

Australian Lamb Supply Chain: A Conceptual Framework

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Abstract

In the last decade, supply chain management has played an important role to lead agribusiness today to succeed in their business goals, to gain competitive advantages, and to improve business performance. As the result of that, there has been extensive studying in a popular topic of strategic supply chain management in order to improve business performance as well as along supply chain performance under the real situation. This is because in current business world, supply chain practices are crucial to influence many agribusinesses to continuously adapt proper supply chain management in their nature of business. This paper will propose a conceptual framework of supply chain practices and supply chain performance indicators of the Australian Lamb Industry.

Keywords: Lamb Supply Chain, Supply Chain Management

Introduction

The lamb sector in Australia is undergoing rapid change because of globalisation, a highly competitive lamb market (local and export), increased production efficiency, quicker production cycle and delivery times and consequently reduced inventories, a trend toward more outsourcing of activities, and the rapid development of IT (MLA, 2004). In this type of business environment, advanced supply chain systems have been observed to have dramatic impact (Finch, 2006, Donlon, 1996, Min and Mentzer, 2004). Hence such systems have the potential to provide significant contributions to Australian lamb industry performance.

Smith (2001, p.3) describes the lamb supply chain as follows: “A system by which the “sectors” involved in lamb production (seedstock generators, cow/calf producers, stockers/backgrounders, feedlot operators, packers, processors, supermarket operators and food-service providers) become “segments” because – no longer isolated from but mutually dependent upon, those in other sectors – they become “links” in a chain (segments in a supply chain)”.

Using data gathered by a survey of lamb industry participants, we adopted a regression approach at the exploratory stage of the study to assess which aspects of supply chain management were critical to lamb producers. The results of this stage revealed that customer relationship management was more important than other supply chain activities. This led to an in-depth examination of customer relationship management for lamb producers.

LAMB PRODUCTION AND LAMB SUPPLY CHAINS

The Australian lamb supply chain can be segmented into four levels: cattle production, lamb processing, lamb retailing/wholesaling and final consumer. There are a few fully integrated

Contributed Paper to the 55th Annual Australian Agricultural and Resource Economics Society Conference, Crown Conference Center, Southbank, Melbourne, Victoria, 8-11th February, 2011

supply chains linked to the major supermarkets. These have cattle moving from feedlot/farms to processors who transform them into lamb products and organise delivery into the hands of end customers. For the most part, however, lamb supply chains are only partially integrated involving activities only from slaughtering to end customers or from producing to slaughtering. Small and medium lamb enterprises mainly contribute to these partially integrated supply chains.

Lamb supply chains can also be classified as aligned or non-aligned. A comparison between them reveals that aligned lamb supply chain management in Australia is associated with highly integrated chains, for example cattle producers/feedlots and other chain partners (processors, retailers and wholesalers) need to meet and sustain chain goals such as efficiency and effectiveness. To achieve these, aligned lamb supply chains need to have several features along the chains operations. First, all levels of lamb supply chains get involved in strategic and operational planning processes. Non-aligned lamb enterprises do not consider this. Second, aligned lamb enterprises need to have trust, awareness (focused on customers' needs), strong partnerships among the partners and transparency (information sharing). Non-aligned lamb enterprises do not consider information sharing and tend to have secrecy as a general principle of operation. Then, there are many complex groupings of unrelated participants, thus level of trust will be inconsistent. Moreover, non-aligned lamb enterprises do not have chain integration, a customer focus or clear market signals.

Cattle production is the first echelon of the Australian lamb supply chain. Several activities in this echelon are varieties of breeding, growing and backgrounding, including fattening and lot feeding. There are around 76,662 lamb enterprises in Australia. They produced around 25 million head of cattle in 2005 with a gross value of production of around \$5.7 billion. Additionally, around 65 percent of production is exported. Feedlots contribute around 27 percent of total lamb production (ABS, 2005, ABARE, 2007).

Cattle are sold in Australia as stud, store or finished stock. There are several methods of selling lamb cattle (depending on the type of stock and market outlet for the stock) (ABARE, 2004, ABARE, 2005, Sneath et al., 2006, DPI&F, 2003). They are paddock sale, over the hook, saleyard auction, AuctionPlus (formerly CALM Auction), direct consignment, forward contract (contract based make to order) and alliance.

Objective of the research

There are two objectives of this research:

1. to describe the Australian Lamb Supply Chain Framework
2. to develop a conceptual framework of supply chain practices and supply chain performance indicators in the Australian Lamb Industry.

