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Abstract

Purpose – The Australian retail food sector, comprising mostly small enterprises, is undergoing change as a result of the innovative supply chain approach adopted. This change has implications across the entire food value chain in Australia. The purpose of this paper is to empirically investigate the adoption of supply chain management practices on small and medium enterprises (SMEs) in the Australian food retail industry.
Design/methodology/approach – The study surveys 120 SME retailers in the food sector. A stepwise multiple regression using SPSS version 14.0 was performed on the data.
Findings – Statistical results suggest that lean thinking and the quality of information shared can lead to greater efficient supply chain performance.
Research limitations/implications – The small sample is the main limitation. The findings bear important implications for further research as understanding these dimensions can help to position key changes and industry improvement that will increase revenue and reduce cost to the SMEs in the food retail supply chain.
Practical implications – Adopting lean thinking and improving information sharing in the supply chain can reduce the cost for SMEs.
Social implications – This study has unique implications for social sustainability, especially the smaller food enterprises, which are hard pressed to combat the challenges within the food sector.
Originality/value – Innovative supply chain management helps SMEs to see beyond the silo mentality and helps them to focus on greater value addition in the supply chain.

Keywords Supply chain, Information quality, Lean

Paper type Research paper

Introduction

The food retail sector in Australia is undergoing rapid change. This change is brought about by aggressive price competition (Round, 2006; Smith, 2006), food safety and quality concerns (Rong *et al.*, 2011), private labels (IBISWorld, 2013), industry rationalization and integration of supply chain activities that affect small producers and processors (Van Donk *et al.*, 2008), consumer demand for organic goods (IBISWorld, 2013), and innovation and research and development investment (IBISWorld, 2013).

These complexities arise due to globalization and the ultracompetitive marketplace, requiring faster speed to market. Consequently, the urgency of just-in-time production and lean thinking has led to lower stock levels. This then forces stricter quality assurance, which is built into the practice of supply chain management, to improve performance. Further, the change in the business environment points more outsourcing of food retail activities using rapid development of information and communication technology (ICT) tools. Technologies such as electronic data interchange (EDI), radio-frequency identification (RFID), self-checkout systems, smart phone application/payment and online shopping are increasingly adopted by the major retailers (IBISWorld, 2013). In such an environment, supply chain practices have been observed to impact supply chain performance (Trienekens *et al.*, 2012; Van Donk *et al.*, 2008; Wognum *et al.*, 2011).

Australia has three large supermarket chains (Woolworths, Wesfarmers and ALDI) and many other smaller players, for example, Costco, IGA, Australian United Retailer and SPAR (IBIS*World*, 2013). Woolworths is the largest chain, accounting for 39.1 percent of market share. Wesfarmers is the second largest player after its merger with the Coles Group (formerly known as Coles Myer) in 2007, accounting for 31.6 percent of market share. ALDI, holding only 4.8 percent, is reshaping the industry through aggressive price strategies,

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home brands and offering other competitive but socially acceptable practices such as donating their excess produce to Foodbank OzHarvest and SecondBite (IBISWorld, 2013). To facilitate better inventory control, the quality and price of products, Australian food retailers have already implemented supply chain collaboration using contractual arrangements. However, the aggressive price wars between Woolworths and Wesfarmers and their hold on the contract farms are likely to have a negative impact on the small and medium enterprise (SME) food producers and retailers (Woodings, 2012). According to AC Nielsen, Woolworths and Wesfarmers control 80 percent of grocery sales, 50 percent of horticultural sales and 68 percent of meat sales in Australia (Woodings, 2012). The margins of the smaller and independent operators have thus suffered from the fierce competition.

In 2012–2013, the turnover of the Australian food industry (which includes food and beverage, grocery, and fresh produce) was $114bn, employing almost 300,000 people. This represents a third of all jobs in the manufacturing sector. Food retail forms the major chunk of this industry by value (80 percent). The Australian Food and Grocery Council estimates that the industry value added (i.e. total value of goods less the cost of production) for food and beverage manufacturing is $24bn. Indeed, the Australian food value chain generates $172bn per annum, with food SMEs forming 98.5 percent of all businesses.

