

3. THEORETICAL BACKGROUND OF SUPPLY CHAIN MANAGEMENT AND POTENTIAL SUPPLY CHAIN OF NORTH QUEENSLAND TIMBER INDUSTRY

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This paper examines the suitability of supply chain management (SCM) as a methodology for examining forestry development options in north Queensland – both industrial and farm – with particular emphasis on hoop pine. SCM has been defined from different perspectives by various authors and some of the alternative definitions of SCM are given. SCM is then placed in the context of the north Queensland timber industry focusing on the current structure and participants and the factors that need to be considered to make the supply chain for hoop pine more efficient. This highlights the need for a broader and more extensive supply chain for the north Queensland timber industry. Facilitation of a broader supply chain requires the development of mechanisms to improve cooperation between supply chain participants. This includes the expansion of the hoop pine resource area, value-adding processes, and improved information flows. The goal of research in progress is to develop a framework to facilitate a diverse multilayered supply chain for hoop pine that will promote a north Queensland industry that is economically and environmentally viable.

INTRODUCTION

The global business environment including agribusiness is in a state of transition, being influenced by globalisation, strategic alliances, merger and acquisition, business process and reengineering. These strategic approaches are altering the focus of overall management of businesses and influencing the ultimate goal – reaching the end-users by shifting from mass-marketing to customised marketing and emphasising relationship-based marketing in all fields. The rapid advancement of information technology is also having its affect on businesses and their management. These changes in turn effect the management of supply chains of all businesses. Generally speaking, the widespread success of any business depends on the efficient utilisation of its supply chain, which links all the participants and players of that particular business. The chain usually starts from the gathering of raw materials or goods and finishes when the good is supplied to the ultimate end-users, the customers. The effective and efficient management of supply chains is challenging, and requires clear understanding of the components of *supply chain management (SCM)*. SCM is usually concerned with managing the chain involving all the participants of the supply of particular product or service starting at the very core of a business. Competitors are also considered a part of the supply chain network and managed under the chain. As a result SCM is considered to be an integral part of the core competencies of a business, enhancing competitive advantage over its competitors.

The agribusiness sector, as a whole, needs to apply SCM efficiently to be competitive in the changing global picture. Forest industries, such as in north Queensland, involve production pipelines such as are found in other agricultural industries, and thus need to incorporate a well developed supply chain in order to be competitive in local and world markets. This paper presents a preliminary analysis of the significance of SCM in the timber industry, especially in relation to hoop pine, in north Queensland. This analysis aims to find the appropriate definition of SCM and its application to the supply chain of the current timber industry. A critical analysis of the current supply chain for hoop pine, and all its participants – the large

private and public foresters and small farm foresters – will highlight the need for and method of incorporating all the participants into the future chain by offering value-adding activities so as to enhance overall profitability and customer satisfaction of the industry.

The aim of this paper is firstly to assess critically the various definitions of SCM and place key aspects of those definitions in the context of the forestry industry in north Queensland, with particular emphasis on hoop pine. Secondly, the paper identifies the current and most suitable definition of SCM to be applied to the timber industry, both industrial and farm, with a focus on hoop pine. Finally, the paper outlines the existing supply chain structure of the north Queensland timber industry. It also proposes a future supply chain structure for the overall industry by suggesting some steps for adding value.

HISTORY OF SCM

Various studies have indicated that supply management is one of the core functions of an organisation – whether production oriented or service oriented. This supply management concept has evolved over the years from being simply a focus on purchasing to encompassing other related areas including the ultimate supply to the end users. Kopczak and Johnson (2003) observed that there are many views of supply chain management and some are quite elaborate and focus on operations, and others on information management. Burt *et al.* (2003) in their analysis of the growing importance of SCM suggested that a future focus would be on 'Kaizen' or continuous improvement, because this is being recognised as one of the core functions of corporate importance. These authors have also highlighted that supply management is crucial for organisations' strategic planning functions. Several researchers have also focussed on the evolution of supply chain management from simply purchasing or procurement to incorporating other functions including logistics and transportation and information management, among others (e.g. Burt *et al.* 2003, Monczka *et al.* 2002, Ayres 2001, Fredendall and Hill 2001, Ross 1998).

