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Inter-firm Relationships and Performance Factors in the Australian Beef Supply Chain: Implications for the Stakeholders

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Abstract:
Recent study by Meat & Livestock Australia revealed that cost competitiveness and market development issues in supply chain are the major factors for a long term decline of the Australian Beef industry. This study, based on the explanation of transaction cost theory argues that competitive performance of an industry depends on improving cost efficiency across the whole of supply chain, the underlying value chain, and the relationship among the stakeholders in the industry. With a main objective to investigate the underlying factors of developing competent inter-firm relationship that influence the supply chain performance and competitiveness, this study presents details of a survey carried out and tests the hypothesis that inter-organizational relationships in supply chain and its antecedents have impact on the performance of Australian beef industry and thus have impact on the competitiveness of the industry.

Data were collected through a telephone survey of 315 firms in the beef industry from the states of Western Australia and Queensland. The sample respondents were categorized as input suppliers, beef-cattle producers, processors, retailers/exporters, and wholesalers. The data were analysed using the partial least square based structural equation modelling. PLS analysis reveals that 'Transaction Climate' is the strongest determinants of developing a competent relationship, while negotiation power, presence of industry competitors, and the degree of vertical coordination significantly influence the relationship strength. Findings also demonstrate that relationship strength is the most prevalent source of performance and competitiveness, while SC performance highly positively influences the Competitiveness of beef industry. Thus this study identifies significant antecedents and consequences of Supply Chain Performance in Australian beef industry, which are strategic and extremely important information for beef producers, processors, retailers, and other stakeholders for appropriate planning and benchmarking.

1. INTRODUCTION

Supply Chain Management (SCM) has become a strategic issue in firm's success as it can result a significant cost savings emanating from quick product sourcing, improved supply and demand management, and reduced inventory. Therefore, companies are increasingly relying on the system efficiency of Supply Chain (SC) as a source of competitive advantage. The SCM of agri-food industry, more specifically in the beef industry, relates to all the linkage from the primary producers to the final consumers such as input suppliers, producers, processors, wholesalers and retailers .The chain is involved with high risk and uncertainty because of the intrinsic and extrinsic quality requirements, and sometimes because of the seasonal variation that affect the production and supply of meat products. Therefore, a strategy from product driven supply chain to market-driven supply chain work best where a set of interdependent companies tied together to manage the flow of goods and services in supply chain. This strategic alliance can meet the issues of multidimensional customer demand, quality, and profitability with a better cost structure and firm performance. For example, some consumer can be sensitive to specific attributes and preparation of meat product that requires the integration of downstream information on market preferences, and requires special arrangement for production, processing and packaging at a reasonable price, such as organic or Halal food preparation (Jongen and Meulenberg, 1998).

Drawing on the above issues of supply chain link to firm performance and competitiveness, this study argues that competitive performance of an industry depends on improving cost efficiency across the whole of supply chain, the underlying value chain, and the relationship among the stakeholders in the industry. With a main objective to investigate the underlying factors of developing competent inter-firm relationship that influence the supply chain performance and competitiveness, this study presents details of a survey carried out to test the hypothesis that inter-organizational relationship factors in supply chain and its antecedents have impact on the performance of Australian beef industry and thus have impact on the competitiveness of the industry. We utilize concepts from the resource based (RBT)/Transaction Cost theory(TCE), supply chain management, and marketing literature in agribusiness to develop the constructs and measurement scales, and then use partial least squares (PLS) to support our modelling.

Despite a lot of research on SC performance, there is a paucity of empirical evidence in agribusiness research domain, specifically in the beef industry of Australia, showing the important antecedents of SC relationship that can influence performance and competitiveness of a firm. There is a lack of operationalization of related concepts such as Vertical coordination, transaction climate, and negotiation power of the firms in the relationship strength and performance. There is also very limited amount of empirical research and good measures that examines the antecedents and consequences of inter-firm relationship strength in SC performance and competitiveness. Given the fact that Australian beef industry is experiencing a long-term decline in terms of trade and has lagged behind other industries in rates of productivity improvement (MLA, 2008), this study can provide extremely important information for appropriate planning and benchmarking of the critical issues in supply chain for a better profitability and performance of the industry.

The next section presents the research context. After that we discuss background theories and hypotheses of the study. The research model and methodologies are then discussed followed by the results of the study. Finally, the study concludes with the implications of the results.

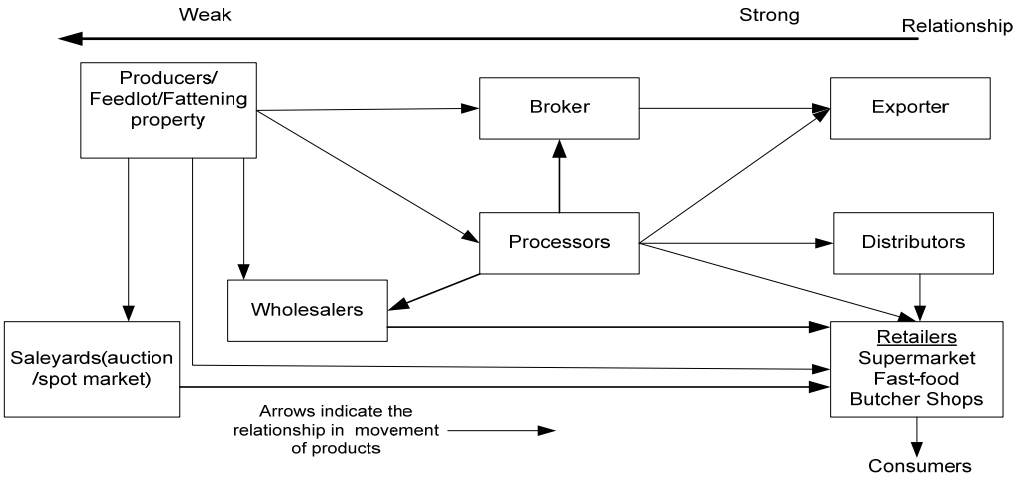
1.1 Research Context

The meat and livestock industry in Australia accounts for more than 45 per cent of Australia's total value of agricultural production within which beef is the largest industry in value terms (Nossal *et al.* 2008) . 1n 2007-08 the industry value was around A$11. 6 billion with export earnings of around A$ 5 billion from beef and live cattle export (MLA, 2008). But the industry is operating in a complex business environment characterised by highly variable seasons and markets, and are experiencing a long-term decline in terms of profitability and productivity compared to other industries (MLA, 2008). The major factors identified as export competitiveness and market development issues such as operational inadequacies, lack of innovativeness of the smaller and local firm, lack of cooperative efforts, cost competitiveness, dominance of spot market, and so on. (Johnson and Islam, 2003; MLA 2008; Uddin and Quaddus, 2008; WY associates, 2009).