Therefore, to increase the effectiveness and efficiency of supply chain management in the food sector, food retailers are actively exploring private brands as a logical extension of the supply chain integration concept moving further downstream. IBISWorld (2013) predicts three trends in the retail food industry. First, supermarket shelf wars are expected to intensify in the next five years. Second, the private label segment will continue to grow to account for 25 percent of all supermarket sales by 2020. Third, the sale of organic products will increase due to greater consumer demand for healthy products. Therefore, the literature combines knowledge of this swiftly changing environment to examine the supply chain practices of food retailers. In this type of business environment, supply chain management has been observed to have dramatic impact on the industry. Previous studies (Finch, 2006; Rong *et al.*, 2011) have addressed the impact of supply, manufacturing/processes, transportation and demand uncertainty on supply chain performance in retail industries. However, there are few studies investigating how supply chain practices impact on food industry (e.g. Rong *et al.*, 2011). Further, most studies were based on a small number of case studies, and research using quantitative methods such as survey questionnaires are rare (e.g. Aramyan *et al.*, 2006). This study intends to fill the research gap and explore how such advanced supply chain systems have a potential to provide contributions to Australian food retail industry performance. Therefore, the research reported was focused on supply chain practices and supply chain performance efficiency in the Australian food retail industry.

In this research paper, the following research questions are posed:

RQ1. How do strategic supplier partnerships, customer relationships, information quality and information sharing, and a lean system affect the supply chain performance of the Australian food retail industry?

RQ2. How do trust and commitment in the trading partners affect supply chain practice and performance in the Australian food retail industry?

This paper reports on a study that evaluated the supply chain practices, which are important in influencing the supply chain performance of the Australian food retail industry. The rest of the paper is organized as follows. The second section discusses the supply chain performance indicators, supply chain practices, the antecedents of cooperative behavior and the Australian food supply chain structure. The third section provides the research method. The fourth and fifth sections present the results and discussion. The sixth section concludes with some limitations and future research directions.

Literature overview

Rapid industry rationalization and fierce cost reduction are shaping the Australian food retail supply chain. For starters, the vertical integration of the supply chain activities of large retailers such as Woolworths and Coles exerts pressure on the smaller food producers and processors. To reduce cost and improve efficiency, large retailers increase their private labels and exert coercive bargaining power to negotiate prices with the producers and processors (Round, 2006; Smith, 2006; Spencer and Kneebone, 2007). It is therefore necessary to measure and evaluate the complexity of the Australian food retail supply chain performance on the SMEs, given the influence from these larger players.

Previous studies confirmed that increasing collaboration with marketing process is very important to improve supply chain performance (satisfying customers and increasing efficiency) (Campo *et al.*, 2000; Emmelheinz *et al.*, 1991; Fitzsimons, 2000; Gruen and Corsten, 2007).

The evidence of research into supply chain performance indicators can be traced to 1980. Murphy *et al.* (1996) identified 19 such indicators; the most popular concerns the financial measurement such as the return on investment (ROI) and net income. These indicators can be summarized as efficiency and service effectiveness (Lai *et al.*, 2002), flexibility and responsiveness (Cho *et al.*, 2012; Lai *et al.*, 2002) and quality (Persson and Olhager, 2002; Rong *et al.*, 2011). Aramyan *et al.* (2006) have developed a conceptual framework for agrifood supply chain performance placing the performance indicators under the dimensions of efficiency, flexibility, responsiveness and food quality. Efficiency refers to how well resources are used (Lai *et al.*, 2002) and is measured by profit, ROI, production and inventory costs. Flexibility, encompassing strategic and manufacturing flexibility, is an antecedent of agility (Ngai *et al.*, 2011). Responsiveness seeks to provide shorter customer lead time (Persson and Olhager, 2002). Food quality, an essential indicator in the food industry, is directly related to the other food attributes of integrity, safety and shelf life (Rong *et al.*, 2011). Given the long distance to Australia's retail market and beyond, efficiency is chosen as an indicator in this study.

Several previous studies on strategic supply chain management (Barratt, 2004; Barratt and Oliveira, 2001; Bowersox and Closs, 2007; Burt and Doyle, 1994; Cammish and Keough, 1991; Clinton and Closs, 1997; Eloranta and Hameri, 1991; Freeman and Cavinato, 1990; Leenders and Blenkhorn, 1988; Lowson, 2003; Lummus *et al.*, 2001; McGinnis and Kohn, 1993; Morris and Calantone, 1991; Power *et al.*, 2001; Reck and Long, 1988; Syson, 1989; Van Hoek *et al.*, 2001).

Supply chain practice is taken as the independent variable for this study to show the set of intra or inter-organizational practices among the trading partners to improve their supply chain performance (see Figure 1). We now discuss each of the constructs.

