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Competitive advantage through responsible innovation in the New Zealand sheep dairy industry

Special issue: Responsible innovation in the agri-food sector

RESEARCH ARTICLE

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Abstract

This paper explores the opportunity for New Zealand to establish and sustain an internationally competitive sheep dairy industry. As part of this it evaluates the role of responsible innovation (RI) within the New Zealand sheep dairy (NZSD) industry and whether this can assist in achieving a sustainable competitive advantage. In the context of agrifood supply chains RI has received little attention despite the fact that these industries have significant environmental, ethical and social impacts. The research also addresses the lack of evidence as how to put RI into practice and the claim that the practical applicability of RI is not possible. The French sheep dairy industry was used as a comparative case study for the New Zealand industry. Information was gathered through a literature search, the comparative case study and interviews with New Zealand and French industry experts. Comparisons were made between the strategic capabilities and structural forces of the sheep dairy industries in both France and New Zealand. The study found that for the NZSD industry to achieve a competitive advantage it would need to pursue a differentiation strategy that focused on customer responsiveness, innovation, sustainability and quality. Furthermore, the study identified that RI had the potential to assist the NZSD industry by providing distinctive competencies to develop a competitive advantage. This is because there were existing resources and capabilities that provided a platform for differentiation. There were also strategic and economic drivers in the NZSD industry that encouraged RI as a competitive strategy. This indicated that for RI to occur there needed to be economic incentives that encouraged companies to pursue this strategy.

Keywords: responsible innovation, competitive advantage, sheep dairy, industry strategy, resource based view
JEL code: Q13, Q10, Q17, Q01

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1. Introduction

This paper explores the opportunity for New Zealand to establish an internationally competitive sheep dairy industry. This is achieved by identifying the resources and capabilities needed to realise a sustainable competitive advantage. It also evaluates the potential for responsible innovation (RI) to contribute to achieving this goal. RI has developed as a new paradigm that evaluates innovations in terms of their ethical acceptability, sustainability and social desirability (Scholten and Van der Duin, 2015; Von Schomberg, 2013). By applying the RI framework this research aims to consider not only the economic value of the industry, but also the social, ethical and environmental aspects. It also addresses the problem of the lack of empirical evidence as how to put RI into practice identified by Blok *et al.* (2015). Furthermore, the application of RI to agricultural innovations has received little attention. This is despite the fact that these industries have significant environmental, ethical and social impacts.

Stilgoe *et al.* (2013) note that responsibility has always been a theme in research and development. Despite this science and moral responsibility are often seen to be in conflict. This has become more apparent as society is more aware of the benefits and harm of science and innovation. As a result, science and innovation has needed to become more responsive to the concerns of society. This has led to a call for a more responsible vision of science and innovation. RI is viewed as an attempt to achieve this. However, the concept is not universally accepted and has been criticised for lacking definition and clarity, both in concept and practice (Owen *et al.*, 2013). The fact that RI is an emerging concept with a number of definitions is likely to have contributed to this situation.

The RI literature describes an input, throughput and an output model of RI (Blok and Lemmens, 2015). The output model evaluates the results of innovation in terms of their ethical acceptability, sustainability and social desirability without specifying the process by which this is achieved. (Scholten and Van der Duin, 2015; Von Schomberg, 2013). In a similar way Von Schomberg (2013) describes a product dimension and a process dimension of RI. The product dimension is similar to the output model as it evaluates the products (outputs) of innovation in terms of their environmental protection, human health, sustainability and societal desirability. The process dimension refers to the management of the innovation process with the belief that an inclusive RI process will result in responsible innovation outcomes. Most definitions of RI tend to focus more on the input or throughput model. For example, Von Schomberg (2013: 9) defines RI as 'A transparent, interactive process by which societal actors and innovators become mutually responsive with a view to the (ethical), acceptability, sustainability and societal desirability of the innovation process and its marketable products' Stilgoe *et al.* (2013: 1570) offers a broader definition that involves, 'taking care of the future through collective stewardship of science and innovation in the present'. They propose four dimensions of a RI process as a way to promote a more responsible vision of innovation. These include anticipation, reflexivity, inclusion and responsiveness. There has been some criticism of this approach, for example, Blok and Lemmens (2015) argue that transparency, mutual responsiveness and collective responsiveness are unrealistic as firms need to use information asymmetries as a source of competitive advantage. Furthermore, due to the inherent unpredictability of innovation a RI process does not guarantee that the outcome will ultimately be responsible. However, they do state that the RI process may be realistic where society and ethical acceptability is an important part of the product's competitive advantage. Another challenge to the RI concept is that engaging in RI requires additional resources in terms of time, financial capital and human resources (Orlitzky *et al.*, 2011; Scholten and Van der Duin, 2015). These result from the need to identify the relevant stakeholders, negotiating with their representatives and consideration of their response (King, 2007). Waldman and Siegel (2008) highlight an additional challenge by pointing out that a company's responsibility is to maximise profitability for its shareholders and therefore a firm's performance should not be sacrificed for the sake of social responsibility. These dilemmas are of particular importance for emerging industries such as the New Zealand sheep dairy (NZSD) industry.

This paper takes an output based, product approach in applying the concept of RI to an emerging animal production industry. The research looks at RI through the theoretical lens of the resource based view (RBV).

This is to identify if RI can contribute to an industry's competitive advantage. Scholten and Van der Duin (2015) also apply the RBV to RI and identify that competitive advantage can arise because consumers and stakeholders are willing to collaborate with firms that have higher levels of sustainability. This enables the firm's products been seen as more valuable by consumers and stakeholders.

The NZSD industry is a new innovation in the New Zealand dairy industry. Currently, New Zealand has only about 30,000 sheep milked per annum by six main producers (Griffiths, 2014). In comparison New Zealand has 6.7 million dairy cattle and 29.8 million sheep (Statistics New Zealand, 2015). New Zealand is a major exporter of sheep meat and a global leader in bovine dairy. The success of sheep meat and bovine dairy provides an opportunity to adapt these existing resources and capabilities with new innovations in farm systems to establish a competitive sheep dairy industry. Innovation in the NZSD is an agro-ecological innovation rather than a technology innovation (Blok and Lemmens, 2015). Agro-ecological innovations involve more than just a single technology, they often involves multiple biological and physical technologies that interact with the environmental, human as well as plant or animal systems (Blazy *et al.*, 2011). It has been noted that these types of incremental innovations that are common in agriculture receive less attention due to the historical, economic, utilitarian paradigm that is generally applied to innovation (Blok *et al.*, 2015; Vanloqueren and Baret, 2009).