Literature Review

Supply chain practice

A review of previous studies (see Table 1) revealed that five aspects of the supply chain were likely to be of major importance to the Australian beef industry: strategic supplier partnerships, customer relationships, information sharing, information quality and lean thinking. These aspects generally exist on an intra or inter-organisational basis, for instance between producers and processors or processors and retailers. Moreover, they would be expected to give various advantages to beef enterprises including improved responsiveness

and flexibility, increased production efficiency, and improved beef quality, and overall enable the industry to better satisfy customers. Improving these aspects of the supply chain would be expected to lead to higher profitability both by increasing revenues and reducing costs of firms in the supply chain. Also, given that cooperative actions form the basis of these supply chain relationships, trust and commitment are necessary antecedents.

Table 1 Previous studies on supply chain practices

No	Author	Description
1.	Donlon 1996 (Donlon, 1996)	There are five elements of supply chain practice: strategic supplier partnerships, continuous process flow, information sharing, outsourcing and cycle time compression.
2.	Tan <i>et al.</i> 1998 (Tan et al., 1998)	Supply chain practice has been tested empirically. There are three elements of supply chain practice: quality, customer relationships and purchasing.
3.	Alvarado and Kotzab 2001 (Alvarado and Kotzab, 2001)	There are two elements of supply chain practice. First, application of EDI can be used in inter-organisational systems. Second, postponing customisation toward the end of the supply chain can eliminate the excess stock levels.
4.	Tan <i>et al.</i> 2002 (Tan et al., 2002)	There are six elements of supply chain practice: supply chain integration, information sharing, supply chain characteristics, customer service, geographical proximity and JIT capability.

1. Strategic supplier partnerships

A strategic supplier partnership is “*a co-operative and collaborative way in which buying and supplying firms interact to achieve mutually beneficial outcomes, these relationships position participants to be more competitive in the marketplace*” (Blancero and Ellram, 1997, p.616). It is a long-term relationship (Stuart, 1997, Narasimhan and Jayaram, 1998, Monczka et al., 1998, Sheridan, 1998, Noble, 1997) . It is designed to leverage the strategic and operational capabilities of individual participating organisations to help them achieve significant ongoing benefits. There are several studies on strategic supplier partnerships in different sectors (Stuart, 1997, Narasimhan and Jayaram, 1998, Monczka et al., 1998, Sheridan, 1998, Noble, 1997). A review of these studies reveals that several components are of major importance to the Australian beef industry: high levels of communications, for instance between cattle producers and processors; trust; interdependence; coordination; participation joint (problem solving and conflict resolution); long-term commitment; co-operative and integrative relationships with key enterprises, for instance effective supplier partnerships; and continuous improvement.

There is limited research about strategic supplier partnerships in agri-business supply chains and even less in beef supply chain management. Thus, it is important that the current research investigates whether strategic supplier partnerships in the Australian beef industry

(cattle producers, beef processors and retailers) can have positive or negative impact on supply chain performance.

2. Customer relationships

One of the major challenges that the meat industry experiences is providing a consistent service level across its wide variety of customers. The implementation of a suitable customer relationship management (CRM) process is designed to assist the organisation to achieve this service consistency. A CRM system can also allow the company to become closer to its customers and more aware of their needs. Close customer relationships may lead to improved customer retention and also positive word-of-mouth promotion for the businesses. CRM is an essential component of many supply chains and has the object of maintaining and delivering consistent quality.

Keeping existing customers is usually a lot less expensive than attracting new customers, so businesses will gain from becoming more aware of their customers' requirements (Faircloth, 2006). The central point of a successful CRM system is information. This foundation of information is then utilised to deliver relevant services to the customer (Barratt, 2004). The information for each customer can then be shared within industry providing a full 360-degree view of the customer (Moore, 2006). As a result, the information within the CRM system must be kept up to date and relevant to the business. Development of new IT infrastructure may be required to assist the CRM process.

Whilst the introduction of the CRM system for the firm may assist in the improvement of customer relationships, customers will still require individual attention to their own unique needs. The development of the CRM process often requires commitment from a number of different stakeholders within the company. Whilst dedication from senior management is seen as critical to success, a company-wide commitment is also required (McGarry, 2006). Employees must see the benefit from the system and its relationship to improving customer service in order for it to become a success. Without this commitment the CRM system will battle for credibility. In order to gauge the needs for the CRM process and what customers want, a survey, focus group or depth interview are to be developed.