Traditionally, Australian food supply chain has been dominated by the auction systems and regulated markets with a very limited use of formal contract, where transactions are conducted without prior commitments placed on producers, and with little control over the commodities by buyers. Similarly, beef supply chains have been based on market arrangements, operations are production pushed and are often adversarial, for which producers do not gain any insight of their customers as they are isolated from rest of the food chain. Likewise, processors are also lacking innovative initiatives to develop a product and

the business with the producers while a low trust environment between the two is often exist (O'Keeffe, 1998; WY associates, 2009).Studies found that these are the key factors that are affecting the performance, competitiveness, and success of the industry highlighting the need of improving the whole of supply chain and the underlying relationships among the participants (Jackson et al. 2007; Jie *et al*. 2007, O'keeffe, 1998; Uddin *et al.* 2009). Studies focused that the success requires a shift from the production driven supply chain to a market driven chain and a closer tie between the upstream and downstream partners with greater communication and commitment. A transparent symmetric relationship with a strong consolidation/integration of business activities, strong communication, and a greater compliance with carcase specifications in supply chain are identified as key success factors in the beef industry (Uddin *et al*. 2009; WY associates, 2009). Figure 1 shows a generic product flow in Australian beef supply chain where the relationships are weak with upstream producers and are often based on market transactions.

Figure 1: Generic Beef supply Chain in Australia at the domestic level



2. BACKGROUND LITERATURE AND HYPOTHESIS

2.1 Inter-firm Relationship Strength and its Effect on Beef Chain

A large part of SCM literature consists of managing competent inter-firm or inter-organizational relationships such as alliances or partnerships in supply chain to gain competitive advantage and firm performance. Studies argued that lack of emphasis on supply chain relations may decline competitiveness in marketplace while cooperative planning and information sharing in chain relationship may lead the entire chain as a source of strategic competitive advantage (Arndt, 1979; Dyer and Nobeoka, 2000; Kannan and Tan, 2003; loader, 1997). In agricultural industry chain O'Keefe (1998) termed it as "co-operating to compete" pointing to the shift of competition from firm versus firm to chain versus chain where a firm can run more competitively if they work together in supply chain in a cooperative environment. Thus, a co-operative and coordinated supply chain relationship can reduce the risk and uncertainties in transaction and can provide many returns such as lower product and or services costs, enhanced quality, innovation and responsiveness, and a better firm performance (Carter and Narasimjhan, 1996; Golicic *et al.,* 2003). In a recent study Lee et al. (2007) showed that a well-integrated supply chain can be a primary business strategy to improve performance by reducing lead-times and reducing the adverse effect (i.e. bullwhip effects) in supply chain. Studies also argued that a 'long-term relationships lead to reduced political, social or economic risk, reduced transaction costs, and access to economies of scale

by by-passing traditional market arrangements'(Loader, 1997 p. 24) which is, as Arndt (1979) noted, is crucial to compete in the marketplace with greater profit margin and performance. Similarly, some studies suggest that successful relationship depends on the extent of interdependence between the partners (Gattorna and Walters, 1996; Mohr and Spekman, 1994), while high bilateral dependence positively influence supply chain performance (Anderson and James, 1991; Duffy and Fearne, 2004).

The stream of literature on Agri-food supply chain describe the components of inter-organizational relationships in the political economy framework, which combines efficiency-based and socio-political approaches as complementary to explain the seller-buyer relationships in a social system. It consists of "interacting sets of major economic and socio-political forces which affect collective behaviour and performance" (Benson, 1975 cited by Nidumolu, 1995, p. 91; Stern and Reve, 1980). Efficiency based approaches focuses on cost and applies theories from microeconomics such as Transaction cost theory (Coase, 1937; Williamson, 1975, 1985) to identify most efficient structure of transaction in a buyer-seller relationship emphasizing the effect of specific investment and optimization of the inter-firm relationship. Socio-political approaches, such as resource dependence theory (Pfeffer and Salancik, 1978), are drawn from organizational theory and social psychology and concerned with trust and power in the marketing channel. These theories argue that a firm initiates inter-organizational linkages primarily to gain control over a critical resource and thus reduce uncertainty and enhance performance in its transaction. While the approach from organizational theory such as Resource based view (Barney, 1991; Wernerfelt, 1984) of firm provides a potential strategy framework to develop supply chain relationship as an intangible asset that are difficult to imitate, that will provide a source of sustained competitive advantage in the chain.

Based on above discussion, this study hypothesize that a perfect synergies of economic and behavioural factors that provide the strength of a supply chain relationship such as reciprocal investment, interdependence, commitment, and mutual trust will influence the performance in the agri-food industry, specifically in beef industry and will influence their competitive advantage. Thus the following hypotheses are made:

H1a: The 'strength of inter-firm relationship' in Australian beef supply chain will positively influence the 'SC performance' of Australian beef industry

H1b: The 'strength of inter-firm relationship' in Australian beef supply chain will positively influence the 'competitiveness' of Australian beef industry

2.2 Competitors Effect on Beef Chain

Presence of industry competitors contribute to the supply chain innovation. Porter (1990) argues that related and supporting industries that are internally competitive is a determinant of competitive advantage. Traditionally, studies support that competitors have significant role in determining strategic goals in manufacturing industries (e.g., Bourgeois, 1985; Buchko, 1994). Increased globalization and advancement in technology are enabling the competitions, particularly driven by large multinational food manufacturers and supermarket chains that have the ability to source their input requirements from many different countries, and are putting greater pressure for change on both Australia's domestic and export oriented food sectors. Studies found that in Australian context, competitors have significant influence to drive the food industry's business strategy and to achieve cost efficiency through the supply chain. But studies also found an absence of competition in Australian beef industry, which is influencing their efficiency and productivity, and are also influencing the profitability and performance in the long run (WA farmers. 2009). Therefore, this study hypothesizes that a

firm that face strong competition, is more likely to develop competitive asset by strengthening their inter-firm relationship that will ultimately effect on the performance and competitiveness. Thus following hypothesis is developed:

H2: Presence of industry 'competition' in Australian beef supply chain will positively influence the 'Strength of Inter-firm relationship' in Australian beef industry.