Strategic alliances (SAs) are commonly viewed as long-term relationships between processors and producers, or processors and retailers (McNeil and Wilson, 1997; Spekman *et al.*, 1998; Zylbersztajn and Filho, 2003). An SA highlights direct, long-term relationships and encourages reciprocal planning and problem solving efforts (Gunasekaran *et al.*, 2001).

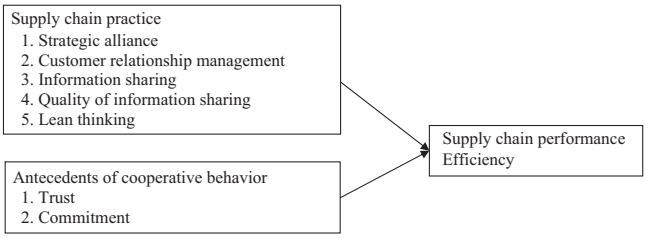

Figure 1.
Conceptual framework for food retail supply chain practice

They appear to control the strategic, tactical and operational capabilities of participating organizations, thereby affording them ongoing mutual benefits. Previous study on retail strategy stated that the use of procedural justice and distributive justice to measure the fairness of trading relationships is useful and comprehensive way of categorizing the many different aspects of retail buyer behavior in trading relationships with suppliers (Duffy *et al.*, 2003). Another previous study is to show why retail strategists need to develop long-term relationships capable of building business partnerships based on mutual trusts (Lee and Trim, 2006). The food sector is aware that organizations need to and can be more proficient through the management of scare resources and superior management practices. For instance, SAs allow firms to share expertise or technical know-how to manage specialized business processes by outsourcing to partners by forming arm's length relationships or even acquiring or merging with other firms (Braziotis and Tannock, 2011; Holweg and Pil, 2008).

Customer relationship management (CRM) is a key element in supply chain practice (Noble, 1997; Tan *et al.*, 1998). CRM includes the gamut of practices employed to manage customer complaints, build long-term relationships with customers and improve client satisfaction (Noble, 1997; Tan *et al.*, 1998). Committed relationships are a major sustainable advantage for competition (Day, 2000). With greater mass customization, CRM is imperative for survival (O'reilly and Paper, 2012; Wines, 1996). Previous studies on CRM included the main function of CRM is to closely interact with customers of a business to increase the level of service given to them (McGarry, 2006); creation of strong, long-term customer relationships is a form of competitive advantage as is creates barriers to competition (Day, 2000); close relationships among supply chain members including customers can lead to increase the value offered to the customer (Moberg *et al.*, 2002).

Next, the element of information sharing is critical to a successful collaborative relationship and the nature of information flow between supply chain participants. This construct refers to the extent to which critical and proprietary information is communicated to a supply chain partner (Noble, 1997; Tan *et al.*, 1998). A high degree of cooperative behavior would require that supply chain participants voluntarily share operating information and jointly plan strategies. Generally, information sharing has two aspects: quantity and quality. Both aspects are fundamental to supply chain practices and are independently constructed in prior studies on supply chain management (Choi and Hartley, 1996; Li and Lin, 2006). Information sharing can vary from strategic to tactical including operational planning and from information about logistics activities to general market and customer information (Mentzer *et al.*, 2000). Research suggests that the key to a seamless supply chain is making available undistorted and up-to-date marketing data at every node in a supply chain (Balsmeier and Voisin, 1996; Childhouse and Towill, 2003; Towill, 1997; Turner, 1993). By taking data available and sharing it with other parties within the chain, information can become a source of competitive advantage (Barratt and Oke, 2007; Jones, 1998; Novack *et al.*, 1995). Some studies on retail supply chains report that sharing information such as the point of sale data, forecasts, and inventory level increase supply chain visibility, thus improve organizational performance (Barratt and Oke, 2007; Lee *et al.*, 1997; Yu *et al.*, 2001). The sharing of information with enabled technologies such as internet- and web-based technologies have a positive impact on process management including procurement, manufacturing and distribution and enable supply chain partners to work collaboratively as an single extended entity to manage a supply chain (Gimenez and Lourenco, 2008; Wang and Lalwani, 2007).

