company that helps businesses, primarily in the agri-food and seafood industries, enhance their long-term profitability and environmental sustainability. Martin possesses considerable experience developing commercially successful value chain initiatives, a number of which have received domestic and international acclaim. Martin holds a PhD and Master's degree in agri-food management, a Bachelor of International Business, along with qualifications in farm management, livestock and crop production. Industry awards that recognized Martin's contributions to innovation and science include Ontario Produce Marketing Association's "Industry Person of the Year" (2017) and "Outstanding Canadian in the area of Food Chain Partnership" by Bayer Canada (2013).

#### **Benjamin Dent PhD**

A VCM Senior Associate, Dr. Benjamin Dent has considerable expertise in agri-food sector value chains, sustainability in the face of climate change, and using consumer research to enhance value chain performance. Prior to gaining experience in the UK, North American, African and Australasian agri-food industries, Ben spent 12 years in the UK government developing environmental and food policies. Ben's PhD investigated how to create shareholder value from reducing carbon emissions across the value chain. Ben advises the UK Soil Association on integrating the needs of licensees, consumers and sustainability within its organic standards; is a strategic advisor to New Zealand's "Our Land our Water" initiative; is an Adjunct Associate Professor at the University of Queensland; and is a Director of the Gloucestershire Food and Farming Partnership, a partnership network formed to build a sustainable future for the region's farm and food industry.

**Jon Morgan BSc. (Hons)**

A VCMi Associate, Jon possesses considerable experience developing and managing best practice agri-food value chains. As Managing Director of [Livestock Marketing](#), Jon represented 650 Welsh farmers in coordinating the supply of beef and lamb to major UK retailers. Livestock Marketing collaborated with the entire value chain, from evaluating genetics in relation to eating quality, economic and environmental factors through to working with processors and retailers in the planning and execution of year-round production schedules. Prior to joining Livestock Marketing in 2002, Jon managed several livestock operations, and held sales and marketing roles with farm input suppliers. Jon holds an Honours Degree in Agriculture.

**Delia Bucknell MSc.**

A VCMi Research Associate, Delia has extensive experience conducting statistical, economic, social, environmental and spatial analysis across various sectors of the international agri-food industry and food security sector. Delia holds a Master of Science Degree in Rural Extension Studies: International Development, and an Honours Bachelor of Science degree in International Agriculture Land and Business Management. Having grown up on a grazing/cropping property in Australia, where her family has over 100 years of grazing history in Australia and her father has been at the forefront of promoting landscape management and regenerative agriculture, sustainability has been a lifelong passion.