2.3 Degree of Vertical Coordination in Beef Chain

Transaction cost economics (TCE) is the most widely used theoretical lens for analysing the development and impact of governance and relationship structure in food supply chain (den Ouden *et al.* 1996; Hobbs and Young, 2000; Sculze et al. 2006), even though it was initiated in an economic background. According to TCE, in buyer-supplier dyads, governance structure is related to the choice of a particular transactional and relational mechanism such as a formal contract or bilateral investment that influences the inter-firm transaction process (Bijman, 2006; Liu et al. 2009). The process always involves with some common cost such as i) costs of searching information on potential buyers or sellers, product prices, etc.; ii) costs of negotiating physical act of transaction such as writing contracts, hiring lawyers, investment in machineries, intermediary auctioneers, etc.; and iii) costs of monitoring or enforcing pre-agreed terms of transaction such as ensuring quality of goods, behaviour of the parties, etc. These costs may increase depending on the information asymmetry, bounded rationality (decision making under partial information) and opportunistic behaviour between partners in transactional relationship. Cost can also be affected by relation specific investment, uncertainty, and frequency in the transaction. For example, a sunk cost, arise for a broken contract can be very high if the relation specific investment is high, although, formal contract can be a major tool to protect specific investment and safeguard the cost of opportunism.TCE posits that governance structure and relational mechanism are derived from economic rationality such as when transaction costs of using spot or open market system rise, it is efficient to carry out the transaction by a strategic alliance through contracting or by vertically integrating the firms (Williamson, 1985; Hobbs, 2000).

Based on the work of Williamson, studies suggest that the method of making inter-firm transactional relationship may range from spot market, specification contracts, relation-based alliances, equity-based alliances, and vertical integration. Studies believe that stricter vertical coordination in agri-food chains, specifically in meat industry, is crucial for better product and information flow, better performance and competitiveness. Because, it provides a better way of contact, control, and contracting cost in the supply chain by addressing the issues of growing quality requirement, food safety, and other difficult-to-detect attributes of food products. (Duffy and Fearne, 2004; Hobbs, 2000; Sculze *et al.* 2006). Hornibrook and Fearne (2003) found that vertical partnership between the producers, abattoirs and supermarkets are the dominant organizational form in the British meat industry. Therefore, it is also hypothesize that:

H3a: Degree of 'vertical coordination' in Australian beef supply chain will positively influence the 'strength of Inter-firm relationship' in Australian beef industry

H3b: Degree of 'vertical coordination' in Australian beef supply chain will positively influence the 'SC performance' of Australian beef industry

2.4 Price Uncertainty and its Effect on Beef Chain

In Transaction Cost Economics (TCE), uncertainty is also a central theme that affects the size of transaction cost and firm performance (Williamson, 1985; Hobbs and Young, 2000; Van derVorst and Beulens, 2002). Many authors believe that standard TCE arguments typically refer to the growing uncertainty in food chain specially in meat industry to give reasons for closer vertical coordination to minimize the uncertainties of inter-firm transactions (Hobbs and Young, 2000; Schulze *et al.* 2006). Lack of vertical coordination and a lack of a stable market is resulting a high price volatility in Australian beef industry, especially for the upstream industries where price uncertainty is a major factor. Hobbs (1997) discussed uncertainty in cattle marketing as a cause of higher transaction cost (cost of information search, monitoring, and sorting cost) by dividing them into two components such as price uncertainty (impose greater information cost) and grade uncertainty (impose greater monitoring cost). At the producer level, price uncertainty may also involve with the compliance of grading if there is a problem of finding a buyer for which the product may go out of required grade and weight. Due to the natural variations in quality, seasonal patterns, and process yield, the uncertainty may propagate in beef supply chain through the variation in demand and supply and can be worse if there is incomplete or imperfect information between the participants. Therefore, it is believed that high price uncertainty has a negative relation with the strength of relationship and firm performance. It gear the need to move towards more formalized relationship structure, more inter-organizational interactions for decision information sharing; and long term relationships to minimize the risk (van derVorst and Beulens, 2002). Based on the argument the following hypotheses are developed:

H4a: ‘price uncertainty’ in Australian beef supply chain has a negative influence on the ‘strength of inter-firm relationship’ in Australian beef industry

H4b: ‘price uncertainty’ in Australian beef supply chain has a negative influence on ‘SC performance’ in Australian beef industry

2.5 Transaction Climate in Beef Chain

Studies argued that the sentiments or relational norms, i.e. transaction climate that exist in buyer –supplier relationship such as the compatibility in goals, commitment, and fairness in sharing the risks, benefit, and burden equally in the relationship reduce opportunistic behaviour and increase cooperation that in turn increase performance in the supply chain (Clare et al. 2005; Duffy and Fearne, 2004; Nidumolu, 1995; Reve and Stern, 1986). Duffy and Fearne (2004) found a direct influence of transaction climate on supply chain performance with evidence that higher the level of co-operative attitude and sentiments, the higher the level of performance. While Bensaou (1997) and Nidumolu, (1995) in their studies empirically showed that compatibility in achieving each other goals and broader perception in setting the priorities to achieve common goals can be considered as value creating economic resource and have important influence on supply chain performance. Some authors also argued that partnership based on respect or symmetry of relationship can be productive where disputes are resolved amicably (Clare et al. 2005). Therefore, the following hypothesis is developed:

H5:‘Transaction climate’ in Australian beef supply chain will positively influence the ‘strength of inter-firm relationship’ in Australian beef industry

2.6 Negotiation Power and its Effect on Beef Chain

Power is defined as the ability of one firm to influence the intentions and actions of another firm (Maloni and Benton, 2000) while negotiation power can be related to the capacity of one party to influence others due to its size, or status. Researchers have applied different power bases in chain relationship and found direct implications of power circumstances in supply chain that have significant effect on inter-firm relationships and successively on chain performance.(Cox 1999; Duffy and Fearne, 2004; Maloni and Benton, 2000). Studies suggest that there are specific supply chain power circumstances based on commitment, dominance, and interdependence for which different relationship management approaches emerge (Cox *et al.* 2007). Though, there is a contrasting views of using the power in supply chain where opportunistic perspective suggest that power increase exploitative tendencies and may encourage to gain disproportionate share of benefit from less powerful partner. While the benevolent perspective suggest that power is associated with functional coordination that comes only through the emergence of a chain driver to increase sales, reduce costs and risk, and increase speed and reliability of supply chain (Duffy and Fearne, 2004; Daviron and Gibbon, 2002).