The sheep dairy industry in France provides a valuable comparative case study for New Zealand as it begins to establish its own sheep dairy industry. France is among the world leaders in sheep dairy production. It is the fourth largest producer of sheep milk worldwide, with 1.6 million dairy ewes producing around 260 million litres per year (Villaret, 2013). New Zealand's sheep dairy industry has significant differences to the French sheep dairy industry with the majority of sheep farmers focused on production of meat and wool. However New Zealand's total sheep numbers have been steadily falling since the mid-1980s as a result of depressed wool prices, lower returns on meat products and competition from other farming industries, such as bovine dairy (Gray, 2014). Only recently has significant interest in innovation in sheep dairy been generated. This is due to the success of the current operators, changes to the global 'palate', various economic and environmental drivers, as well as contributions from various institutions and stakeholders.

1.1 The New Zealand sheep dairy industry

Although New Zealand has produced and exported sheep meat for over 100 years, the production of sheep milk has only recently developed. The industry first began in 1992 when eleven pregnant East Friesian ewes and four East Friesian rams were imported into New Zealand from Sweden and entered a private quarantine station (New Zealand Sheep Breeders Association, 2015). These animals formed the breeding stock for the current sheep dairy flock in New Zealand. Embryo transfer techniques were used and only those animals derived from embryo transfers were released from quarantine. New Zealand's dairy sheep industry has since had a difficult history due to challenges directly related to the industry's small scale, instability of supply, limited flocks of milking sheep, lack of experience and minimal domestic consumption of sheep dairy products. As a result, only two producers are survivors of the commercial venture that began in the 1990s (Peterson and Prichard, 2015).

1.2 Market demand

Global demand for dairy products, including sheep dairy, is growing by 2.5% annually. It is driven by developing economies and the growing demand for healthy, natural and traditional foods. Despite this, sheep milk products only occupy 1.4% share of the global dairy market. However, it is estimated that the demand for sheep milk is growing by 10-20% each year (Downie-Melrose, 2014). New Zealand's largest sheep dairy operation, the Blue River Dairy, has seen a 50% increase in the milk powder price over the last three years (Peterson and Prichard, 2015). KPMG (2016) has identified Singapore and California as promising initial markets for New Zealand to focus on. This conclusion was based on market access, population demographics, growth in dairy and non-dairy alternatives and consumer trends in taste buying behaviour.

1.3 Health benefits

The growing presence of the health-conscious consumer is further boosting the demand for sheep dairy products that cater for preferences for healthy foods. Furthermore, sheep milk has properties that are favourable for cheese, yoghurt and butter manufacturing. Also sheep milk has three-times higher whey content compared to cow milk, which aids digestion as well as other notable health benefits (Downie-Melrose, 2014). For example it has higher calcium levels (162 mg/100 g compared to cow's milk 110 mg/100 g) and higher Vitamin D levels, which aid the regulation of phosphorous and calcium absorption essential for bone mineralisation (0.18 g/100 g compared to cow's milk at 0.04 g/100 g). Sheep milk also contains different forms of proteins that are unlike the beta-lactoglobulin and alpha S1 casein in cow milk that commonly cause milk allergies and intolerance (Peterson and Prichard, 2015). Thus, sheep milk is preferable for consumers who are unable to consume cow milk due to allergies. These health benefits can be seen through the RI lens as providing an innovation that meets the goal of social desirability.

1.4 Environmental and human welfare

New Zealand has traditionally marketed its agricultural products on its environmental credentials, using the image of a pristine 'clean and green' environment. This has formed the basis of New Zealand's competitive advantage and brand for its agricultural exports. New Zealand has a global reputation for using safe, sustainable and trusted methods of production. However, maintaining this image in the face of growing agricultural intensification has become a challenge and is an important priority for a range of stakeholders, including the New Zealand government, regional councils, Fish and Game¹, Greenpeace and the general public. For example, there is growing concern among these stakeholders about the impact of farming on water quality. Between 1989 and 2007 there was an overall degradation in water quality in New Zealand's major rivers. Over that period levels of nitrogen increased significantly at many sites (Proffitt, 2016). The New Zealand bovine dairy industry has been identified as a major contributor to this problem (Ministry for the Environment, 2009). Effluent and nitrate leaching from bovine dairy farms contribute significantly to water contamination. Leaching occurs when there is excess nitrate in the soil profile which is typically, the result of effluent, nitrogen fertilisers or cow urine patches² (Downie-Melrose, 2014). Studies have shown that leaching levels can increase five-fold for a pasture grazed system with cows than without (Downie-Melrose, 2014). The bovine dairy industry has focused on innovation that has increased productivity to the detriment of the environment and ignoring the concerns of many stakeholders. Increased productivity has been achieved by increasing the number of cows per hectare and through increased supplementary feeding using imported palm kernel extract. This has significantly increased the amount of contamination of waterways. This demonstrates production based innovation that does not align with concept of RI. Most of the innovations in the bovine dairy industry have led to significant intensification and improved the productivity. These have been driven by economic criteria without consideration of environmental factors and with little stakeholder involvement. Therefore, the bovine dairy industry has significant factors that do not fit RI criteria. As noted by Blok *et al.* (2015) and Stilgoe *et al.* (2013), RI acknowledges that not all innovation is good and that there are often negative externalities.

By comparison, the NZSD industry presents an opportunity for greater alignment with RI principles as there are significant characteristics that can deliver environmental and human health benefits. Sheep do not have the same leaching effect because they have a lower volume of urine³. For example, one trial found that nitrate leaching levels of sheep grazed on ryegrass and clover pasture did not increase as much compared to a similar pasture from which hay was cut and where there was no stock access (Downie-Melrose, 2014). In terms of environmental credential and the 'clean green image' New Zealand promotes, milking sheep

¹ Fish and Game New Zealand manages, maintains and enhances sports fish and game birds and their habitats in the best long-term interests of present and future generations of anglers and hunters.