On the quality of information shared, this includes aspects such as the accuracy, timelines, adequacy and credibility of information exchanged (Moberg *et al.*, 2002; Monczka *et al.*, 1998; Monczka *et al.*, 1998). Divergent interests and opportunities of supply chain participants can affect the quality of information (Feldmann and Müller, 2003). The literature is replete with

examples of the functional effects of inaccurate/delayed information, as information moves along the supply chain (Lee *et al.*, 1997; Mason-Jones and Towill, 1997; McAdam and McCormack, 2001; Metters, 1997). Li and Lin (2006) find that supplier uncertainty and inter-organizational relationships such as trust and commitment influence the level of information sharing and information quality. It has been suggested that organizations will deliberately distort information that can potentially reach not only their competitors, but also their suppliers and customers (Eckerd and Hill, 2012; Mason-Jones and Towill, 1997). There is a predisposition toward a perceived loss of power when giving away information, which, in turn, becomes a critical aspect of effective supply chain practice (Feldmann and Müller, 2003). Thus, organizations tend to view their information as a strategic asset and ensure that it flows with minimum delay and distortion (Barratt and Oke, 2007; Yu *et al.*, 2001).

The principle of lean thinking refers to the "moving towards the elimination of all waste in order to develop an operation that is faster, more dependable, produces higher quality products and services and operates at low cost" (Slack *et al.*, 2004, p. 519). Lean systems therefore focus on eliminating all kinds of waste (time and material) through the reduction of lead time and inventory levels, and to focus on systems that provide a total quality framework (Bell, 2006; Burgess, 1998; Finch, 2006; Srinivasan, 2004). Lean management includes the practices of JIT, total quality management, and work processes, total productive maintenance and supplier involvement (Amin and Karim, 2012). A number of studies, for example, find that lean thinking has become an important dimension in the food supply chain. Zarei *et al.* (2011) report that while the adoption of lean practices in the red meat industry in the UK is appropriate in the internal supply chain, it is difficult to apply to an inter-organizational perspective, as it might result in a high level of dependency on the buyers and decline the level of profitability.

Antecedents of cooperative behavior (trust and commitment)

The two components for improving the relationship among trading partners are trust and commitment (De Ruyter *et al.*, 2001; Morgan and Hunt, 1994). Trust is the willingness to rely on an exchange partner in whom one has confidence and is the extent to which the buyer believes that a supplier has the necessary expertise to perform the activity effectively and reliably (Noble, 1997; Tan *et al.*, 1998). Kenning (2007) suggests that trust has a positive relationship with buying behavior, for instance, repeated purchase and size of shipping basket. There are several dimensions of trust in the agribusiness supply chain, namely, confidence in a preferred trading partner, always keeping promises, always being honest, good reputation, belief in the information provided, close personal friendship, and a trading partner always considers our best interest. It usually takes time to develop trust and commitment in a strategic supplier relationship (Crotts *et al.*, 2001; Hammervoll, 2011; Robson *et al.*, 2008). Trust and commitment for food retail enterprises in Australia will improve relationships with future value to both parties (i.e. between producers and processors or between processors and retailers). For example, in order to sustain the relationship, the suppliers of food retail enterprises must deliver the right stock in the correct amount, at a price deemed reasonable to both parties. As a result, trust and commitment can improve supply chain performance through responsiveness, efficiency, quality and flexibility (Anderson and Weitz 1989; Mirani *et al.*, 2001; Mohr and Spekman, 1994). It will allow the trading partners to maximize the efficiency of their capabilities and resources, and lower cost (Achim and Ritter, 2003). Clearly, collaboration cannot exist in supply chain relationships without meaningful commitment and trust. Trust is a general expectancy that the word of an individual or organization can be relied on (Rotter, 1967). Thus, trust is the willingness to rely on a trading partner in whom one has confidence (Ganesan, 1994; Mariotti, 1999; Monczka *et al.*, 1998; Morgan and Hunt, 1994; Spekman *et al.*, 1998). Overall, trust is the degree to which partners perceive each other as credible and

benevolent (Doney and Cannon, 1997; Ganesan, 1994; Kumar *et al.*, 1995) and is expected to have a positive effect on the degree of collaboration in supply-chain relationships. In addition, trust is a key factor in fostering relational capabilities (Gilmore *et al.*, 2006). Recent study on supply chain management and marketing process is considering trust as one of contingency variable in the SCM–M interface study at the firm level (Pero and Lamberti, 2013). Commitment is characterized by long-term relationships or the willingness of each partner to exert effort on behalf of the relationship. Commitment and trust are dimensions of a business relationship that determines the degree to which each party feels they can rely on the integrity of the promise offered by the other.