However, the bulk of the research on chain relationship suggests that the use of power in a mediated way (coercive, legal) inversely effect on the relationship and performance. Authors found that coercive or mediated power will increase conflict and negatively effect on commitment and cooperation, i.e. on inter-firm relationship due to reduce satisfaction, benefit, and resentment over the subordinate situation. While others found a positive association between non-mediated power such as expert, referent, legitimate power (Brown et al., 1995) and chain cooperation and commitment. This study assumes that to play a consequential role in the formation and maintenance of supply chain relationships, a firm should have some degrees of negotiation power that may come from its cooperative arrangement, larger market share, and or brand penetration. A positive pro-active supply chain is only enforceable or likely to emerge when there is consistent direction in dominance or interdependence among the chain participants (Revell and Liu, 2007). Based on the discussion the following hypotheses are developed in this study:

H6a:'Negotiation power' of a firm in Australian beef supply will positively influence the 'strength of inter-firm relationship' in Australian beef industry

H6b:'Negotiation power' of a firm in Australian beef supply chain will positively influence the 'SC performance' in Australian beef industry.

2.7 Competitiveness through SC Performance

Competitiveness refers to the capabilities that allow an organization to differentiate itself from its competitors & is an outcome of critical management decisions (Jie I 2007; Tracey *et al*. 1999).Recent studies focused that firms actually achieve competitive advantage by leveraging the management of their supply chains (Du, 2007; Ketchen and Hult, 2007; Salam, 2005). The seminal work of Porter (1985) formed the basis for the development of supply chain enablers and their ties to firm performance and competitive advantage. While porter focused on improving the activities of value chain, i.e. the value a firm is able to create for buyers that exceeds the firm's cost of creating it, is a source of competitive advantage; other studies (Ketchen and Hult, 2007; Proactive communication, 1996) argued that performance improvement in supply chain provides competitiveness of the industry as a whole.

In respect to the high uncertainty in the food industries for the higher demand of quality, freshness, and value of the money that consumer spend, food industries are developing their

strategies stemmed by the performance of supply chain to increase competiveness. Studies revealed that the participants from the upstream to downstream industries in SC have their own competitive and marketing strategy to keep them viable in the business, such as producers are diversifying their products and developing alternative marketing strategy to increase their productivity and competitiveness in the food chain (Uddin et al. 2008)

Cost efficiency is one of the most highlighted challenges in firms, for which, they are increasingly emphasizing on rapid delivery service performance, reducing distribution steps and lead times, with a highly effective logistic system; and thus getting competitiveness in fulfilling customers and consumer demands with the availability (product) and convenience(cost and time) they want (Proactive communication, 1996). As a result, the supply chain performance of food industries, for its association with perishability and high uncertainty of supply/demand, is highly important to gain competitiveness. Based on the discussion the following hypothesis is developed:

H7: 'SC performance' in Australian beef supply chain will positively influence 'competitiveness' of the Australian beef industry.

3. THE RESEARCH MODEL

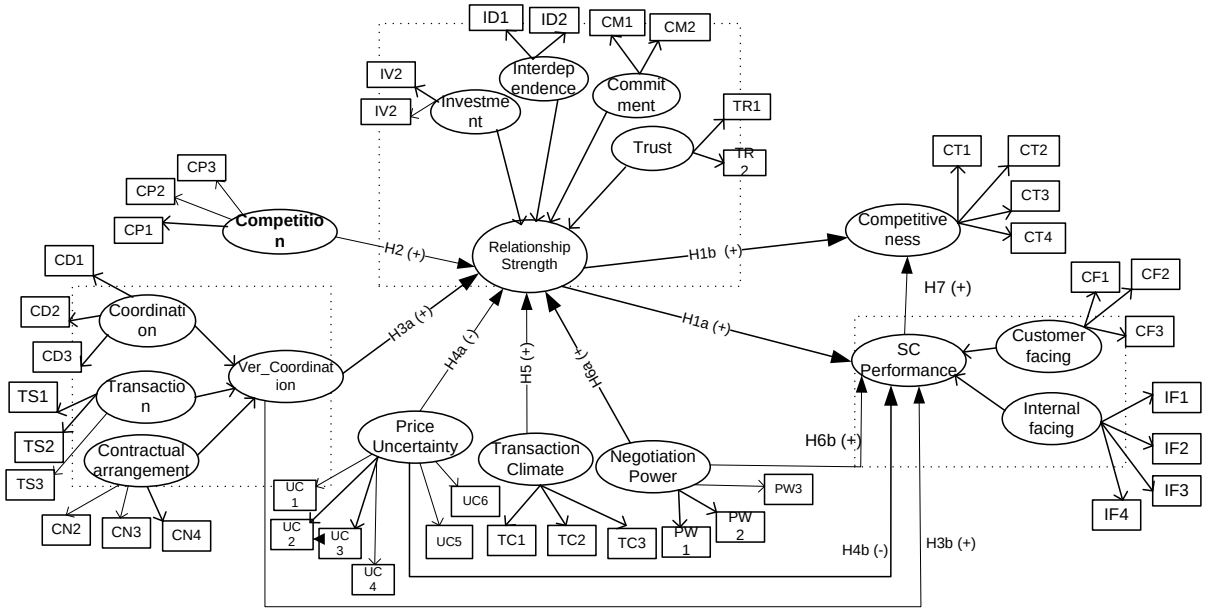
The operational model is designed according to the hypotheses, which are developed and tested using the partial least square (PLS) algorithm's path analytic capabilities based on structure equation modelling (Hair *et al.*1995). Figure 2 presents the latent variables and the hypothesized structural relationship investigated between the predictor and predicting variables. The factors 'Industry Competition' 'Vertical Coordination', 'Price Uncertainty', 'Transaction Climate' and 'Negotiation Power' are designed as exogenous variables and are predictors of Inter-firm 'Relationship Strength'. While the factors 'Vertical Coordination', 'Price Uncertainty', 'Negotiation Power' and 'relationship Strength' are modelled as being influencing the 'SC Performance'. The two emanating paths from 'Relationship strength' and 'SC Performance' are to see their effect on the 'Competitiveness' of the industry as a whole.