² A urine patch is the area of soil that is covered when a cow urinates. Measurements have shown that within this patch there may be up to 1000 kg/ha of nitrogen (Moir *et al.*, 2016).

³ The lower volume of urine provides the soil with greater capacity to absorb the nitrogen where it can be utilised by plants.

on lush green pastures provides a more accurate representation of that image as it is far less detrimental to the environment. Future environmental constraints make milking sheep a more sustainable option than milking cows in New Zealand. Also, as environmental sustainability becomes a key to market access, and consumer acceptance, there is a significant marketing opportunity for environmentally sustainable sheep dairy products. Sheep dairy has a number of distinctive features including environmental outcomes, and health properties that can improve the welfare of consumers. These provide an opportunity to build on these within a RI framework. The research proposes that for these environmental and health benefits to be fully realised the RI framework needs to provide the industry a competitive advantage.

1.5 Research questions

The research questions to be addressed in this research are:

- Can New Zealand establish and sustain an internationally competitive sheep dairy industry and what are the important resources and capabilities needed to achieve this?
- What strategy should the NZSD industry adopt to achieve competitive advantage?
- What can RI contribute to the NZSD industry developing a sustainable competitive advantage?

There is little research on the implementation of RI and whether, in fact, it can actually be applied in practice. For example, Blok *et al.* (2015: 31) concludes, 'the practical applicability of RI is highly questionable.' Furthermore, they suggest that it is 'doubtful whether mutual responsiveness and shared responsibility is feasible in a commercial setting' (Blok *et al.*, 2015: 148). This research will investigate whether a RI approach can be considered a distinctive competency that provides an industry with a competitive advantage. In other words, does RI need economic and market incentives to be applied in practice. The evaluation of the French and New Zealand sheep dairy industries will enable the nature of New Zealand's competitive advantage to be evaluated and if RI can further enhance this competitive advantage.

2. Research methods

The study employs a qualitative, exploratory case study approach to investigate the factors needed for New Zealand to establish an internationally competitive sheep dairy industry. The exploratory case study method was used in order to gain insight into the complex factors that contribute to the establishment of this industry. According to Yin (2003) case study research can involve single or multiple cases. Two case studies were chosen for this research as this provides advantages in identifying patterns. An exploratory case study method was also chosen due to the current lack of knowledge as to how RI and resources and capabilities can affect competitive advantage of an industry. Up until now RI has only been applied in a small number of contexts (Scholten and Van der Duin, 2015) with limited research in the agricultural context or for an industry as a whole. Furthermore, case study research has particular applicability when studying contemporary events (Yin, 2003). This is applicable to this research as it focuses on the current competitive advantage in the two sheep dairy industries. Furthermore case study research is suitable when asking the 'how' or 'why' questions involved in this research (Yin, 2003). Quantitative research was deemed to be inappropriate due to the small scale of the New Zealand sheep industry. This would mean the quantitative data would likely not be representative and would not achieve statistical significance.

Initial desktop research was conducted on both the New Zealand and French sheep dairy industries. Current and historical information relating to the evolution and structure of sheep dairy production in New Zealand and France was examined and compiled from the literature search. This included a review of existing recommendations from previous research into the NZSD industry, as well as defining and mapping the current condition of the industry in New Zealand and France.

The literature search provided information on the characteristics of the industries for the case studies and the interview questions. Semi-structured interviews were used in order to obtain specific and practical information. Actors who were interviewed included researchers, producers and manufacturers. This ensured that the

interviews covered actors at different levels of the supply chain. The interviewees provided information on the current resources and competences within New Zealand and France, as well as the competitive forces within the global sheep dairy industry that could offer opportunities for New Zealand's sheep dairy industry. A list of the interviewed actors is included in Supplementary Methods S1. The interviews provided additional information and confirmation to the literature relating to two the industries. The questions used in the interviews are included in Supplementary Methods S2 and S3.

2.1 Case selection

Two case studies were selected to provide different perspectives about the industries and their resources and capabilities (Eisenhardt, 1989). The two case studies selected were the New Zealand and French sheep dairy industries. New Zealand was chosen as the sheep dairy industry is an emerging agro-ecological innovation and is still developing its resources and capabilities. The French industry was selected as a comparative case study due to the significant differences in terms of scale, history, marketing and branding, government resources and farmer knowledge and expertise. A convenience sampling methodology was employed to select interviewees, however the sampling method was structured to ensure that the sample included farmers, distributors and processors and other stakeholders. This ensured that the interviews represented actors at different roles in each industry.

2.2 Data collection

Face-to-face semi-structured on-site interviews were the primary method of data collection. The question used as prompts for the interviews are found in Supplementary Methods S2. These interviews were complemented with secondary data such as published company information, supply agreements and newspaper reports. Other secondary data included observations at supplier field days and informal personal communication with suppliers and company personnel. Secondary sources provided additional information and validation of the interview data. The interview questions acted as a guideline for the interviews to enable the interviewee to lead the discussion. These focused on competitive advantage and value creation so as to avoid leading questions involving RI. This gave the opportunity for the interviewee to be free to express their view on the most important resources and capabilities that might lead to competitive advantage. Furthermore, for most industry actors the RI concepts are somewhat abstract.

Research in the Roquefort Area of France examined the current state of the sheep dairy industry in France from the perspective of farmers and processors. This also provided an understanding of the opportunities for the NZSD industry to develop into an industry that was not only attuned to market needs, but also that ultimately returns benefits to its farmers, distributors and processors and other stakeholders. Information from the literature, case studies and the field research were applied to the theoretical framework and analysed to identify themes and build on ideas that would help New Zealand's sheep dairy industry develop and sustain a competitive advantage.

3. Theoretical framework

RI evaluates innovations in terms of their ethical acceptability, sustainability and social desirability (Scholten and Van der Duin, 2015; Von Schomberg, 2013). Scholten and Van der Duin (2015) draw a link between RI and the RBV arguing that RI interacts with the accumulation of resources and firm capability. From the perspective of the RBV resources that are valuable, rare, inimitable and non-substitutable provide a firm with competitive advantage (Barney, 1991). The RBV describes the concept of competitiveness or competitive advantage as implementing a value-creating strategy not simultaneously being implemented by any other current or potential competitor (Barney, 1991). Scholten and Van der Duin (2015) argue that competitive advantage is possible because stakeholders and consumers are more willing to collaborate with firms that are sustainable, ethical and have production systems and products that are socially desirable. This means

that RI can be a valuable resource to achieve competitive advantage. This research attempts to show how RI fits within the RBV framework in the context of creating competitive advantage for the NZSD industry.