There are five strategic sub-processes in customer relationships (Croxtton et al., 2001) which industry needs to embark on in order to implement a proposed CRM process:

1. review corporate and marketing strategy (for example, strategic decisions – this provides a snapshot of the firm),
2. identify criteria for categorising customers (via surveys to determine customer needs),
3. establish guidelines for the degree of differentiation in the product/service agreement,
4. develop a framework of metrics, and
5. develop guidelines for sharing process improvement benefits with customers (value attributes).

Customer relationships management is a process whereby relationships with the customer are developed and maintained (Croxtton et al., 2001).

3. Level of Information Sharing

The information sharing paradigm is the widespread belief that achieving a high degree of cooperative behaviour requires that supply chain participants voluntarily share operating information and jointly plan strategies. The level of information sharing refers to the extent to

which critical and proprietary information is communicated to one's supply chain partner (Monczka et al., 1998). There are many previous studies on level of information sharing in different sectors (Handfield and Nichols Jr., 1999, Jutla, 1999, Saaksjarvi, 1999, Jones, 1998, Novack et al., 1995, Balsmeier and Voisin, 1996, Towill, 1997, Lalonde, 1998, Monczka et al., 1998, Stein and Sweat, 1998, Mentzer et al., 2000, Vokurka and O Leary-Kelly, 2000, Yu et al., 2001, Ballou, 2004, Schroeder and Hope, 2007).

Inter-organisational information sharing can bring together suppliers, firms and customers towards achieving decision consensus with shared goals and mission. Clearly, this kind of information sharing can improve transaction efficiency and reduce information delay along the entire supply chain. Meanwhile, the sharing of information among all partners in the supply chain can gain competitive advantage, improve performance and profits (Handfield and Nichols Jr., 1999, Jutla, 1999, Saaksjarvi, 1999, Jones, 1998, Novack et al., 1995, Balsmeier and Voisin, 1996, Towill, 1997, Lalonde, 1998, Monczka et al., 1998, Stein and Sweat, 1998, Mentzer et al., 2000, Vokurka and O Leary-Kelly, 2000, Yu et al., 2001, Ballou, 2004, Schroeder and Hope, 2007).

Based on the existing and previous studies over the years in different sectors, it is clear that information sharing can substantially improve overall supply chain performance. By using simulation-based experiments, Closs and Roath demonstrated that a supply chain in which retail sales information is shared instantaneously with the retailers' respective distributor(s), as well as with manufacturer(s) and raw materials suppliers, places a premium on consumer service and can reduce inventory level dramatically in comparison to the traditional anticipatory supply chain strategies (Closs et al., 1998).

4. Quality of Information Sharing

It is clear that efficiency in supply chains is influenced by both the level of information sharing and the quality of information sharing. In a beef industry context, information sharing between producers and processors about carcass weight, size, etc. needs to be accurate, adequate and credible. Numerous previous studies on quality of information sharing in supply chain management have been completed over the years (Closs et al., 1997, Gustin et al., 1995, Moberg et al., 2002, Monczka et al., 1998, Alvarez, 1994, Berry et al., 1994, Chizzo, 1998, Chopra and Meindl, 2004, Holmberg, 2000, Jarrell, 1998, Lee et al., 1997, Mason-Jones and Towill, 1997, McAdam and McCormack, 2001, McCormack, 2003) (see Table 2). A review of these studies reveals several criteria measuring quality of information sharing in different sectors (mostly in manufacturing and retailing): accuracy, timeliness, adequacy, credibility and reliability. In a similar manner, it would be expected that these information sharing criteria would be of major importance to the Australian beef industry. For example, if the chiller assessment and carcass information are accurate, complete, reliable and not delayed from processors to beef wholesalers, it will impact positively on the quality of beef. Then, wholesalers can deliver high quality products to their markets (either domestic or international).