At the construct level, there are three 2nd order multidimensional latent construct named as 'Vertical Coordination', 'Relationship Strength' and 'SC performance' modelled as being caused by first order latent variables or sub-constructs. A second order construct/factor is modelled as being at a higher level of abstraction, which is essentially created by using all the indicators from first order factors (Chin, 1998a). For example, the construct 'Relationship Strength' is a 2nd order higher level construct which is created by using all the eight measurement items from its four sub-constructs such as 'Reciprocal Investment', 'interdependence', 'Commitment', and 'Trust' each of which has two items. Similarly the construct 'Vertical Coordination' is created using nine items from its three sub-constructs, and 'SC Performance' is created using seven items from its two sub-constructs.

While the model operationalization relied primarily on reflective measures (the items are caused or driven by the construct), formative measures (the items cause or define the construct) are used for all the 2nd order constructs as they are composed of indicators with different dimension. Formative constructs are formed by several indicators representing different independent phenomenon (Chin, 1998b). The decision to model a construct as formative should be based on four major criteria 1) the indicators are defining characteristics of the construct, not necessarily correlated where the direction of causality is from indicators to construct, 2) indicators need not be interchangeable and dropping an indicator may alter the conceptual domain of the construct 3) covariation among indicators is not necessary, and 3) nomological net i.e. the antecedents and consequences of the indicators may not be same

(Jarvis *et al.* 2003). The construct should be modelled as reflective if the opposite conditions apply. Except the three 2nd order factors, all first order and other latent variables in the research model are relied on reflective multi item scales most of which are derived from previous studies. Table 1 presents the factors, their definition, and the items used in the study.

Figure 2: The research model showing the structural relationship and the measurement items



4. SURVEY PROCEDURE AND SAMPLE

The survey instrument including the set of questionnaire, measurement scales, and logic of the questions against each of the constructs were reviewed by four professional people having long experience of researching in the agricultural industry value chain. The questionnaire was then pre-tested by three people working in the meat industry. Rephrasing, reordering, and even omitting of some of the similar items are made based on the feedback.

Data were collected through telephone survey by contracting a professional survey centre from Edith Cowan University Perth, Western Australia. Telephone surveys differ from the self-completion questionnaires or those filled out by an interviewer face-to-face as the respondent cannot see the scale and have limited ability to recall response categories. To overcome the limitation, researchers often use multiple-category numerical scales that simply ask the respondent to give a number as an answer, for example from between one to five, or zero to ten where the starting and end-points of such scales can be anchored as "Never …always" "very poor…very good" among others (Dawes, 2001). In our survey a seven point likert scale ranging from "strongly disagree to "strongly agree and "Never to Always" was used without mentioning any mid point as study found more lower scores and fewer higher scores in telephone survey in Australia when a mid point was mentioned (Dawes, 2001).

The sample respondents were categorized as beef-cattle producers, processors, retailers/exporters, wholesalers and input suppliers. A minimum of 30 and a maximum of 100 interviews were targeted for each of the three main categories of producers, processors and retailers firms in each of the two states of Western Australia (WA) and Queensland (QLD). A list of around three thousands firm addresses and phone numbers from WA and QLD was

generated, targeting one interviews (with the person holding higher position in supply chain/distribution) per one firm, through the help and proper agreement of data security with some government and private organizations.

Table 1: Definition and reference of the factors , sub-factors, and the items used in the study

Construct Name	Definition	Sub-constructs/items used
Relationship Strength (Clare *et al.* 2005; Duffy and Fearne, 2004; Meloni and Benton, 2000)	The economic and behavioral factors that provide strength in an alliances or partnerships in SC relationships	Reciprocal investment Interdependence Commitment Trust
SC Performance (Cohen and Roussel, 2005; Gunasekaran *et al.,* 2004; Supply Chain Council, 2003)	The outcome from a coordinated transactional and relational mechanism in the form of reliability, responsiveness, quality, cost, and Asset.	Customer Facing Reliability Responsiveness Quality Internal facing Cost Asset
Competitiveness (Han et al. 2007**;** Porter, 1985; Tracey *et al*. 1999)	The capabilities that allow an organization to differentiate itself from its competitors & is an outcome of critical management decisions.	Cost efficiency Profitability Market Share Innovation
Vertical Coordination (Hobbs and young, 2000; Mighell and Jones, 1963; Schulze et al, 2006.)	Organization of a supply chain where each successive stage in the production, processing, and marketing of a product is appropriately managed and interrelated. We conceptualize VC in terms of the types of inter-firm coordination, transactions and contractual arrangement.	Coordination Level Asset specificity Information Sharing Coordinated Exchange (eg. Sales, delivery) Formalization of Transaction Use of Spot market, short-term, long-term contracts Contractual arrangement Contract types
Price Uncertainty (Beulens, 2002; Hobbs, 1997; Sandmo, 1971; Van derVorst and Beulens, 2002)	The situation related to highly variable season and market making it complex to accurately predict the control actions for a viable price.	Grade Uncertainty Price Uncertainty Supply Uncertainty demand Uncertainty
Transaction Climate (Duffy and Fearne, 2004; Bensaou 1997; Nidumolu, 1995; Reve and Stern, 1976)	The sentiments or relational norms that exist in buyer –supplier relationship.	Goal Compatibility Mutual understanding Symmetry
Negotiation Power (Cox, *et al*. 2007; Duffy and Fearne, 2004; Maloni and Benton, 2000)	The ability of one firm to influence the intentions and actions of another firm	Price negotiation Benefit negotiation
Competition (Bourgeois, 1985; Buchko, 1994; Porter, 1985; Saeed *et al.* 2005)	Refers to the presence of industry competitors that influence strategic decision	Degree of competition Technology policy

The survey was administered during September to October 2009. A CATI (Computer Aided Telephone Interviewing) system was used, which makes administering different versions of the questionnaire to different categories of people very easy. If the person called was not available at that time, up to three call backs were made to contact them to make an appointment. A proportion of the interviews were monitored by a supervisor to ensure the interviewers followed their instructions closely as part of normal quality control guidelines.

Thus a total of 315 interviews from 315 firms in the beef industry of WA and QLD in Australia were conducted. The responses showed that majorities (43.2 percent) of the firms are producers, which is expected as processors (28.9 %) and retailers (21.9%) were difficult to get because of their busy environment and reluctance to interviews. The firms are characterized as SME as 79.6% of them have 1-5 million of yearly average revenue whereas only 10.2 %have more than 20 million of revenue. In terms of the growth 32.7 % characterized them as growing, 31.1 % as established and trying to get bigger, 15.2 % identified as matured; while 12.1 % said that they are just surviving in the business.