A brief review of the history of the development of SCM reveals that the importance of purchasing function was referred to as far back as 1832 in Charles Babbage's book on the economy of machinery and manufacturing (Monczka *et al.* 2002, Burt *et al.* 2003). Monczka *et al.* (2002) suggested that the greatest development of purchasing occurred after the 1850s when the American railroad went through a growth phase. This led to the recognition of purchasing as a distinct corporate function, which makes a contribution to overall company profitability. The essential elements of the modern purchasing functions of the supply chain developed in the period from 1900 to 1939 were applied in World War I to purchase of war materials, with a particular focus on procuring raw materials.

During World War II (1939-45), the corporate significance of purchasing inputs was increasingly recognized, and courses in business logistics were offered in various US universities, but the post-war phase was quieter as the number of market-driven firms increased in the USA (Monczka *et al.* 2002). According to Monczka *et al.* (2002), even though value analysis techniques developed, pioneered by General Electric in 1947, the emphasis was on satisfying consumer demands and requirements of a growing industrial market. Burt *et al.* (2003) also observed that post-war years did not see much growth in research into input purchasing, as emphasis was given on marketing, finance, operations and research and development. Purchasing incurred a significant portion of costs of goods sold, but was not managed by skilled personnel. Interest in materials management grew around 1960s to 1970s and the focus was more on solving the problems from a total system viewpoint for an organisation rather than the individual function (Fredendall and Hill 2001, Monczka *et al.* 2002, Burt *et al.* 2003). During this time the purchasing managers emphasised multiple sourcing through competitive bid pricing, and the major focus of buyers was on purchase price and the prevention of line shutdowns. Suppliers were rarely viewed as value-adding partners.

By the end of 1970s and the beginning of 1980s, the world business situation changed drastically and was influenced by globalisation, automation, technological change, increased inflation, international competition and strategic alliances. These changes affected the SCM and gave birth to an integrated approach to SCM, where the demand and requirements of the customers and role of suppliers were accorded increased importance. In recent years, purchasing and materials management have been considered vital in adding value to the overall organisation and increasing its profitability (Burt *et al.* 2003), and in meeting the challenge of worldwide competition, rapidly changing technology and customer expectations (Monczka *et al.* 2002). These changes have increased the profile of SCM in the success of an organisation by emphasising the fact that supply managers are active participants in the organisation's strategic planning process. Thus differing SCM definitions have emerged highlighting the importance of supply stages for the overall success of an organisation.

DEFINITIONS OF SCM

When defining SCM, most authors have emphasised the importance of the various chain players as well as considering the customers as a vital part of the chain. Many definitions also focus on the two-way flows of goods and services along with information and funds from purchaser to end-user, so the industries involved achieve their final goal of sustainability and profitability in the global competitive marketplace. This section focuses on the critical aspects of some of the paradigms of SCM as defined by various practitioners and authors.

Changes in the global business situation and increased competition among organisations have influenced the management complexity of all organisations. Monczka *et al.* (2002) pointed out that today's organisations must manage both the upstream firms – suppliers providing direct and indirect inputs – and downstream firms or the distributive network delivering and offering after-market service to customers. Based on this, (Monczka *et al.* 2002, p. 4) offered an extensive definition of supply chain and its management:

The supply chain encompasses all activities associated with the flow and transformation of goods from the raw materials stage (extraction), through to end users, as well as the associated information flows. Material and information flow both up and down the supply chain. The supply chain includes systems management, operations and assembly, purchasing, production scheduling, order processing, inventory management, transportation, warehousing, and customer service. Supply chains are essentially a series of linked suppliers and customers; every customer is in turn a supplier to the next downstream organisation until the finished product reaches the ultimate end user.

Supply chain management is the integration of these activities through improved supply chain relationships to achieve a sustainable competitive advantage.

SCM has a great impact on wider organisational strategies, mainly those associated with purchasing and sourcing (Monczka *et al.* 2002), incorporating multiple organisations as chain participants. Monczka *et al.* (2002) have divided the participants in three categories – the internal functions, upstream suppliers and downstream customers. Two of the major internal functions of an organisation are order processing and production scheduling. Order processing involves extensive customer interaction – starting from taking the order to after-market service while production scheduling involves actual plans and schedules. The upstream suppliers manage the flow of the right materials, at the right time to the right internal users. Downstream customers include the distribution channels, processes and functions, which the product passes through in order to reach the ultimate customers. The logistics managers are involved here in the form of managing transportation and distribution.

Monczka *et al.* (2002) observed that there are upward and downward flows of materials, information and funds between the participants of the supply chain. Thus the management of

relationships among these players are imperative and offer an opportunity for competitive advantage to the firm. Supply chain as a core competency presents the following advantages to a company:

- Cost reduction or improvement;
- Improved material delivery;
- Shorter cycle time, including product development cycle times;
- Access to product and process technology; and
- Quality improvement.