Table 2. Previous studies on quality of information sharing

Author	Description
Closs <i>et al.</i> 1997; Gustin <i>et al.</i> 1995 (Closs <i>et al.</i> , 1997, Gustin <i>et al.</i> , 1995)	The determinants of information quality in most settings that have been examined are accuracy, timeliness, and proper formatting of the information
Moberg <i>et al.</i> 2002; Monczka <i>et al.</i> 1998b (Moberg <i>et al.</i> , 2002, Monczka <i>et al.</i> , 1998)	There are four criteria of quality of information sharing: accuracy, timelines, adequacy, and credibility of information exchanged.
Alvarez 1994; Berry <i>et al.</i> 1994; Chizzo 1998; Chopra and Meindl 2004; Holmberg 2000; Jarrell 1998; Lee <i>et al.</i> 1997; Mason-Jones and Towill 1997; McAdam and McCormack 2001; Metters 1997; Monczka <i>et al.</i> 1998b; O'Brien 1999; Schroeder and Hope 2007; Sellitto <i>et al.</i> 2007; Storer 2006 (Monczka <i>et al.</i> , 1998, Chizzo, 1998, Holmberg, 2000, Jarrell, 1998, McAdam and McCormack, 2001, Metters, 1997, Lee <i>et al.</i> , 1997, Mason-Jones and Towill, 1997, Berry <i>et al.</i> , 1994, Alvarez, 1994, Schroeder and Hope, 2007, Storer, 2006, O'Brien, 1999, Chopra and Meindl, 2004, Sellitto <i>et al.</i> , 2007)	The extent to which information exchanged is complete, adequate, credible, accurate, reliable, depth and range of content and being timely and up-to-date.

5. Lean system

Several definitions of a lean system are:

- Lean system is the practice of driving out the unnecessary costs, and other wastes from the entire supply chain (McIvor, 2001, Taylor, 1999, Womack and Jones, 1996, Mason-Jones and Towill, 1997, Handfield and Nichols Jr., 1999, Burgess, 1998, Srinivasan, 2004, Bell, 2006).
- The term “lean” represents a system that uses less of all inputs to create outputs similar to the mass production system, but offer an increased choice to the end customer.
- The logic behind lean thinking in supply chain management is that organisations jointly identify the value stream for each product from concept to consumption and optimise this value stream regardless of traditional functional or corporate boundaries (McIvor, 2001).
- Lean management can be defined as the process of eliminating the amount of waste in the production line in order to maximise customer value (Coote and Gould, 2006).

Seven types of waste that became a problem in most companies have been recognised by production engineer Taichii Ohno (Krafcik, 1980). These are: defects, over-production, waiting, transporting, movement, inappropriate processing, and inventory (Krafcik, 1980). Although the “Seven Wastes” were originally developed in a manufacturing context, research has shown that waste removal is equally relevant as a basis for improvement across the whole range of supply chains (Taylor, 1999).

Womack and Jones (1996) identify five principles which are essential to the elimination of waste. Taylor (1999) extends the above five principles into a supply chain management context:

1. understand what creates value from the customer's point of view,
2. identify the activities which are necessary to deliver that value across the whole supply chain – the value stream,
3. create value by eliminating waste between value-adding activities and within value-adding activities,
4. only make, or move, what is pulled by the customers and not what production units choose to make and push into the supply pipeline, and
5. strive for perfection not only in terms of product quality but also in the physical process, information systems, and management.

Lean thinking has become a very important dimension of implementing supply chain management (Mason-Jones and Towill, 1997, Handfield and Nichols Jr., 1999). Organisations have to restructure their entire supply chains to remove the unnecessary costs, time and other wastes, so they can deliver high quality, best value products in a timely manner. Lean operating practices are the dominant driver of a highly integrated and down-sized supply chain, assuring both cost savings and closer, more productive working partner relationships. Reducing the time required to develop, manufacture, and distribute products not only cuts costs, but also increases productivity, allows premium prices to be charged, reduces risks, and increases flexibility (Burgess, 1998)

6. Antecedent Cooperative Behavior: Trust and Commitment

Trust

There are several definitions of trust in supply chain relationships:

- Trust is a general expectancy that the word of an individual or organisation can be relied on (Rotter, 1967).
- Trust is the willingness to rely on a trading partner in whom one has confidence (Ganesan and Shankar, 1994, Monczka et al., 1998, Wilson and Vlosky, 1998, Spekman et al., 1998, Mariotti, 1999, Moorman et al., 1992, Morgan and Hunt, 1994). Confidence on the part of trust in supply chain relationships is reliable and high integrity, which is related with consistency, competency, honesty, fairness, responsibility, accountability, predictability and dependability (Anderson and Narus, 1990, Dwyer et al., 1986, Lamming, 1996, Moorman et al., 1992).
- Trust is the degree to which partners perceive each other as credible and benevolent (Doney and Cannon, 1997, Ganesan and Shankar, 1994, Kumar et al., 1995) and is expected to have a positive effect on the degree of collaboration in supply-chain relationships.
- Trust is *“the belief that a party's word or promise is reliable and that a party will fulfil his/her obligations in an exchange relationship”* (Schurr and Ozanne, 1985, p.12).
- Trust is *“the degree to which the channel member perceives that its relationship with the supplier is based upon mutual trust and thus is willing to accept short-term dislocation because it is confident that such dislocation will balance out in the long-run”* (Anderson et al., 1987, p.6).
- Trust is *“one party's belief that its needs will be fulfilled in the future by actions undertaken by the other party”* (Anderson, 1989, p.33).