4.1 Data Analysis Using PLS

We use partial least squares, a confirmatory second-generation multivariate analysis tool, to test our model as opposed to covariance based approach (such as LISREL, EQS, AMOS) because of its ability to model latent construct under conditions of non-normality, ability to handle both formative and reflective measures, and the ability to deal with small to medium sample size (Chin, 1998b; Chin and Gopal, 1995). As a components-based structural equations modelling technique, PLS is similar to regression but simultaneously models the structural paths (i.e., theoretical relationships among latent variables) and measurement paths (i.e., relationships between a latent variable and its indicators). Unlike LISREL, it tests the strength of individual component relationships to show the significance of individual paths rather than the overall fit of a proposed model to observed covariance amongst all of the variables (Johnston *et al*. 2004). It also calculates and shows the output of all the indirect and direct effect to establish the relative importance of antecedent constructs.

PLS supports variance analysis (R^2) and is generally recommended for predictive research where the emphasis is on theory development. In our case, our focus is also on theory development, as there are very few empirical studies in this research domain and little prior theory. There are two analysis stages in PLS (Barclay, 1995; Santosa, *et al.* 2005) . First, the measurement model is estimated showing statistics (i.e. loadings) that assess the validity and reliability of variables and their respective constructs. Second, the results for the structural model are reported showing the relationships (i.e. path coefficients) between the constructs and the explained variance. Thus PLS shows which assumed predictors have substantive links to outcomes and we can infer the relative strength of relationships among variables by their path loadings. We can also judge the extent of which variation in one set of variables might help explain variance in a variable of interest, through the R^2. The analysis is suitable to test relationships where interrelated antecedent conditions are modelled and measured through multiple-items and connected through various paths.

In determining sample size under PLS, studies demonstrated that the required minimal sample size was 100-150 cases (Gefen *et al*. 2000). Barclay et al. (1995) Suggest that sample size should equal ten times either the number of indicators of the most complex formative latent variable or the largest number of independent variables impacting a dependent variable whichever is greater. The largest number of independent variables impacting on a dependent variables in this study is Five. Five constructs such as ‘Competition’ ‘Vertical Coordination, ‘Price Uncertainty’ ‘Transaction Climate’ and ‘Negotiation Power’ as independent variables

are impacting on 'Relationship Strength'. Thus, according to this rule required minimum sample size is 50. On the other hand, the model used three 2nd order formative construct with the most complex one (Relationship Strength) comprised of eight items (Drawn from its first order sub-constructs). This demonstrates a minimum sample requirement of 80, while we have a lot more 315.

5. RESULTS

The two required steps for data analysis in PlS, as stated earlier, were conducted using PLS-Graph version 3.0. It involved (i) assessment of the measurement model describing the relationship between latent constructs and their manifest indicators, and (ii) assessment of the structural model describing the hypothesized relationship between latent construct. Bootstrap (Efron and Tibshirani, 1993_PLS 1) or Jackknife (Barclay *et al.* 1995) output can be used for the analysis and assessment of both the measurement and structural part. This study used Bootstrapping to obtain the path coefficient and its t-value to test the hypotheses.

5.1 Assessment of the Measurement Model

In our model all the reflective constructs used multiple-items measure that had to be tested for reliability. To check whether the measurement items appropriately reflect a construct, the convergent validity of latent construct in PLS is assessed by 1) the reliability of individual item that make up the measure, 2) the composite reliability or internal consistency of the item as a group (comparable to cronbach's α), and 3) the discriminant validity which is the average variance extracted (AVE) from the constructs by each of the items (Barclay *et al.* 1995; Fornell and Larcker,1981)

The individual item reliability is assessed by examining the loading or simple correlations of the measures with their respective construct. The initial model was first tested using 43 observed variables. A minimum value of 0.6 ($\lambda \geq 0.6$) is used to accept the reliability of individual items (Hair *et al.* 1998)..The results of the initial model showed that CD2, TS1, UC1, UC2, UC3, and IF2 had loading less than 0.6.Thus they were removed from further analysis to improve the item reliability. Table 2 shows the individual item reliability after the removal.

Composite reliability ($\rho\xi$) assesses the inter-item consistency following the procedure of Fornell and Larcker (1981) where the cut-off point is normally 0.7.Table 2 shows all latent variables have acceptable internal consistencies above 0.7. The third standard of reliability is that AVE from the construct by the items should exceed 0.5, meaning that the items, on an average, share at least half of their variance with the construct (Barclay *et al.* 1995).Table 2 shows that all constructs performed acceptably on this standard.

It is important to note that the use of loading for formative indicators is misleading (Chin, 1998a) since indicators may represent different dimensions and are assumed not to be correlated. While, internal consistency is not important because two variables that might even be negatively related can both serve as meaningful indicators in a formative construct (Santosa *et al.* 2005; Nunnally and Bernstein, 1994). Therefore, some authors suggest using the weights of the formative indicators to provide information on relative importance of the indicators (Barclay et al. 1995). But as this study used 2nd order formative constructs where the reliability of the items are tested in their first order reflective constructs, weights are not applicable.

Table 2 Convergent validity checks for reflective constructs

Construct and Item Name	Loading	Composite reliability	AVE	Construct and Item Name	Loading	Composite reliability	AVE
Competition		**0.777**	**0.544**	**UC6**	**0.7374**		
CP1	0.7868			**Negotiation power**		0.844	0.731
CP2	0.8289			PW1	0.8859		
CP3	0.5699			PW3	**0.8228**		
Competitiveness		**0.876**	**0.639**	**Relationship strength ***	**N/A**	**N/A**	**N/A**
CT1	0.7847			**Investment**		**0.889**	**0.728**
CT2	0.8135			IV1	**0.8367**		
CT3	0.7848			IV2	0.8718		
CT4	0.8136			**Interdependence**		0.924	0.859
Vertical Coordination *	**N/A**	**N/A**	**N/A**	IP1	0.9283		
Coordination level		**0.776**	**0.635**	IP2	0.9252		
CD1	0.8474			**Commitment**		**0.922**	**0.856**
CD3	0.7424			**CM1**	**0.9253**		
Formalization of Transaction		**0.736**	**0.584**	CM2	0.9251		
TS2	0.7208			**Trust**		**0.816**	**0.529**
TS3	0.8047			TR1	0.6430		
Contractual Arrangement		**0.891**	**0.733**	**TR2**	**0.8201**		
CN1	0.8583			**SC Performance***	**N/A**	**N/A**	**N/A**
CN2	0.9018			**Customer-Facing**		**0.886**	**0.722**
CN3	0.8051			**CF1**	**0.8636**		
Transaction Climate		0.859	0.555	**CF2**	**0.8550**		
TC1	0.8218			CF3	0.8295		
TC2	0.8019			**Internal-Facing**		**0.756**	**0.511**
TC3	0.6196			**IF1**	**0.7429**		
Price Uncertainty		**0.795**	**0.563**	IF3	0.6098		
UC4	0.7583			IF4	0.7808		
UC5	0.7554						