From the RBV perspective, for the NZSD industry to succeed, it needs to identify and understand how it differs from its competitors in ways that allow it to achieve superior performance through competitive advantage. The first stage of this research evaluates the resources and capabilities that lead to the distinctive capabilities of the NZSD industry. Based on these the next stage of research considers the strategies needed to create an appropriate differentiation or cost-leadership advantage. Treacy and Wiersema (1993) identify building blocks of competitive advantage which involve the deployment of a firm's unique combination of resources and capabilities to achieve operational excellence, customer intimacy and product leadership. The nature of these plus the associated resources and capabilities determine whether a firm should adopt a differentiation or a cost leadership strategy. They emphasise that to achieve competitive advantage a firm must excel in at least one of these and meet the industry standard in the other two. Bernroider (2002) and Hill and Jones (2008) propose similar concepts that have significant overlaps with the concepts of Treacy and Wiersema (1993). These include quality, innovation, efficiency and customer responsiveness. They argue that firms need to deploy their distinctive competencies in these areas to achieve competitive advantage. The concepts described by Bernroider (2002) and Hill and Jones (2008) were used in this research due to the clarity of their definitions (Figure 1).

Within the resource-based view (RBV) there are two components of strategic capabilities that contribute to a competitive advantage: resources and capabilities (Johnson *et al.*, 2008). Resources are assets that a company owns, controls and uses for the purpose of creating value; capabilities are a firm's capacity for undertaking a particular activity, while competencies are the ways these resources and capabilities are used or deployed effectively (Johnson *et al.*, 2008). Resources can be divided into two types: tangible and intangible. Tangible resources are physical entities, such as land, buildings, manufacturing plants, equipment, inventory and capital (David and Han, 2004; Hill *et al.*, 2014). Intangible resources are nonphysical entities, such as brand names, reputation, knowledge and experience, as well as the intellectual property of the company including patents, copyrights, and trademarks (David and Han, 2004; Jones and Hill, 2013). Just how RI fits into the RBV framework is not entirely clear from the literature. Scholten and Van der Duin (2015) develop a conceptual model that describes RI as an antecedent to absorptive capacity. From a RBV prospective RI could lead to valuable intangible resources such as value of the brand, reputation and relationships with various stakeholder groups, as well as leading to tangible resources, such as government funding. This research proposes that RI is a distinctive competency which results from a unique combination of resources and capabilities (Figure 1).

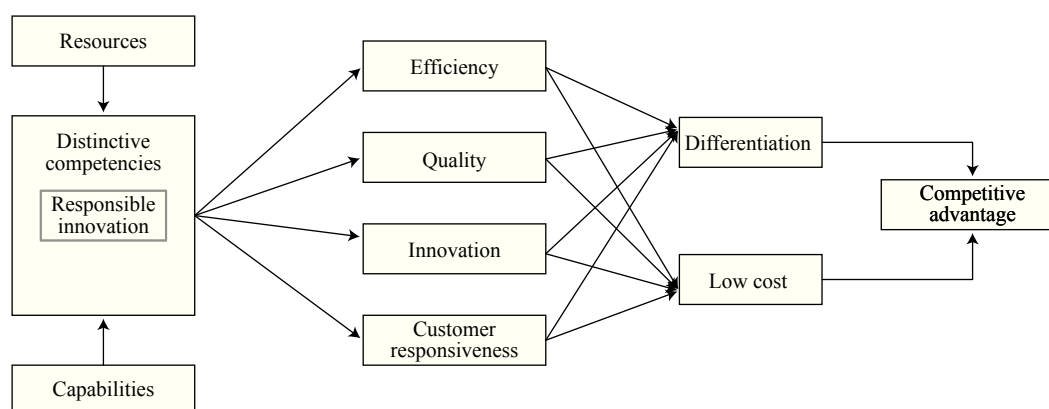


Figure 1. The basis of competitive advantage (adapted from Bernroider, 2002; Hill *et al.*, 2014).

Furthermore, these strategic capabilities can be divided into threshold competencies that are required in order to be able to compete in a market, or distinctive competencies that might help the organisation achieve competitive advantage and superior performance. These are summarised in (Table 1).

While threshold capabilities are important for competing in a market, they do not, in themselves, create a competitive advantage. Competitive advantage is more dependent on having distinctive capabilities. This raises the question of whether RI is a threshold or distinctive capability.

■ *Generic strategies for competitive advantage*

For the NZSD industry to develop a competitive position globally it must achieve superior profitability, either through creating a differentiation or cost-leadership competitive advantage (Porter, 1985).

■ *Cost leadership*

By pursuing a cost leadership strategy, a cost leader can gain a competitive advantage by producing goods or services at a lower cost than their competitors thus allowing them to charge a lower price for their product.

■ *Differentiation*

By pursuing a differentiation strategy, a differentiator creates a unique product that customers perceive as different or distinct, while still being able to satisfy their needs. This enables the product to be sold at a premium price.

3.1 *Building blocks of competitive advantage*

From the RBV perspective, in order for the NZSD industry to achieve international competitiveness it needs to build on the distinctiveness of its competencies and use these to build competitive advantage through efficiency, quality, innovation, or responsiveness to customers (Figure 1).

■ *Innovation*

Innovation refers to the act of creating new products or processes (Jones and Hill, 2013; Thompson, 1965). Innovation is recognised to play a central role in creating value and sustaining competitive advantage (Baregheh *et al.*, 2009).

Innovation creates value by creating new products, or enhanced versions of existing products, that customers perceive as having more utility. More recently, there has been a change towards innovation that meets society's goals and involves stakeholders in the innovation process. This encapsulates the RI approach that balances the economic, social and environmental aspects of the innovation process (Blok *et al.*, 2015; Von Schomberg, 2013). The case studies assess whether, by prioritising the social, ethical and environmental

Table 1. Threshold and distinctive competencies (adapted from Johnson *et al.*, 2011).