Ross (2000) identified the complexities in defining SCM, recognizing that the concept involves a matrix of applications and can be defined in various ways. He viewed SCM as a comprehensive, dynamic, growth-oriented, competitive management approach that is nurtured by globalisation, change and uncertainty. He also stated that SCM is based on the following three dynamics:

- Operations management techniques where all the organisations' functions – marketing, manufacturing and finance – are optimally utilised and integrated to form the common business system. These techniques offer competitive advantage by adding value to the day-to-day performance of regular activities. The three sets of activities are inbound logistics, processing activities and support activities.
- Integrated logistics management, which is extended to the interchannel logistics activities. The objective at this level is to interface closely with, not merge, the identical functions performed by logistics counterparts in outside supply channel partners. The main rationale of this dynamic process is that an organisation needs support from its internal as well as external supply chain partners to gain competitive advantage and market leadership.
- Strategic dynamics that concentrate on reducing delivery times and costs, and adopting new management techniques and management information system to achieve breakthroughs in products and services that satisfy the ever-changing customer needs. This focus opens up a new dimension for the organisation and gives it a competitive edge through forming alliances with channel system partners and offering relationship-based marketing to suppliers and customers.

Ross (2000, p. 9) summed up the above analysis with the following definition of SCM:

Supply chain management is a continuously evolving management philosophy that seeks to unify the collective productive competencies and resources of the business functions found both within the enterprise and outside the firm's allied business partners located along intersecting supply channels into a highly competitive, customer-enriching supply system focused on developing innovative solutions and synchronising the flow of the marketplace products, services, and information to create unique, individualised sources of customer value.

Some practitioners have underlined the importance of customer as partners all along the chain, including Fredendall and Hill (2001) and Burt *et al.* (2003). Fredendall and Hill (2001) examined the importance of including customers as participants in the supply chain because of the advantages mentioned below:

- Integration of customers in the chain improves the flow of information so as to understand better the needs of the customers. If the customers are not included, the purchaser (the focal firm offering the goods or services) is uncertain about the customers' needs and ends up complicating the overall plan, with increased costs and lead times.

- It allows the firm to incorporate the product development function along with other organisational functions, so that the communication, internal and external, between product development staff and customers is strengthened. Concentrating on the internal customers makes all employees aware of the chain and encourages their participation to accomplish the end goal of satisfying the customers.

Ross (1998) also highlighted the importance of customers and argued that SCM strategies should be completely customer driven. SCM plays a dual role of a communicator of customer demand from point-of-sale all the way back to the supplier, and physical flow process that ensures the timely and cost-effective flow of goods through the entire pipeline. This is crucial for the efficient application of SCM because customers nowadays are increasingly accustomed to receiving customised products, as the market responds to demand-pull product strategies rather than traditional demand-push strategies.

Various paradigms of SCM have focussed on the management of internal customers as well as external customers. The internal customers can be defined as the receiver persons or departments of another person's or department's output or final product, service or information (APICS Dictionary, cited in Fredendall and Hill 2001). These internal customers again ensure the delivery of product, services or information to the external end-users. Ross (1998) argued that SCM is a dynamic and open-ended approach to marketplace competitiveness and a continuous process of determining intracompany and intercompany performance, information system techniques, products and services, and organisational and personal competencies to utilise the customer demands. The utilisation of such internal and external participants ensures that the chain achieves productivity, profit and growth. This again is related to the two-way flows of product, service, funds and information, from raw material to end-user.

Burt *et al.* (2003) defined SCM as simply the linkage between the ultimate customers and Mother Earth. They also highlighted the involvement of funds, which come in only when end-users purchase a product or a service. Otherwise transactions within the supply chain are the simple allocation of those funds among the chain's external and internal members. The Internet can be a valuable factor in coordinating and synchronising the activities of the members of a supply chain. Based on this, Burt *et al.* (2003, p. 9) have defined SCM as a chain that includes

all internal functions plus external suppliers involved in the identification and fulfilment of needs for materials, equipment, and services in an optimised fashion. The supply system plays a key role in helping the firm satisfy its role in the supply chain.

This relationship of the internal functions and external players of the system has been depicted as in Figure 1.