- Trust is “*the firm’s belief that another company will perform actions that will result in positive outcomes for the firm, as well as not take unexpected actions that would result in negative outcomes for the firm*” (Anderson and Narus, 1990, p.3).

Based on definitions above, there are possibly three ways to build trust in relationships among trading partners in lamb Industry: trading partners should demonstrate reliability in their operations, consistently performing as promised and meeting expectations; trading partners need fully and accurately sharing of all information necessary for the effective functioning of the relationships.

Commitment

Commitment is characterised by a long-term relationships which can be defined as the willingness of each partner to exert effort on behalf of the relationship (Lee and Kim, 1999, Balsmeier and Voisin, 1996, Tompkins, 2000, Burnell, 1999, Dale, 1999, Morgan and Hunt, 1994). Commitment and trust are dimensions of a business relationship that determine the degree to which each party feels they can rely on the integrity of the promise offered by the other.

Table 3. Previous studies on trust and commitment

Author	Description
(Anderson and Narus, 1990, Anderson, 1989, Geyskens and Steenkamp, 1995, Morgan and Hunt, 1994)	Trust is seen as central to successful relationships leading to higher levels of loyalty to the bargaining partner and thus to increased profitability because trust encourages partners to co-operate, seek long-term benefits and refrain from opportunistic behaviour
(Kwon and Suh, 2004)	Research clearly shows that the presence of trust and commitment substantially improves the chances of successful supply chain performance (to increase the value delivered to end customers).
(Egan and Greenley, 1998)	Four dimensions of trust: honesty; safety; credibility and previous experience.
(Morgan and Hunt, 1994)	Trust and commitment (key influential constructs in channel relationships) has been considered in domestic buyer-seller relationships.
(Freytag and Nielsen, 1990)	Trust has been examined in international buyer-seller relationships.
(Zaheer et al., 1998, Handfield and Bechtel C., 2002)	Trust is a strategic value of buyer-supplier relationships.
(Sahay and Maini, 2002)	Collaborative relationships in SCM need trust and commitment for long term cooperation along with a willingness to share risks.
(Ghoshal and Moran, 1996,	The concepts of trust and collaboration in the supply chain began to challenge the explanatory power of transaction

- Chiles and McMackin, 1996) cost theory.
- (Lengnick-Hall, 1998) Trust with effective communication could create resources that lead to a competitive advantage.
- (Henriott, 1999) Information sharing as a prerequisite for trust.
- (Peters and Hogensen, 1999, Monczka et al., 1998, Chandra and Kumar, 2000) Trust and collaboration were becoming more prevalent in supply chain relationships because of their ability to reduce uncertainty.
- (Lee and Billington, 1992) Supply chain management is built on a foundation of trust and commitment.
- (Blois, 1999, Volery and Mensik, 1998, Handfield and Nichols Jr., 1999, Rankin, 1998, Selnes, 1998, Richards, 1995, Cowles, 1997, Doney and Cannon, 1997, Wolff, 1994, Lambert et al., 1999, Welty and Bercerra-Fernandez, 2001, Olorunniwo and Hartfield, 2001, Zineldin and Jonsson, 2000) The high levels of trust characteristic of relational exchange enable trading partners in supply chain to focus on the long-term benefits of the relationships.
- (Lewis, 2000) Trust is number one on the list of priority concerns why so many firms do not think that their partner relationships are working as well, as they should
- (Fawcett et al., 2006) Examine the nature and extent of commitment to supply chain collaboration and also the state of supply chain governance structures.
- (Higginson and Alam, 1997) Top management commitment is a key component of successful implementation of SCM.
- (Zineldin and Jonsson, 2000). Trust and commitment can only be earned and built on actions such as communication, adaptation, cooperation, shared values, and quality satisfaction
- (Meyer et al., 1984). Three types of commitment emerge from the literature: calculative or continuance commitment, normative commitment, and affective commitment
- (Wilson, 1995) Commitment is viewed as critical in the literature of organisational purchasing behaviour. Researchers have used commitment as the most common dependent variable in buyer-seller relationship studies
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Trust and commitment for lamb Industry in Australian will improve relationships with future value to both parties (buyer and seller). For example, in order for the relationship to be sustained the supplier of lamb Industry must deliver the correct stock, in the correct quantity, at a price that is reasonable to both parties. As a result, trust and commitment can improve supply chain performance (responsiveness and efficiency). For instance, it will allow trading partners in the Australian lamb enterprises to maximise the efficiency of their capabilities and resources and lower their cost.