	Resources 'what we have'	Capabilities 'what we do well'
Threshold competencies: required to be able to compete in a market	Threshold resources	Threshold capabilities
Distinctive competencies: required to achieve competitive advantage	Distinctive resources	Distinctive capabilities

impacts the NZSD industry can develop RI as distinctive competency that can help develop a significant competitive advantage (Figure 1).

■ *Quality*

A product is of a superior quality when customers perceive that its attributes provide them with higher utility than a competitors' product. The quality of a product is commonly evaluated against two kinds of attributes: those relating to 'quality as excellence', such as design, features and functions, and those relating to 'quality as reliability', such as consistently performing its designed function with few faults (Gilmore, 1974; Jones and Hill, 2013; Levitt, 1972). With food products, however, quality is a more complex phenomenon. Quality also includes credence attributes – quality characteristics that cannot be verified even after purchase or consumption of the product; these are, therefore, difficult or costly to evaluate (Lees and Saunders, 2015). Credence attributes include food safety, animal welfare, environmental sustainability and cultural authenticity. Quality in terms of meeting consumers and societies needs for ethical and sustainable production systems as well as healthy food products is closely aligned to the RI concept.

■ *Customer responsiveness*

To achieve superior responsiveness from customers, a company must outperform its competitors in identifying and satisfying its customers' needs. This is closely aligned to the quality criteria. This can include improving the quality of the products or developing new products to meet consumers' demands. Fischer *et al.*, (2009) and Van der Vorst (2000) argue that consumers are demanding greater variety and quality in the food they eat. They also require a consistent year-round supply of high quality, safe food. In addition, there is a demand for food that aligns with consumers' personal values, including credence attributes, such as environmental sustainability, animal welfare and fair trade, as well as local and organic production (Grunert, 2005; Saunders *et al.*, 2013). Blok *et al.* (2015) refer to interaction and responsiveness as two important aspects of RI. Customers are important stakeholders therefore responsiveness to customer needs can be seen as aligned with dimensions of RI. Interaction and responsiveness to customers is currently taking place in the NZSD industry through sales at farmer's market where direct interaction with customers is possible.

■ *Efficiency*

The simplest measure of efficiency is the quantity of inputs required to produce a given output. The more efficient a company is, the fewer the inputs required to produce a particular output. Superior efficiency enables an industry to lower its costs and improve its performance and profitability. While innovation, quality and customer responsiveness directly impact the consumer, the relationship with efficiency is less direct. The main way efficiency impacts the consumers-stakeholders is through price. Efficiency is an important focus for undifferentiated commodity products and can directly compete with society's desire for sustainable and ethical production. Therefore, industries that focus on efficiency may be in conflict with achieving RI outcomes.

4. Results

4.1 *Threshold and distinctive capabilities of New Zealand's sheep dairy industry*

This section compares the threshold and distinctive capabilities of the French and New Zealand sheep dairy industries. The results show that the NZSD industry has a significant lack of both threshold competencies and distinctive competencies compared to the French industry (Table 2 and Table 3).

Table 2. Resources and capabilities in the French sheep dairy industry.

	Resources	Capabilities
Threshold competencies	<ul style="list-style-type: none"> • Capital • Critical mass • Dairy genetics • Significant market development • Substantial government assistance • Equipment and technology 	<ul style="list-style-type: none"> • Experience and expertise • Industry structure
Distinctive competencies	<ul style="list-style-type: none"> • Strong brand • Traditional product • Product history 	<ul style="list-style-type: none"> • Market leaders

Table 3. Resources and capabilities in the New Zealand sheep dairy industry.

	Resources	Capabilities
Threshold competencies	<ul style="list-style-type: none"> • Capital constrained • Lack of critical mass • Narrow dairy genetics • Limited market development • Some government assistance • Developing equipment and technology 	<ul style="list-style-type: none"> • Lack of experience and expertise • Undeveloped industry structure
Distinctive competencies	<ul style="list-style-type: none"> • Pasture based – grass fed • Natural image • Low environment footprint 	<ul style="list-style-type: none"> • Innovation – lack of constraint in production and product innovation

4.2 Threshold capabilities

■ Capital

France has significant physical and financial capital invested in the sheep dairy industry. This includes a sheep herd of 1.6 million milking ewes, significant on farm investment in barns and milking sheds and processing. In contrast, New Zealand's current sheep dairy industry is severely capital-constrained both at the production (investment in land, animals and milking sheds), processing and marketing level. This is predominantly due to the uncertainty of the long-term viability and sustainability of the industry. Consequently, banks are reluctant to lend, and private investors are reluctant to invest because the industry is viewed as unproven, and they have concerns about historical agricultural industry failures. Without capital, it is difficult for the industry to focus on developing the competencies necessary to achieve RI outcomes.

■ Critical mass

France has a national sheep dairy flock of 1.6 million dairy ewes producing 260 million litres of milk per year (Griffiths, 2014). By comparison, New Zealand's sheep dairy flock is estimated to be approximately 30,000 ewes with an annual production that is very low by world standards (Griffiths, 2014). These low numbers mean there is a deficiency in critical mass. This is preventing New Zealand from turning its sheep dairy industry into a viable industry. The lack of sheer volume makes it difficult to compete effectively in the world marketplace.

■ *Sheep dairy genetics*

The genetic selection programmes in France are not only of substantial scale, they are also highly coordinated and technically well supported. This framework has ensured the availability of effective selection programmes that have translated into substantial genetic progress. The difficulty for the NZSD industry is that its dairy gene pool is small. Although time has been spent on developing the East Friesian and Awassi breeds, New Zealand is still well behind the genetic progress of the northern hemisphere. The New Zealand industry also lacks flock-wide improvement programmes and, instead, farmers strive to improve the genetic merit of their dairy animals through their own selection programmes. The slow rate of progress in genetic innovation is an example of how agricultural innovation tends to be slower and therefore the negative impacts are easier to identify and mitigate.

■ *Market development*

Traditional sheep milk producing countries, such as France, have the advantage of historically high levels of domestic consumption of sheep milk products. By comparison sheep milk is not traditionally consumed in New Zealand. Although the demand is growing, the limited size of the domestic market⁴ means New Zealand's sheep dairy industry has to adopt an international strategy early on. Reliance on overseas markets poses a number of challenges for the NZSD industry, specifically, market access requirements, customer requirements, vulnerability to global economic conditions and the international trade environment. Despite these challenges targeting export markets often means that producers need to meet higher standards in terms of food safety, environment sustainability and ethical production. These requirements of international customers introduce an economic incentive to meet RI criteria of ethical, sustainable and socially responsible innovation.