Supply chain practices are defined as the set of activities undertaken in an organization to promote effective management of its supply chain (Li *et al.*, 2005). An extensive literature review above revealed that five aspects of the supply chain were likely to be particularly important to the Australian food retail industry: SA, customer relationships management, information sharing, quality of information sharing and lean thinking. These aspects generally exist on an intra or inter-organizational basis, for instance, between producers and processors or processors and retailers. Also, given that cooperative actions form the basis of the supply chain relationships, trust and commitment are necessary antecedents.

Moreover, they would be expected to give various advantages to food retail industry including increased supply chain performance efficiency, 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.

Based on the extensive literature review above, we posit the following hypothesis (see Figure 2):

H1. SA, CRM, information sharing, quality of information sharing, lean thinking, trust and commitment improve supply chain performance efficiency.

Method

Australian food supply chain structure (domestic)

Webster (2001, p. 5) states the food and drinks supply chain: "the food and drink supply chain has been a linear relationship involving the primary producers, or farmers, the manufacturers or processors who fabricate the food for the table and the retailers who gather a range of such products and sell them to the consumer" (Webster, 2001)

There are four echelons or functions in food supply chain (producers, processors, wholesalers/distribution, food retailers and food services). Please see Figure 3 for Australian food supply chain structure.

Producers

The first function of Australian food supply chain structure is producers. In this regard, we use beef product for food supply chain structure. There are around 76,600 beef enterprises in Australia. Beef producer produces around 25m head of cattle in 2005 with gross value of

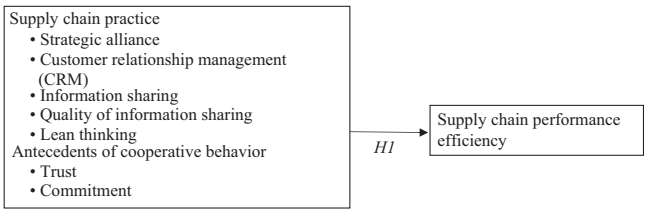

Figure 2.
Hypothesis

production around $5.7bn. Additionally, there is around 65 percent of production exported. The contribution of feedlot sector is around 27 percent of total beef production (ABS, 2005; Drum *et al.*, 2007).

Processors

The second function of the Australian food supply chain is processors. In this regard, we are using beef product. Beef processors manufacture the cattle into carcase and primal beef and veal products. The most valuable product from beef processing is meat.

There are around 240 abattoirs in Australia. Abattoir is the factory where the cattle are manufactured into meat and other products such as offal and hides. Bone out is done primarily at the abattoir where the animal was killed. In order to have good quality and safety of the beef product as well as to ensure the humane treatment of cattle, abattoirs need to have a high level of government inspection and self-regulation.

Wholesalers/distributors

After processing beef or veal, those products may be distributed to the wholesaler or broker. Then they might go to the food services sector, butchers' shops or supermarkets such as Coles, Woolworths, BILO, IGA, and Franklins. In this stage, the transportation is very important of delivering beef to either domestic or international markets. Beef is transported in refrigerated trucks with the surface temperature of one or quarters hanging carcase must not go above 7°C.

Food retailers/food services

Beef or veal products are distributed to food retailers (around 250,000 tonnes to go to supermarkets and around 71,000 tonnes to go to specialty) and food services (around 117,000 tonnes).

Research design

The research design involves a survey, and data collection and analysis. The data collection procedure includes sampling frame, sampling method, sample size, unit of analysis and key information techniques. A stratified random sampling (STRS) combined with purposive sampling method or judgment sampling was used in this study. STRS is a sampling method that divides the population into specific strata containing certain types of respondents, and then selects sub-samples of the required size drawn for each stratum. The pilot test was performed by inviting some industry experts to review the survey instrument. The final version was revised based on the comments from the panel of experts. A survey of the Australian food retail industry was conducted by distributing postal or online questionnaires to the retailers. The respondent profile and survey items are presented in Table I. We asked 800 participants to express their views on various aspects of supply chain management, with focus placed on the supply chain practices discussed above. The objective was to establish a model explaining the supply chain performance indicators of the retailers on supply chain practices. In other words, which