Based on discussion above and literature studies, trust and commitment (antecedent cooperative of behaviour framework) are considered in this research. Thus, seven sub-elements of trust and commitment in the questionnaire are developed. Seven sub-elements are:

1. Our trading partners respect the confidentiality of all the information they receive from us.
2. Our trading partners have been open and honest in dealing with us.
3. Our transactions with trading partners do not have to be closely supervised.
4. Our firms have invested a lot of effort in our relationship with trading partners.
5. Our trading partners have made sacrifices for us in the past.
6. Our firm and trading partners always try to keep our promises to each other.
7. Our trading partners abide by agreements very well.

Supply Chain Performance Indicators

It is essential to measure and evaluate the Australian lamb supply chain performance, particularly because the complexity and multiple functions of the businesses (producers/lotfeeders, processors and retailers/wholesalers) are involved. Thus, this research considers the supply chain performance indicators as one domain in the conceptual framework.

Based on critically literature review, four sub-elements of the Australian beef supply chain performance framework have been developed in this study: food quality, flexibility, responsiveness and efficiency (see Figure 1).

Table 4 describes the previous studies from 1979 to 2006 on supply chain performance indicators (customer responsiveness and efficiency) in manufacturing, food, transport, steel production, horticulture and other sectors.

Table 4 Previous studies on customer responsiveness, efficiency and flexibility

Customer responsiveness	Efficiency	Flexibility
(Berry and Naim, 1996, Beamon, 1998, Beamon, 1999, Li and O' Brien, 1999, Talluri et al., 1999, Van der Vorst, 2000, Gunasekaran et al., 2001, Thonemann, 2002, Lai et al., 2002, Talluri and Baker, 2002, Persson and Olhager, 2002, Claro et al., 2003,	(Eppen, 1979, Lee and Billington, 1992, Berry and Naim, 1996, Murphy et al., 1996, Beamon, 1998, Beamon, 1999, Li and O' Brien, 1999, Talluri et al., 1999, Van der Vorst, 2000, Gunasekaran et al., 2001, Thonemann, 2002, Lai et al., 2002, Talluri and Baker,	(Berry and Naim, 1996, Beamon, 1998, Beamon, 1999, Li and O' Brien, 1999, Van der Vorst, 2000, Gunasekaran et al., 2001, Lai et al., 2002, Talluri and Baker, 2002, Persson and Olhager, 2002, Claro et al., 2003, Gunasekaran et al., 2004, Aramyan et al., 2006)

Gunasekaran et al., 2004, Aramyan et al., 2006)	2002, Persson and Olhager, 2002, Claro et al., 2003, Gunasekaran et al., 2004, Aramyan et al., 2006)
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Conclusion

- Application of supply chain performance indicators (customer responsiveness and efficiency) have been proposed to around ten manufacturing industries, one food industry, one transport industry, one steel production industry and one horticulture industry.
- Most previous studies focussed on efficiency – supply chain performance indicators. It is confirmed that supply chain performance efficiency is essential to Australian lamb Industry

1. Food quality

Red meat quality has many different definitions (Loxton, 2005):

- Quality refers to aspects of the carcass such as weight, fat cover and distribution, muscling/conformation and bruising.
- Quality refers to aspects of chiller assessment attributes such as meat colour, intermuscular fat colour and marbling.
- Quality refers to beef processors', wholesalers' and retailers' assessments such as primal cut shape, size, weight, success of vacuum packaging, amount of drip loss in vacuum bags, ultimate pH, meat colour and fat colour in the display case.
- Quality refers to the end consumers' assessments such as food safety, price, tenderness, visual attributes (for example: appearance; meat colour and fat colour; fat content (perceived marbling and external fat cover of meat); wholesomeness and nutrition.