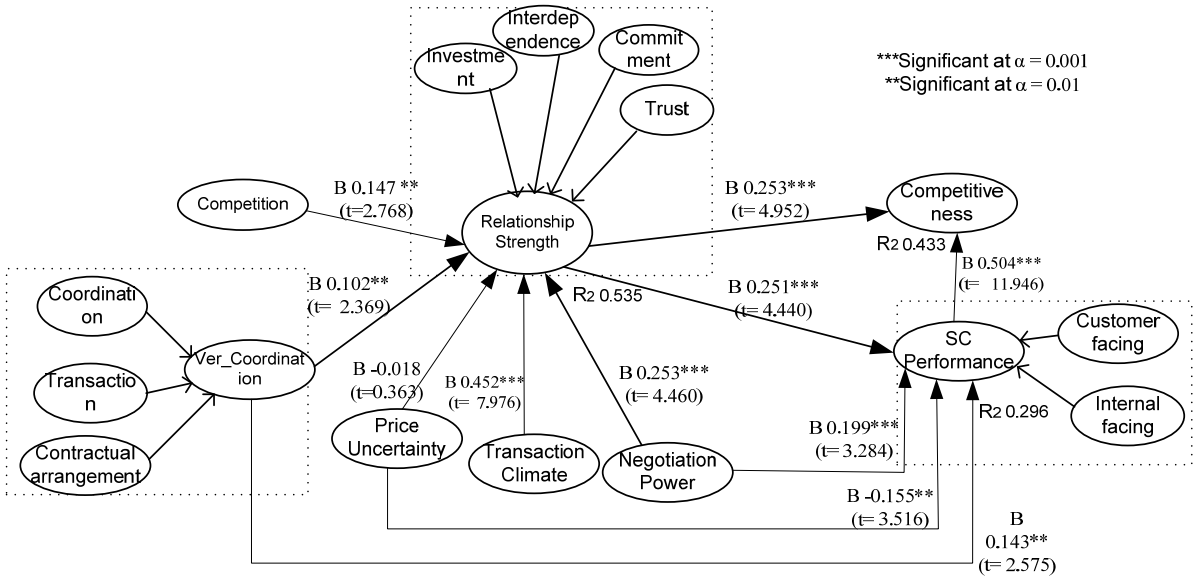
*2nd order formative construct, therefore values are not applicable

Discriminant validity indicates the extent to which a given construct is different from other constructs and addresses the potential problem of having measures for one construct overlap the conceptual territory of another construct. For adequate disciminant validity PLS requires that a construct should share more variance with its measures than it shares with other construct in the model, i.e. the latent construct should be demonstrably closed to its measurement items than to any other construct (Barclay; Johnston_PLS1).In PLS, it is tested using the procedure of Fornell and Larcer [1981] which is comparing the square root of AVE (Average Variance Extracted) with the correlation of that construct with all other constructs. AVE is the average variance shared between the construct and its measures. In other words, it is the amount of variance captured by the construct in relation to the variance attributable to measurement error (Santosa, *et al.* 2005). The diagonal of table 3 shows the square root of AVE where the off-diagonal elements are the correlations among latent variables. For adequate discriminant validity square root of AVE should be significantly greater than the off-diagonal elements in the corresponding rows and columns. Again table 3 shows all the variables demonstrates acceptable performance on this basis.

Table 3: Correlation matrix for discriminant validity check for latent construct

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Competition(1)	**0.737**													
Competitiveness(2)	0.308	**0.799**												
Transaction Climate (3)	0.312	0.411	**0.744**											
Price Uncertainty (4)	-0.059	-0.275	-0.206	**0.750**										
Negotiation Power (5)	0.360	0.435	0.421	-0.302	**0.854**									
Interdependence (6)	0.110	0.229	0.186	-0.073	0.300	**0.926**								
Trust (7)	0.313	0.224	0.462	-0.213	0.337	0.131	**0.727**							
Investment(8)	0.260	0.317	0.257	-0.098	0.347	0.120	0.153	**0.853**						
Commitment(9)	0.302	0.386	0.585	-0.140	0.365	0.216	0.329	0.154	**0.925**					
Coordination (10)	0.347	0.440	0.380	-0.258	0.421	0.129	0.293	0.238	0.278	**0.796**				
Transaction formalization (11)	0.264	0.190	0.204	-0.101	0.217	0.166	0.176	0.257	0.156	0.284	**0.764**			
Contractual arrangement (12)	0.218	0.126	0.180	-0.013	0.193	0.134	0.128	0.248	0.104	0.215	0.731	**0.856**		
Customer Facing (13)	0.269	0.473	0.257	-0.233	0.319	0.143	0.206	0.187	0.353	0.314	0.195	0.100	**0.849**	
Internal facing (14)	0.300	0.608	0.383	-0.284	0.435	0.178	0.239	0.271	0.311	0.346	0.202	0.177	0.604	**0.714**

Figure 3: The model with path loading and corresponding t values.



5.2 The Structural Model and Test of Hypothesis

The PLS results of the structural part are shown in figure 3. The coefficient of each hypothesized path and its corresponding t-value obtained from bootstrapping procedure in PLS are also shown in table 4. It reveals that all of the paths, except Price uncertainty's association with Relationship strength (H4a), have significant loading (standardized β's) and t-values. Thus the model providing support for the null hypotheses H1, H2, H3, H4b, H5, H6 and H7 at P <0.001 and P <0.01 level. The nomological validity or the explanatory power of the model can be assessed by R^2 of the endogenous construct, which should be at least 0.10 for an acceptable standard (Falk & Miller, 1992). Figure 3 shows that 53 percent variance in

Relationship strength, 29 percent variance in 'SC performance', and 43 percent variance in competitiveness was explained giving a substantial nomological validity of the model when a large number of factors could impact both relationship and performance outcomes. The model has adequate merit in that it explains over 50 percent of variance in relationship strength and 25 percent of the variance in both SC performance (R^2 0.296) and Competitiveness (R^2 0.433) [28].