Burt *et al.* (2003) have also focussed on the combination of total costs and sales in SCM as depicted in the Figure 2. They argued that SCM directly affects the total costs and sales of the firm and also the investment in assets, which in turn increases the overall profitability of a firm and establishes supply management as a core competency. As a result, shareholders' values are increased. These authors point out that SCM increases sales through particular activities performed by the firm such as being early to the market, improving product quality, reducing the cost of production and innovation of new products and services, thus enhancing customer satisfaction. As a consequence, the firm offers customer fulfilment flexibility by shorter production cycles and lead times. Burt *et al.* (2003) moreover suggested that the total cost of ownership could be reduced by early supply management and supplier involvement through better product designs. Cutting down the acquisition costs, processing costs, administrative quality costs, downtime costs, risk costs, cycle time costs, conversion costs,

non-value-added costs and supply chain costs can further reduce the cost associated with ownership and bring about better utilisation of assets and collaborative and alliance relationship between buyers and sellers.

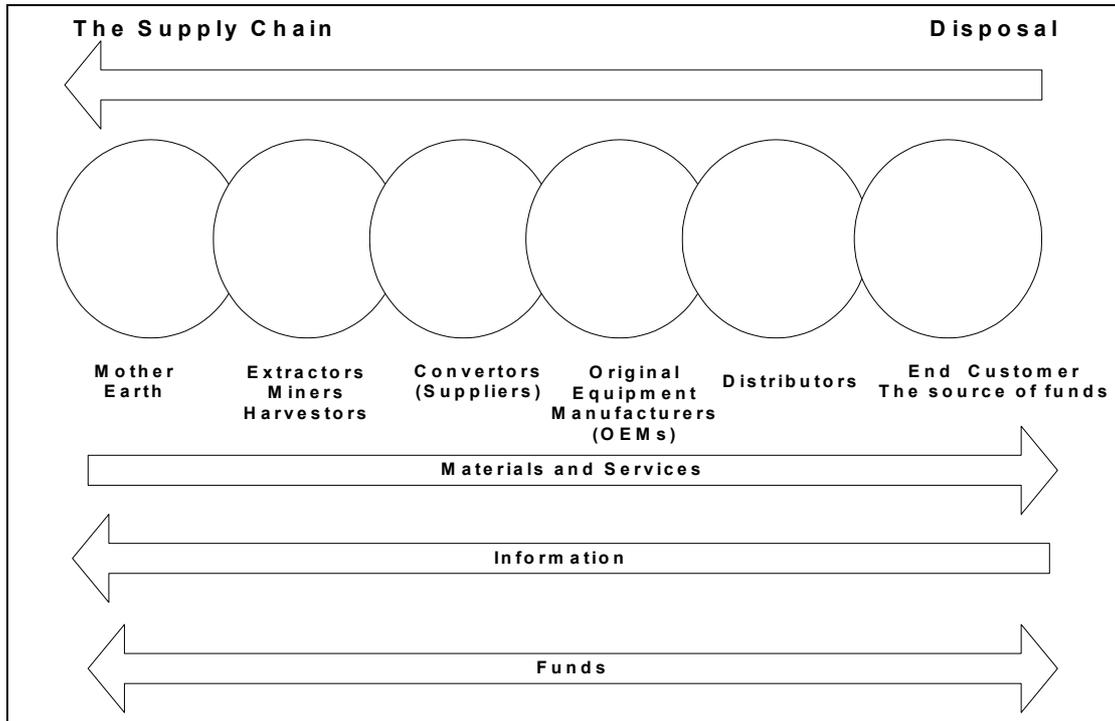


Figure 1. The Supply chain

Source: Burt *et al.* (2003, p. 9).