Nothing can be taken for granted in this space and the real difference will be hard work and dedication of our marketers and the support they get in terms of finance, regulatory, and of course on farm.

Business manager, sheep dairy operation, Waikato, New Zealand

■ *Government assistance*

The government represents a significant stakeholder in the French industry. Milk production, breeding selection programmes, as well as marketing and processing, all receive major financial and technical support from the government. For example, a government-backed official scheme exists for labelling outstanding product quality, and the coordination and leadership of genetic improvement programmes are supported by the government's *Génétique Elevage*. Furthermore, European agricultural producers receive subsidies for their production. It is estimated that subsidies make up 26% of the total income of sheep dairy farmers in France (Griffiths, 2014). Changes to the Common Agricultural Payment scheme may further benefit farmers in the French sheep dairy industry.

By comparison, New Zealand's government eliminated agricultural subsidies in 1984 (Sandrey and Reynolds, 1990). This was a major turning point in changing the subsidy-driven volume-based production systems that existed previously. This led to the New Zealand agricultural industry restructuring with an emphasis on production efficiencies and product quality. While a reintroduction of government subsidies is not likely, the New Zealand government does provide assistance for developing industries, such as the sheep dairy industry, as well as investment in broader sustainability outcomes. This makes the New Zealand government a significant stakeholder in the NZSD industry with its own objectives in terms of agricultural innovations. For example the New Zealand government has set out 10 National Science Challenges⁵. The one known as 'Our Land and Water' aims to enhance the production and productivity of New Zealand's primary sector,

⁴ The 2016 New Zealand population is 4.7 million (Statistics New Zealand, 2016).

⁵ These National Science Challenges represent what might be termed grand challenges or 'wicked' problems facing New Zealand.

while maintaining and improving the quality of the country's land and water for future generations (MBIE, 2016). From the government's perspective, the NZSD industry can be seen as a responsible innovation that can have a direct impact on reaching the goals of this challenge. As a result, there has been direct government investment in new sheep milk ventures. For example, a new NZ\$31.4 million, six-year programme called 'Sheep – Horizon Three' is a partnership between Spring Sheep Milk Co. and the Ministry for Primary Industries.

The Sheep – Horizon Three PGP programme will establish another important industry that will provide a real economic boost for New Zealand that is environmentally and socially sustainable.

CEO of the Spring Sheep Milk Company

This indicates that RI is a critical component of the project and was significant in accessing funds from the government stakeholder. Therefore, developing relationships of transparency and responsiveness with government agencies provided the ability to access direct financial support. This shows that RI can add to an industry's competitive advantage, in this case by directly accessing government finance and support.

■ *Equipment and technology*

The French electronic animal identification and information systems are exemplary. Not only have they improved the quality and reliability of agricultural products, they allow food traceability and have become key components in the success of their genetic programmes. New Zealand has no similar system limiting the ability to have reliable methods of individual identification, monitoring and tracking. These systems can also yield information about milk quality that are important indicators of product quality. This type of system is most certainly a key step in adding value to products and upholding food safety.

■ *Experience and expertise*

The importance of experience and expertise in sheep dairy farming cannot be underestimated. The French sheep dairy industry was established in the 8th century. Because of this a wealth of knowledge has been amassed through the centuries from the proficiency of farmers through to the industry expertise of technical and scientific organisations. Though the NZSD sheep industry lacks experience and expertise, New Zealand is a global leader in cow dairy production and this expertise can be adapted to the sheep dairy industry (Griffiths, 2014). However, there is still insufficient information directly relevant to NZ sheep dairy production and extrapolating information from dairy cattle research or international information may not always be applicable to the New Zealand industry.

■ *Industry structure*

The NZSD industry in its infancy has a blank canvas to design an effective industry structure. While there are many possible systems, valuable lessons can be learnt from other successful agricultural co-operatives in New Zealand, such as the Dairy Goat Co-operative and Fonterra Cooperative. Their effective use of a customer-focused, co-operative business model has helped them overcome the challenges of capital constraints in their start-up phase, as well as the challenges relating to New Zealand's small scale and geographic isolation. Both co-operatives have grown into large international firms that contribute significantly to New Zealand's economy. Co-operative models also present innovative ways of raising capital.

Furthermore, the way the industry is structured is important for management and industry coordination. Within France, the sheep dairy industry's success can be attributed to its coordinated value chain, including selection programmes, milk production, processing, product marketing and cheese merchandising. The establishment of collaborative industry structures and supply chain relationships both require openness, transparency and responsiveness, all of which are features of RI.

4.3 Distinctive capabilities

Distinctive capabilities help achieve competitive advantage and superior performance.

■ Innovation

For most of the last century New Zealand's competitive advantage came from being a low-cost producer of agricultural products. This is by virtue of adopting a seasonal, pasture-based system and avoiding reliance on the high grain or supplementary feed costs associated with the confinement systems used overseas. New Zealand also used this 'clean and green' image to its marketing advantage by developing a New Zealand image with a global reputation for safe, environmentally friendly and sustainable products. As a result, New Zealand branded kiwifruit, wine and some dairy products are capturing significant consumer premiums (Lees and Saunders, 2015).

As already mentioned, New Zealand is rapidly losing this competitive advantage and its clean, green reputation is under threat. This is because much of the past focus of innovation in New Zealand was based on increased productivity through higher stocking rates, improved nutrition and other technologies. This intensification has led to negative environmental impacts with associated externalities.

It is very hard for farmers to remain customer focused when [they] are production orientated. This tends to continually undermine the good work that is done.

Business manager, sheep dairy operation, Waikato, New Zealand

This is an area where RI in the NZSD industry can improve New Zealand's environmentally friendly image while, at the same time, meeting consumers' demands for more sustainable and healthy food products. Milking sheep has far less impact on the land and there are fewer negative environmental implications so, in terms of the clean green image New Zealand promotes, milking sheep on lush pastures is an accurate picture of the industry. This provides an opportunity to build on this positive perception of low intensity, pasture-based production systems. By emphasising these attributes in marketing, NZSD products could obtain market advantage and could potentially gain higher product premiums. At the same time, this would help meet the requirement from stakeholders for environmentally sustainable agricultural production. Furthermore, consumers are increasingly looking for foods that align with their personal values, such as environmental sustainability, animal welfare, fair trade and organic production. The NZSD industry has the potential to see this not as a compliance cost but, through the application of RI it can be seen as a way to provide a valuable competitive advantage.