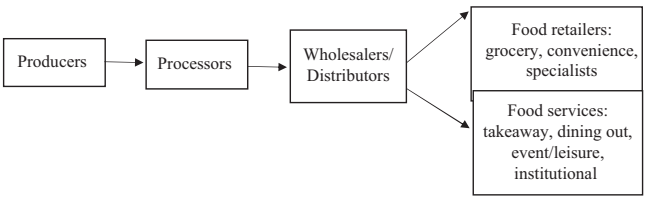

Figure 3.
Australian food supply chain structure

Respondent profile		Count (percent)
SMEs food retail	Meat	15 (13%)
	Seafood	5 (4)
	Dairy	20 (17)
	Fresh produce	30 (25)
	Oil and fats	3 (3)
	Cereal	2 (2)
	Bakery	10 (8)
	Confectionery	15 (13)
Years in operation	Less than 1 year	18 (15)
	1 to <5 years	83 (69)
	5 to <10 years	12 (10)
	10 years or above	7 (6)
Education level	No formal	3 (3)
	Secondary	27 (23)
	Diploma	10 (8)
	Bachelor degree	80 (67)
Gender	Male/female	77 (64)/43 (36)
Variables	Items	Description
Strategic	SA1	Our firm treats quality as the number one criterion when selecting suppliers
Alliance	SA2	Our firm regularly works together with our suppliers to solve problems
	SA3	Our firm and key suppliers have a continuous improvement program
	SA4	Our firm assists our suppliers to improve their product quality
	SA5	Our key suppliers are involved in our planning and goal-setting activities
	CRM1	Our firm frequently measures and evaluates customer satisfaction
Customer	CRM2	Our firm frequently interacts with customers to set reliability, responsiveness and other standards for the firm
Relationships	CRM3	Our firm frequently works to determine future customer expectations
Management	CRM4	Our firm regularly evaluates the importance of our relationship with our customers
	CRM5	Our firm facilitates customers' ability to seek assistance from us
Information	IS1	Our trading partners share business knowledge of core business processes with us
Sharing	IS2	Our trading partners share proprietary information with us
	IS3	Our firm informs trading partners in advance of our changing needs
Quality of	IQ1	Information exchange between our trading partners and us is accurate
	IQ2	Information exchange between our trading partners and us is timely
Information	IQ3	Information exchange between our trading partners and us is complete
Sharing	IQ4	Information exchange between our trading partners and us is reliable
	IQ5	Information exchange between our trading partners and us is adequate
Lean	LT1	Our firm has a continuous quality improvement system
	LT2	Our firm drives suppliers for shorter lead-times
Thinking	LT3	Our firm continuously streamlines ordering, receiving and other paperwork from suppliers
Trust	T1	Our trading partners respect the confidentiality of all the information they receive from us
	T2	Our trading partners have been open and honest in dealing with us
	T3	Our transactions with trading partners do not have to be closely supervised
	C1	Our firms have invested a lot of effort in our relationship with trading partners

Table I.
Respondent profile and survey items

(*continued*)

Respondent profile		Count (percent)
Commitment	C2	Our trading partners have made sacrifices for us in the past
	C3	Our firm and trading partners always try to keep our promises to each other
	C4	Our trading partners abide by agreements very well
Efficiency	SCPE1	Our firm has had a low inventory cost
	SCPE2	Our firm has had high labor costs
	SCPE3	Our firm has had low transportation costs
	SCPE4	Our firm has had low operations costs
	SCPE5	Our firm has had minimal waste cost
	SCPE6	Our firm has mad high profits

Note: Percentages do not add due to rounding errors; survey items (Li *et al.*, 2005)

Table I.

aspects did those managers working in the supply chain consider essential to achieving supply chain performance. In all, 120 useable responses were received, giving an effective response rate of 15 percent.

We Amstrong and Overton (1977)'s suggestion to test for non-response bias. Non-respondent bias is possible in any data collecting procedure. The problem with non-response is the bias or systematic distortion in an exploratory study (questionnaire/survey) happening because of an incapability to get a response from some groups of the selected sample (Luning *et al.*, 2002). Non-response may happen for any one of several reasons, such as not being in the firm at the time of data collection, refusal to participate in the research study, and so on. A typical method for assessing non-response bias might be to compare the kinds of respondents to the characteristics of the population from which the sample was drawn. However, this was not possible. Therefore, non-response bias in this study was assessed by comparing early to late respondents (Amstrong and Overton, 1977). They argued that later repliers are likely to be more representative of non-respondents than early repliers.