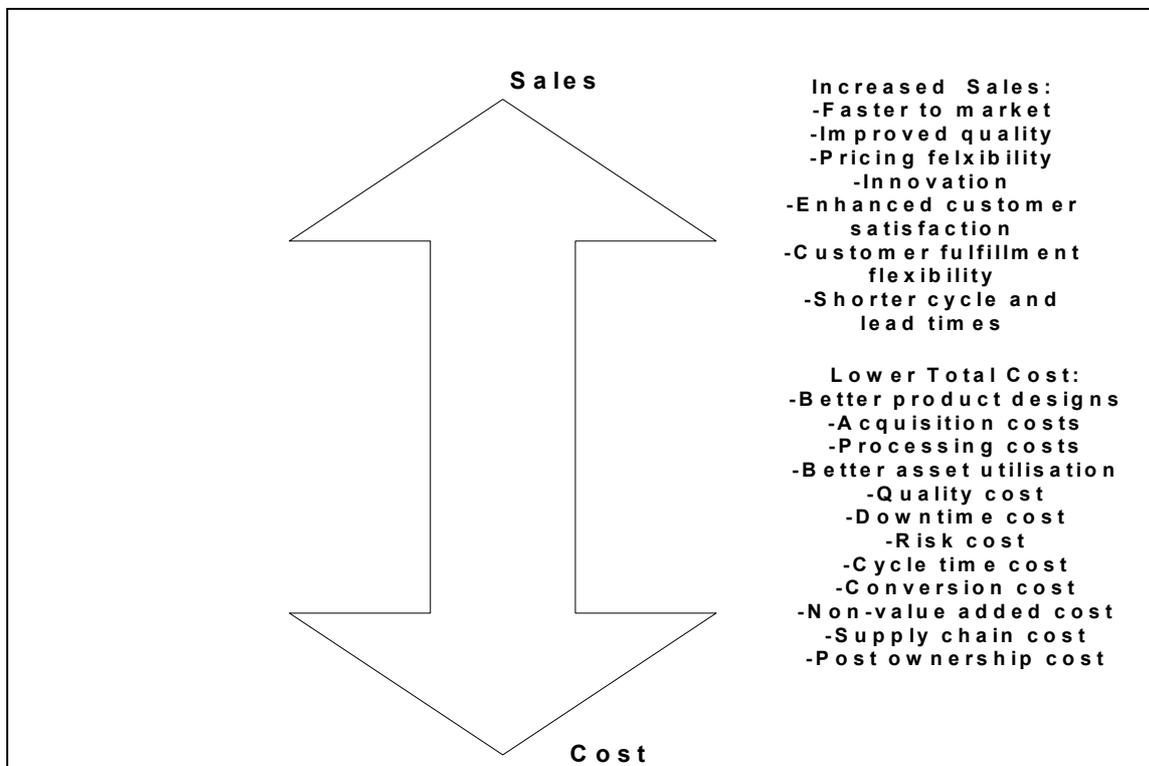


Figure 2. Impact of SCM on sales increase and cost reduction

Source: Burt *et al.* (2003, p. 11).

There are other professionals and researchers who support the view that SCM creates value by reducing costs and increasing sales. For instance, Hoover *et al.* (2001) argued that companies with best-practice supply chain management have greater cost-efficiency than their competitors, with increased contribution margin and permanently lower prices.

Burt *et al.* (2003) argued that all participants of a supply chain should further concentrate on a series of value-adding functions:

- **Quality** – should relate to Total Quality Management (TQM) to offer the best possible product and service given the market segment;
- **Cost** – should focus on strategic cost management programs by reducing the total cost throughout the chain;
- **Time** – aim at reducing lead-time so products and services are available to the end users in the minimum possible time;
- **Technology** – should be used appropriately both internally and externally with the members of supply chain to gain competitive advantages; and
- **Continuity of supply** – develop appropriate supplier relationships by monitoring the trends in the chain and marketplace.

Fredendall and Hill (2001) differentiated between SCM and Value Chain (VC), whereas some researchers view them as synonyms. Fredendall and Hill (2001) defined SCM and VC as follows:

SCM: Process from initial raw materials to the consumption of the finished good by ultimate consumer, incorporates the external and internal functions of an organisation to enable the use of value chain (APICS, The Educational Society for Resource Management, Dictionary, 1995).

VC: Internal functions of an organisation to add value to the overall products or services offered by the company (APICS, The Educational Society for Resource Management, Dictionary, 1995).

Larson and Halldorsson (2002) compiled various definitions of SCM focussing on diverse aspects of its functions. Larson and Halldorsson (2002) recognised the role of the Institute of Supply Management (ISM) in terms of the Glossary of Key Purchasing and Supply Terms (2000), in which SCM is defined as the identification and management of specific supply chains that are critical to a purchasing organisation's operations. They also argued that SCM involves the entire flow of information, materials and services from raw materials suppliers through factories and warehouses to the end-users. Therefore SCM incorporates both upstream and downstream relationships along the chain (Christopher 1998, Handfield and Nichols 1999, Lambert and Cooper 2000 cited in Larson and Halldorsson 2002).