The French sheep dairy industry has largely been based around protecting traditional products and processes, perhaps at the expense of innovation. By comparison New Zealand has led the way in many agricultural innovations, with a dedicated agricultural research community supported by the government, commercial entities and researchers. Many of New Zealand's agricultural advantages have come from commercialising scientific innovations into market applications. Product development of New Zealand sheep milk could focus on nutritional benefits and sustainable farming systems that make it superior to other milk. To do this, the industry needs to interact with key stakeholders, including the government, the research community, investors and consumers, to ensure innovation meets consumers' desires for health and wellbeing as well as sustainable production systems.

The NZSD industry could invest in developing new innovative products that are validated by scientific research. Key areas of development include:

- Superior sheep milk products for niche sectors like health, infant care and gourmet food.
- Production systems that deliver a consistent supply of high quality safe food that also meet customers' expectations of animal welfare and environmental stewardship.

- Market innovation and knowledge to communicate with customers.

New Zealand needs to keep focus on the high value add position; naturally-based, fresh and nutritious products, with trusted and reliable production. We then must maintain control over the supply chain and have strong protocols.

Sheep dairy producer, Canterbury, New Zealand

The main competitive advantages of the NZSD industry are aligned with the RI outcomes of ethical acceptability, sustainability and social desirability (Scholten and Van der Duin, 2015). Though the industry lacks significant threshold resources (Table 3) the results indicate that exploiting these RI competencies can support the development of the industry.

5. Discussion

The results indicate that though there is potential for New Zealand to establish a globally-competitive sheep dairy industry there is a significant lack of some important resources and capabilities to achieve this (Table 3). The opportunity for a sheep dairy industry is based on the growing global demand for sheep dairy products with growth estimated to be between 10-20% per year (Griffiths, 2014). This growth can be also attributed to consumer trends that focus on the quality and health attributes of premium sheep dairy products. For the NZSD industry to capitalise on this opportunity it would need to focus on developing some of the lacking threshold resources. This would require overcoming current capital constraints, growing the national flock, genetic improvements for productivity, developing experience and expertise, securing market relationships and achieving industry cooperation and collaboration. The industry would also need to develop its unique resources and capabilities in order to create distinctive competencies that will give the industry a sustainable competitive advantage. These include resources such as the pasture-based production systems that enable environmentally sustainable production and meets consumer's desires for healthy, natural products (Figure 2).

The results from the interviews emphasised that the best option was for the NZSD industry to pursue a differentiation strategy whereby it creates and sells a product that better satisfies customer needs over its rivals (Jones and Hill, 2013; Porter, 1985). To achieve this the NZSD industry would need a competitive strategy that focuses on customer responsiveness, innovation and quality products (Figure 1). These strategies also contain some aspects of RI as they are closely aligned with responsiveness and innovation that meets ethical, social and environmental stewardship (Scholten and Van der Duin, 2015). The incorporation of these are also likely to result in higher quality products through involvement of customers and stakeholders.

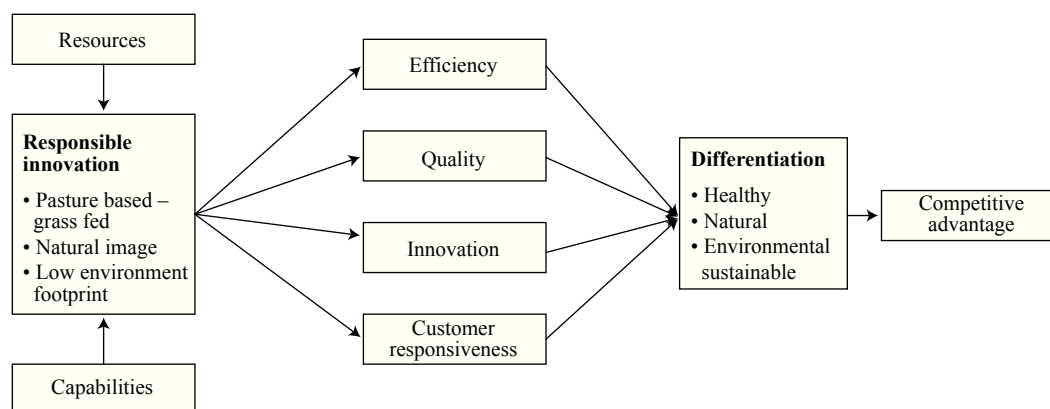


Figure 2. Basis of competitive advantage for the New Zealand sheep dairy industry.

Figure 2 shows how this competitive advantage might be achieved. It shows that RI can be interpreted as a distinctive competency based on specific resources and capabilities. For example, the ability of the NZSD industry to produce grass fed, natural products with low environmental footprint is based on resources such as temperate climate, fertile soils and large areas suitable for grassland farming. These resources are developed into distinctive competencies by farmer's knowledge of grazing management and a research community with capability in grassland research.

The results indicated that to achieve a competitive advantage the NZSD industry needs to pursue a differentiation strategy. By focusing its distinctive competencies on customer responsiveness, innovation, quality and efficiency would enable the industry to differentiate on health, natural production and environmental sustainability. It is of note that Figure 2 does not identify the processes of RI. There was no consistent awareness by the interviewees of these processes such as transparency, interaction, responsiveness and co-responsibility (Blok and Lemmens, 2015). Instead the model identifies only some of the outputs of RI for the NZSD industry. This may be because agro-ecological innovations tend to be incremental and they focus on the whole system that includes a variety technologies and innovations. This makes identifying specific RI practices difficult. For example, genetic improvement of stock makes slow gains over several years. Furthermore, the research is focused on a whole industry rather than a specific firm. This means there may be a range of RI practices at work by different actors.

The results showed that to further build on existing competitive advantages the NZSD industry needs to collaborate with its stakeholders and take a balanced approach about the social, ethical and environmental impacts, both now and in the future. Furthermore, the NZSD industry needs to continue to build on its socio-cultural benefits that include the preservation of sheep farming traditions and customs, as well as the welfare and health of the population.