According to Table II, the p-value is 0.123, which is greater than α (0.05), so the null hypothesis would not be rejected. Hence, the non-response bias does not appear to be a concern in this research. For internal consistency, the results of Cronbach's α yielded values in the range of 0.60–0.87. As this study is exploratory, 0.50–0.60 is considered sufficient. Most items in the survey were based on previously established scales that passed content validity (Aramyan *et al.*, 2006; Li *et al.*, 2005). In addition, the pre-test confirmed that a group of industry experts viewed the scales used as acceptable. Discriminant and convergent validity was assessed satisfactorily. Factor analysis is a data reduction method used to decrease a large number of variables to a smaller set of underlying factors that summarize the important information contained in the variables (Coakes *et al.*, 2005). More frequently, factor analysis is used as an exploratory method when the researcher wants to summarize the structure of a set of variables (in other words, to consolidate items which are correlated). However, for testing a

	Early	Late response
Mean	3.924	3.916
Variance	0.147	0.203
F	0.728	
p ($F \leqslant f$) one-tail	0.123	
F-critical one-tail	0.637	

Table II.
Non-response bias F-test two sample for variances between early and late response

theory about the structure of a particular domain, confirmatory factory analysis is appropriate to use (Coakes *et al.*, 2005). The confirmatory factor analysis is normally used in the advanced stages of the research project. When the researcher's goal is to construct a reliable test, factor analysis is an additional means of determining whether items are tapping into the same construct. The factor menu in SPSS allows seven methods of factor extraction: principal components, unweighted least squares, generalized least square, maximum likelihood, principal axis factoring (PAF), alpha factoring and image factoring (Coakes *et al.*, 2005). In order to assess discriminant validity, factor loadings are being used for each item. The loadings reflect the strength of the relationship between an item and a particular construct or factor. The higher the loading, the better the representation that particular item has on the factor. The factor loadings greater than 0.3 are the minimum requirement; loading of 0.4 are considered more important; and loadings of 0.5 or greater are considered significant. If the items have low factor loadings (lower than 0.3), they should be deleted.

Factorability of the correlation matrix – a correlation matrix that is appropriate for factor analysis will have several sizeable correlations. The procedure is to inspect the matrix for correlations in excess of 0.3 and, if none is found, reconsider the use of PAF. The anti-image correlation matrix is used to assess the sampling adequacy of each variable. Measures of sampling accuracy that falls below the acceptable level of 0.5 should be excluded from the analysis. Barlett's test of sphericity and the Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy are both tests that can be used to determine the factorability of the matrix as a whole. If Bartlett's test of sphericity is large and significant and the KMO measure is greater than 0.6, then factorability can be assumed. (Table III)

Finally, stepwise multiple regression using SPSS ver 14.0 was performed on the model in Figure 1.

Results

Following our hypothesis that some relationship exists between supply chain performance efficiency and the explanatory variables of SA, information sharing, information quality, customer relationships, lean thinking, trust and commitment, our test results show that the regression run yielded an R^2 value of 0.58, and only quality of information sharing and lean thinking are significant influences on the food retailers' supply chain efficiency.

Discussion

According to the results section (Table IV), two elements of supply chain practice (lean thinking and information quality) have statistically signification relationships with efficiency. Therefore, we will discuss lean thinking and information quality, respectively.

Lean system has the highest standardized coefficient, suggesting that the food retail sector should focus on lean thinking. Indeed, lean thinking is found to have a significant positive impact on efficiency in food retailers, where mismanaged information sharing can result in food wastage costs to all stakeholders. This is consistent with the lean thinking philosophy which is to drive out the unnecessary costs and other wastes from the entire supply chain. Hence, it can lead to greater efficiency of the business (Coote and Gould, 2006; McIvor, 2001; Taylor, 1999; Womack and Jones, 1996) According to MLA (2005, p. 12), "lean thinking could strip 30 percent of the costs from the supply

Table III. The summary of factor analysis output for Australian food retail

Elements	Factor loading	Item deleted
Supply chain practice	Greater than 0.3	No items deleted
Antecedent cooperative of behavior	Greater than 0.3	No items deleted
Supply chain efficiency	Greater than 0.3	No items deleted

Regression statistics					
Multiple R	0.76				
R^2	0.58				
Adjusted R^2	0.56				
SE	0.85				
Observations	120				
ANOVA					
	df	SS	MS	F	Significance F
Regression	5	112.24	22.45	30.95	8.776E-20
Residual	114	82.68	0.73		
Total	119	194.93			
	Coefficients	SE	t	p-value	
Intercept	0.791	0.387	2.046	0.043	
Lean	0.327	0.079	4.151	0.000	
Information quality	0.565	0.067	8.493	0.000	

Table IV. Results

chain between the farm gate and the meat retailer. It needs a culture change in managing the business in a very large commitment, but over the next five years it's the next major step we can make."