Table 4: Test of hypotheses

Hypothesis	**Path**	**Path coefficient(β)**	**t-value**	**Outcome**
H1a (+)	Rel strength —> SC Perf.	0.251	4.440***	Supported
H1b (+)	Rel strength —> Competitiveness	0.253	4.952***	supported
H2(+)	Competition —> Rel strength	0.147	2.768**	Supported
H3a (+)	Vert. Coord. —> Rel strength	0.102	2.369**	Supported
H3b (+)	Vert. Coord. —> SC perf.	0.143	2.575**	Supported
H4a (-)	Price Unc —> Rel strength	-0.018	0.363	Not Supported
H4b (-)	Price Unc —> SC perf.	-0.155	3.516***	Supported
H5 (+)	Trns Climate —> Rel strength	0.452	7.976***	Supported
H6a (+)	Negot. power —> Rel strength	0.253	4.460***	Supported
H6b (+)	Negot. power —> SC perf.	0.199	3.284**	Supported
H7 (+)	SC Perf. —> Competitiveness	0.504	11.946***	Supported

*** p <0.001, ** P< 0.01 (Two Tailed).
R^2 for Relationship Strength = 0.535, R^2 SC performance = 0.296,
R^2 for Competitiveness = 0.433

6. DISCUSSION

The factors of developing competent inter-firm relationships and their effect on Performance and competitiveness have been the focus of the paper. Eleven hypotheses were tested in this study and the data support ten of the hypotheses. The findings reveal that inter-firm 'Relationship strength' has a strong positive influence on SC performance (H1a) and Competitiveness of beef industry (H1b). Given the insight of RBV/TCE, this is very consistent with the literature that a strong inter-firm relationship can be considered as value creating strategic/economic resource and can contribute to firm performance and competitiveness. Relationship strength based on joint venture, interdependence, and commitment and trust can enhance business transaction, can minimize the cost structure, and can improve productivity and profitability of firm. The result also demonstrate that the level of 'vertical coordination' (H3b), 'price uncertainty' (H4b), and negotiation power (H6b) have significant effect on SC performance. It shows the evidence that a relational structure based on coordinated business activities, contractual arrangement, and a solid power base from upstream producers to downstream retailers can enhance the performance. Otherwise price uncertainty may propagate with a possible disproportionate share of the risk and profit among

the chain members. Results also indicate the necessity of some vertical integration and the development of marketing channel across the supply chain. A more formalized vertical interactions and information exchanges with relation specific asset, long term contract, and higher level of coordination on production, sales, and delivery times have significant positive effect on the performance.

The model testing found some significant determinants that impact on Relationship strength. Industry 'competition' (H2), level of 'vertical coordination' (H3a), 'transaction climate' (H5), and 'negotiation power' (H6a) all has significant positive influence on the strength of inter-firm relationship. The result shows that 'transaction climate' is the strongest predictor (β 0.452) of developing a strong relationship followed by 'negotiation power' (β 0.253), industry 'competition'(β0.147), and the level of 'vertical coordination' (β0.102). The finding is expected and in line with the literature that the climate of relationship, i.e. mutual understanding, compatibility in achieving each other goals, and fairness in sharing the risk and benefit enhance the relationship performance (Clare et al. 2005; Duffy and Fearne, 2004). Other important sources of relationship strength are the presence of negotiation power and industry competitors, which demonstrate the requirement of strong industry players and/or a successful cooperative to make the relationship competitive for a better profitability and future development.

Interestingly, among the antecedents, although it was expected price uncertainty will negatively influence the strength of inter-firm relationship, the effect is found statistically insignificant (H4a). However, may be it is because of the participation of large number of beef processors and retailers (51.8%) in the survey who have reduced their uncertainty by the operational efficiency and strengths. While studies found a higher degree of price uncertainty exist at the upstream producers, emanating from the highly variable season and cost structure, forcing to take risk alone and operate at marginal share from the chain. At this stage, a revision to the model/theory can be considered for subsequent testing.

Another unique contribution of this model is the evidence of SC performance link (H7) to industry competitiveness, which is supported with more than 43 percent of variance (R^2=0.433). As PLS calculate all of the indirect effects, in addition to the direct effect, to establish the relative importance of antecedents constructs; the total output of 'SC performance' effect on 'competitiveness' reveals that competitive advantage lies in the system efficiencies and performance of supply chain. It also demonstrate that the ability to create a strong inter-firm relationship with an organized vertical interactions, transaction climate, and solid power bases enhance supply chain performance and thus provides competitive advantage.

7. CONCLUSION AND IMPLICATIONS

This study presents details of a survey carried out and tests the hypothesis that a strong inter-organizational relationship in supply chain and its antecedents have impact on the performance of Australian beef industry and thus have impact on the competitiveness of the industry. We utilize concepts from organizational theories and marketing literature in agribusiness to develop the formative/reflective constructs, their measurement scales, and then use partial least squares (PLS) to support our modelling. Data were collected through a telephone survey of 315 firms in the beef industry from the states of Western Australia and

Queensland. The sample respondents were categorized as input suppliers, beef-cattle producers, processors, retailers/exporters, and wholesalers.

Results from the PLS analysis, which is similar to regression but simultaneously tests the structural paths (i.e., theoretical relationships among latent variables) and measurement paths (i.e., relationships between a latent variable and its indicators) revealed that the conceptual model we proposed gained substantial support from the data. Eleven hypotheses were tested out of which ten were supported. The results reveal that 'Transaction Climate' is the strongest determinants of developing a competent relationship, while negotiation power, presence of industry competitors, and the degree of vertical coordination significantly influence the relationship strength. Findings also demonstrate that relationship strength is the most prevalent source of SC performance and competitiveness of the industry, while SC performance highly positively influences the competitiveness of the beef industry

Thus this study identifies significant antecedents and consequences SC performance in Australian beef industry supply chain, which are strategic and extremely important information for beef producers, processors, retailers, and other stakeholders for appropriate planning and benchmarking. The important implication is that firm should build their supply chain as a resource itself by improving the cooperation and relationship structure between primary producers, processors, and retailers, wholesalers or other partners in supply chain. It will offer an economic and long lasting transactional relationship with benefits cascading through the supply chain such as a better cost structure, better use of working capital, and better contingencies of supply and demand related problems; and thus to better performance and competitiveness.

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