It was difficult to identify the processes of RI in the case study of the NZSD. There was no intentional application of the input or throughput model of RI operating in the NZSD industry. Despite this there were clear characteristics and products of the industry that met the output model of RI (Von Schomberg, 2013). This supported the view that RI would occur when there is an economic incentive to do so. For example, sheep dairy systems already have advantages in terms of existing environmental and ethical production systems as well as products with significant health benefits. The industry was focused on exploiting these as it aimed to achieve a differentiation strategy. The NZSD therefore already has significant resources that make following a RI approach beneficial to attain a competitive advantage. Therefore, this demonstrates how RI outcomes could provide a competitive advantage within a specific industry.

The case studies provided evidence that the practical application of an output and product model of RI is possible. This may be more likely in situations where industries are adopting a differentiation strategy as products may be promoted on their specific benefits, including social, ethical and environmental aspects. For the NZSD industry, there were significant benefits to achieving RI outcomes therefore there was an economic incentive to apply RI. Firstly, consumers benefit due to the health properties of sheep milk but also because the product had been produced sustainably. Secondly, the New Zealand government has benefited from a more transparent relationship with industry, as well as economic and environmental benefits. Finally, the farmers themselves benefit from an alternative farming enterprise that could provide significant social and cultural benefits.

Since the removal of agricultural subsidies in 1984 New Zealand government policy has been to leave the development of innovations to the market and individual entrepreneurs, with minimal government intervention. This approach is supported by Von Schomberg (2013: 4) who states that 'competition in the market should ensure product improvements for the benefit of all'. The RI literature acknowledges that even with the adoption of a RI process that is transparent, interactive and mutually responsive to stakeholders, there is no guarantee the outcome of this process will result a more responsible outcome. Given the uncertainty of the outcome of the RI process and the additional resources required, adopting a market led outcome focused

approach to RI may be just as effective as the process and throughput models (Blok and Lemmens, 2015; Von Schomberg, 2013).

This raises the question of what a more complete application of a process model of RI in the NZSD industry would look like. Furthermore, this would need to examine how this might affect the RI outcomes of the industry as well as the impact on its competitive advantage. A more complete application of RI would require an anticipatory, inclusive, reflexive and responsive approach to engaging with stakeholders. Although this would require greater investment in terms of time, financial and human resources there may be benefits from applying a more complete RI model. For example, given the environmental and health benefits associated with the sheep dairy products wider stakeholder engagement may increase support and resources available to the industry. This could involve the inclusion of public health organisations plus the specific involvement of animal rights and environmental protection organisations. Proactive inclusion of these stakeholders may anticipate potential issues that need to be addressed such as concerns over animal welfare⁶ or the industry's contribution to climate change⁷. An anticipatory, inclusive, reflexive and responsive approach may identify issues and enable the development of a collective response to some of the negative aspects of the NZSD innovation. Viewing these stakeholders as partners rather than threats could increase the legitimacy of the industry in the public perception and with government agencies. This could help the marketing of the products as well as access to government funds. If the NZSD industry is adopting a differentiation strategy then its reputation is valuable resource that can support a sustainable competitive advantage. This may also enable the development of a more cohesive industry with a clearer vision of its future. The downside of this approach is that this RI process will require greater resources in terms of time, financial and human resources (Orlitzky *et al.*, 2011; Scholten and Van der Duin, 2015). The research has shown that the NZSD industry is currently severely capital constrained and therefore fully implementing a RI strategy may be in conflict with this stage of its economic development. Clearly there would be some tension between the economic drivers of the industry and the opportunities that a more complete adoption of RI may present.

6. Conclusions

The results suggested that the NZSD industry should pursue a differentiation strategy rather than a low-cost strategy to attain a competitive advantage. To achieve this the NZSD industry would need to focus on the building blocks of competitive advantage that can differentiate the industry through customer responsiveness, product innovation and quality. The NZSD industry can achieve a competitive advantage by focusing on its unique competencies which include grass fed pasture based production, natural image and low environmental footprint (Figure 2). Furthermore, the NZSD sheep dairy industry has potential to provide further societal benefits based on the ways to structure this industry. For example, a farmer-owned co-operative is one way of helping to encourage social benefits. This would ensure key stakeholders can address the relevant ethical and societal aspects to achieve desirable goals, such as returning profits to the New Zealand producers. Sheep milk is well known to have health attributes; therefore, there are major opportunities for the NZSD dairy industry to develop products with specific health benefits for consumers. This will be a key area of success for the industry, as consumers increasingly desire healthy food choices. This can also be seen as an aspect of RI outcomes for the industry.

This research has highlighted the environmental benefits of a NZSD industry, especially as future environmental constraints impose challenges on milking cows in New Zealand. Increasingly environmental sustainability will become a key to market access. The NZSD has the opportunity to forge some of New Zealand's highest agri-environmental standards, such as carbon and water foot printing. This is a key area of research and ongoing development that needs to involve a variety of stakeholders including government, NGOs and customers. In evaluating the relevance of RI to the NZSD industry there was evidence that a practical

⁶ Sheep dairy production requires the sheep to produce a lamb each year. As raising a lamb competes with the milk collected for processing in some cases these lambs are put down in order to maximise production.

⁷ Methane (CH₄) is the largest contributor to New Zealand's greenhouse gas emissions, and it also comprises 45% of all emissions in terms of global warming potential (Landcare Research, 2017).

application of an output model of RI was possible. This was shown to be more likely for industries that are adopting a differentiation strategy as products may be promoted on specific benefits, including social, ethical and environmental aspects.

In summary, New Zealand has the potential to create an internationally competitive sheep dairy industry by focusing on RI outcomes as a distinctive competency that can support a competitive advantage. Building on responsiveness to its customers, innovation and quality is necessary to realise the benefits of this. The NZSD industry would need to continuously assess and anticipate the need for change, with particular consideration of its wider social, ethical and environmental implications. In this way, the industry can develop economically at the same time as achieving more responsible outcomes.

Supplementary material

Supplementary material can be found online at <https://doi.org/10.22434/IFAMR2017.0013>.

Methods S1. People interviewed.

Methods S2. Interview questions, New Zealand.

Methods S3. Interview questions, France.

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