There are six key questions of food quality indicator proposed in the questionnaire:

1. Product safety and health are an important indicator in our firm.
2. Our firm believes animal welfare and health are of paramount importance.
3. Our firm implements an environmental management system.
4. Our firm has skilled and/or experienced employees.
5. Our firm has good records of all inspections and test performed.
6. Our firm implements occupational health and safety regulations.

2. Flexibility

There are two definitions of flexibility in this conceptual framework. First, flexibility is the agility of a supply chain in responding to marketplace changes to gain or maintain competitive advantage (SCOR, 2006). Second, flexibility is the ability to respond to changes in the environment such as customer demand (volume flexibility).

There are four sub-elements of flexibility in this conceptual framework:

- Volume flexibility
Volume flexibility is *“the ability to effectively increase or decrease aggregate production in response to customer demand”* (Cleveland et al., 1989, p.103). Volume flexibility may require close coordination between producers and processors or processors and retailers to anticipate for increasing demand. Volume flexibility directly impacts on the performance of the supply chain by preventing out-of-stock

conditions of products that are suddenly in high demand or by preventing high inventory levels if obsolete stock occurs.

In summary, if volume flexibility is achieved hence the firm will be able to meet the customer satisfaction.

- Flexibility in dynamic operations.
Flexibility in dynamic operations is the same as order flexibility which has discussed in chapter 3. This refers to the ability to adjust order size, volume or composition during logistics operation. In other words, this refers to the ability to respond to a changing environment during supply chain operations.
- Delivery flexibility
Delivery flexibility is the capability to adapt lead times to the customer requirements. An example of high delivery flexibility is just in time process, when suppliers deliver the products to the customer at the right quantity, place and time.
- Handle the late orders
Handle the late orders is the same as delivery time flexibility. This refers to the ability to provide delivery times for customers (including handle the late orders).

Based on discussion above, four sub-elements of flexibility supply chain performance indicator have been proposed in this study. These sub-elements are presented in the questionnaire. Four sub-elements are:

1. Our firm is able to meet the customer satisfaction.
2. Our firm is able to respond to a changing environment such as revised customer order.
3. Our firm has a flexible delivery system
4. Our firm is able to handle late orders.

3. Responsiveness

Responsiveness is the velocity at which a supply chain provides products to the customer (SCOR, 2006). There are six sub-elements of responsiveness supply chain performance indicator that are considered in this research. These sub-elements are presented in the questionnaire. Six sub-elements are:

1. Our firm fills customer orders on time.
2. Our firm has a short lead time (the time between the order is placed and when it is received by the buyer).
3. Our firm has a fast customer response time.
4. Our firm always delivers on time.
5. Our firm has a customer return policy.
6. Our firm has no shipping errors.

4. Efficiency

Efficiency supply chain performance indicator is defined as cost reductions enhancement to plan, make, source, delivery the products to consumers. For instance, there are several costs to be considered in cattle producers: total beef production, cattle enterprises costs (herd health costs, transport and cartage, selling costs), total labour costs (cost of permanent employees, cost of additional family labour) and overhead costs (repairs and maintenance for shed, yards, fences, land and other equipments, insurance, administration, fuel and oil, electricity and gas, pasture costs) (MLA, 2005).

Based on discussion above and literature review, there are six sub-elements of efficiency supply chain performance indicator in this research. These sub-elements are presented in the questionnaire. Six sub-elements are:

1. Our firm has had a low inventory cost.
2. Our firm has had high labour costs.
3. Our firm has had low transportation costs.
4. Our firm has had low operations costs.
5. Our firm has had minimal waste cost.
6. Our firm has had high profits.