Recently, two lean thinking concepts of takt-time (Simons and Zokaei, 2005), which is for horizontal continuous production flow, and standardized work (Simons and Zokaei, 2005), which reflects the need for continuous improvement have been suggested. Lean approaches have been ignored in the food industry according to Simons and Zokaei (2005) and Zarei *et al.* (2011). However, our research suggests that lean thinking has a significant positive relationship with efficiency, as lean practices can drive out the unnecessary costs and other wastes in the food supply chain. Drawing from the lean thinking approach (Amin and Karim, 2012; Hines and Taylor, 2000; Simons and Taylor, 2007), a firm should understand a customer's specific requirements. It is necessary to establish a value stream by classifying products that follow similar paths from raw material to the point of consumption. Next, the bottlenecks of time-consuming work practices should be eliminated. Finally, supply chain pull strategies should be used to minimize inventory.

We propose a lean philosophy which resembles a Kaizen (plan-do-check-action (PDCA)) management model that involves a continuous improvement process for the smaller retailers and 5-S as a lean practice. Such Kaizen and 5-S programs, while common in the manufacturing and the automotive industries (Hirano, 1995), are scant in the food industry. There are good justifications for this case. First, these programs can improve operational efficiency by reducing waste. For example, the National Foods' manufacturing plants in Morwell have applied lean practices (5-S, operator maintenance, production leveling, standardized work practices, and product and equipment rationalization) to improve the overall performance. As a result, operational efficiency improved by 55 percent, weekly production plan was achieved 95 percent of time, man hours reduced by 12 percent, lost time injury reduced by 53 percent, medically treated injuries reduced by 52 percent, reduction in sick leave by 5 percent and a reduction in physical waste by $20/ton of product (CSIRO, Victoria Government, AMPC, & MLA, 2007). Second, both Kaizen and 5-S are simple methods which are easy to apply by the SME food retailers and are more practical or tactical, rather than being strategic.

On the quality of information shared, our finding confirms the earlier studies (Li and Lin, 2006; Prajogo and Olhager, 2012). Better quality information shared ensures a better platform for supply chain partners to engage in supply chain coordination, participation and problem solving activities; this reduces the bullwhip effect. As suggested by Li and Lin (2006), the quality of information shared can be improved by sharing point of sale data, maintaining

consistent order cut-off times, and implementing advanced ICT. Prajogo and Olhager (2012) further argue that ICT capabilities and information sharing both have a significant impact on logistics integration. Food retailers have pressure to reduce the level of inventory. Thus, to facilitate better stock control, product quality and price, the Australian food retailers must adopt innovative supply chain practices to improve information sharing and quality of information sharing. For example, Woolworth adopted a web-based feedback system to share the information of meat quality. Coles built up meat processing facilities with Wire Cold Storage and advanced warehouse management systems to improve the quality of information shared between Coles and the processors.

Implications and conclusions

The results indicated that lean thinking and information quality have strongly positive impact on the efficiency key performance indicator; therefore, this research discussed lean thinking and information quality, respectively. This paper has proposed a lean approach based on Kaizen philosophy (PDCA) as a continuous improvement in food retailers and 5-S as one of the lean practices. The 5-S approach is basically focused on organization, neatness, cleanliness, standardization and discipline. Several alternative suggested configurations to food retailers in order to have accurate, timeliness of information quality in food value chains are to establish EDI and bar-coding system; to realize that information technology advocates with respect to e-commerce; and to apply better tools and standards for their information system.

This research makes several contributions. First, we have a framework to describe and present the Australian food retail supply chain and its supply chain practices. The supply chain practices, supply chain performance indicators and antecedents of cooperative behavior in the Australian food retail industry are complex and diverse. Therefore, understanding these dimensions can help to place key changes and industry improvement that will increase revenue and reduce cost to the SMEs in the food retail supply chain. The study has some limitations: the study used a questionnaire to examine the research questions. Future research will use multiple case studies to triangulate the supply chain practices and performance of food retail industry. Second, this study only used efficiency as the supply chain performance indicator. Other indicators such as flexibility, quality and responsiveness can be examined in future.

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