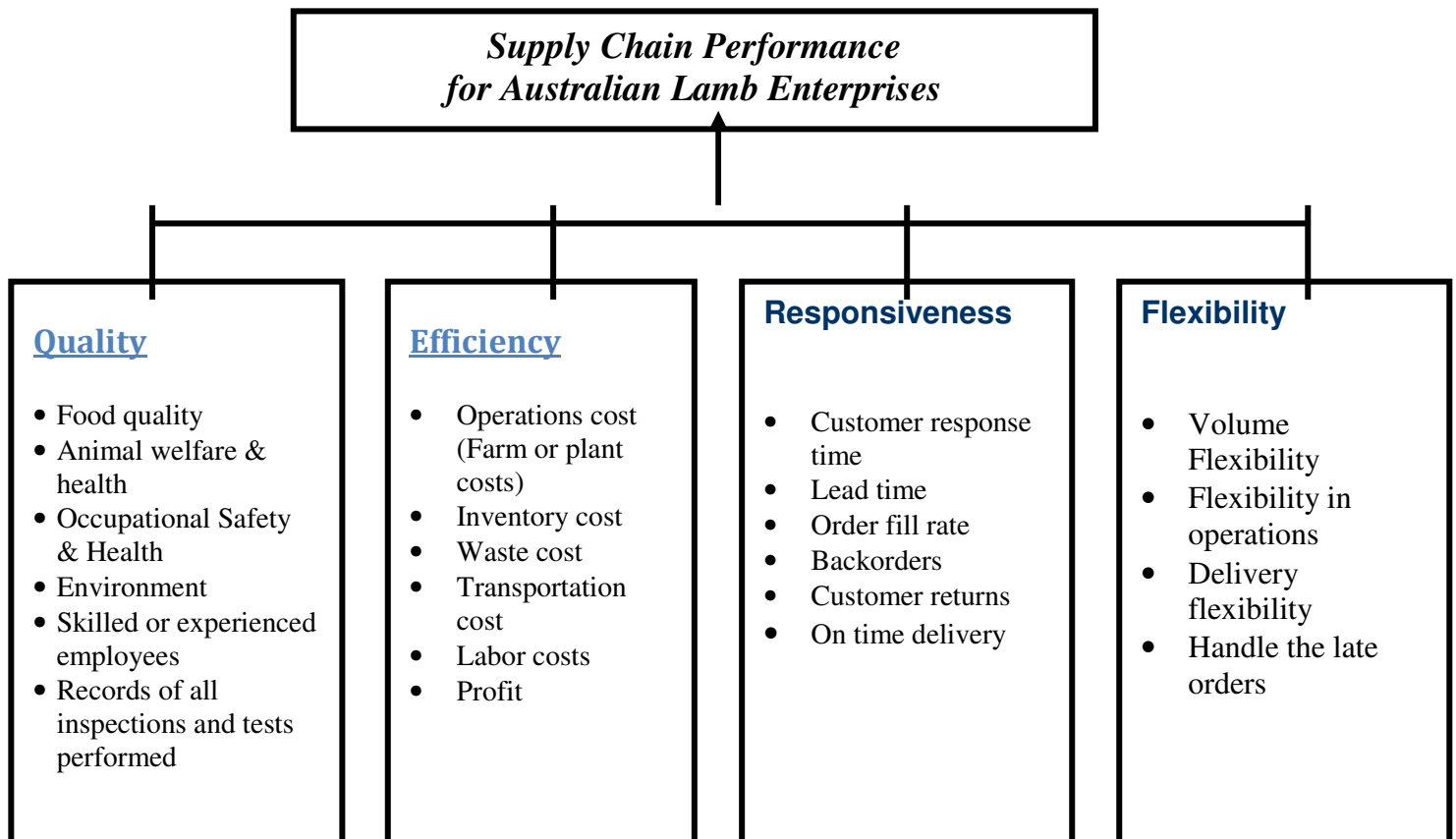


Figure 1 A conceptual framework of supply chain performance indicator (Beamon, 1999, Li, 2002, Luning et al., 2002, Gunasekaran et al., 2004, Aramyan et al., 2006)

Based on the literature review of supply chain practices described above, the hypothesis of this research is:

Null hypothesis: No real relationship exists between *SCP-Food quality* and the explanatory variables – *SSP, CRM, IS, IQ, LS, Trust and Commitment*

Research hypothesis: A real relationship exists between *SCP-Food quality* and at least one of the explanatory variables – *SSP, CRM, IS, IQ, LS, Trust and Commitment*.

Conclusion and Further Recommendation

This paper proposes a conceptual framework of supply chain practices and supply chain performance for Australian Lamb Industry.

To test several main hypotheses of this conceptual framework, an empirical approach will be implemented in this research project because it can represent manifest characteristics of agri-food supply chain, and relate to the conceptual framework. The statistical techniques of hypotheses testing will be planned that are reliability analysis, factor analysis, multiple regression analysis and Pearson correlation matrix. The significant contributions of this research are that farm management can be adapted, and Australian government regulation can support the red meat industry in order to handle any effects from supply chain factors.

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