Four types of conceptual perspectives of SCM have been defined by Larson and Halldorsson (2002), as illustrated in Figure 3. These are

- **Traditionalist** – view SCM as a strategic aspect of purchasing. They emphasise the development of partnerships with both first and second tier suppliers.
- **Relabeling** – as has been pointed out by various authors, purchasing has evolved to become SCM. They narrow down the focus of SCM only to purchasing.
- **Unionist** – purchasing is a part of SCM and SCM involves a number of business processes, such as purchasing, quality management and customer service.
- **Intersectionist** – various authors have suggested that purchasing and SCM intersect as part of various business processes, giving SCM a broader focus.

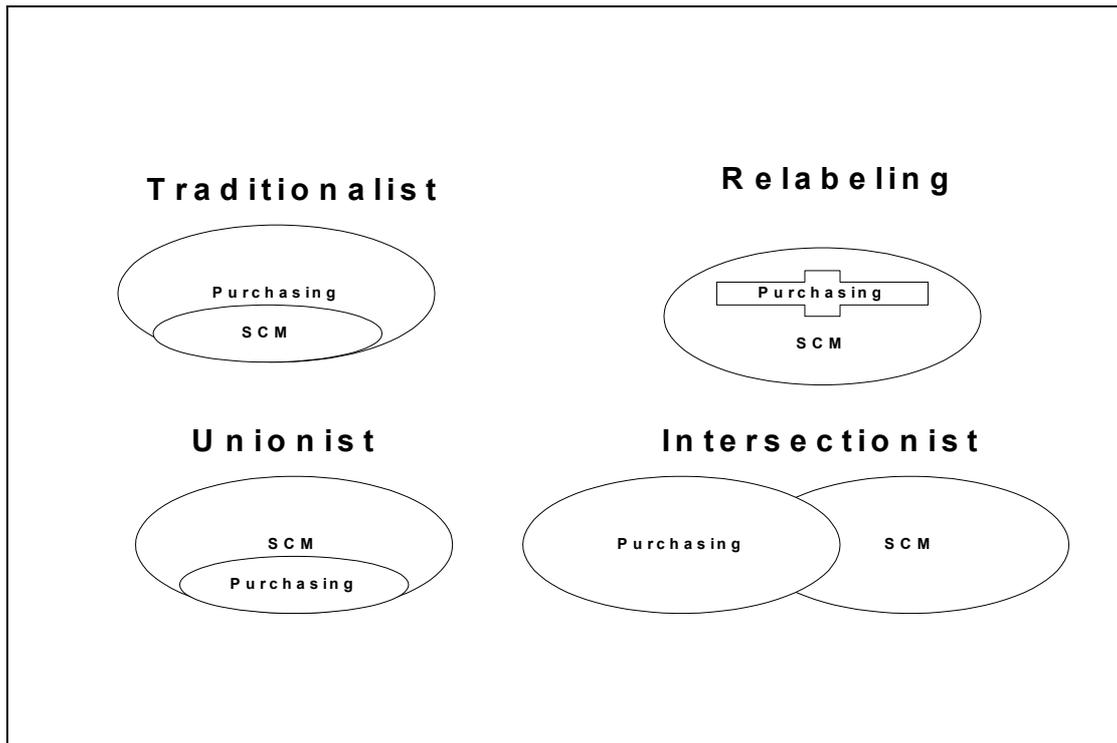


Figure 3. Conceptual perspective of SCM

Source: Larson and Halldorsson (2002).

Ayers (2001) defined SCM with a broader focus on information, financial flows, and the creation and deployment of intellectual capital, and concluded by defining it as the life-cycle processes supporting physical, information, financial and knowledge flows for moving products and services from multiple linked suppliers to end-users to satisfy end-users' requirements. The life-cycle process here includes both the market life cycle and usage life cycle. Ayers (2001) added the usefulness of knowledge management into the definition of SCM and mentioned that value adding in the form of intellectual capital is vital for the profitable marketing of any goods and services. The knowledge inputs lead to increased product innovation in the chain. The flow direction has been highlighted in this definition because SCM not only incorporates flows from suppliers to end-users, but also backward flows including product returns and rebates.

When defining SCM, most practitioners focus on the chain relationships and describe the importance of such relationships among members of the chain. In explaining such relationships, Fredendall and Hill (2001) emphasised the need for collaborative planning among the chain members, which requires the organisation to work with suppliers and customers, so as to ensure that the suppliers maintain production and delivery schedules that satisfy the needs of the customers. Burt *et al.* (2003) further supported this argument and pointed out that there are three types of buyer-supplier relationships – transactional, collaborative and alliance. According to these authors, the transactional relationship is the most basic form, where neither party is concerned about each the other's wellbeing. There is little collaboration and learning; costs, data and forecasts are not shared; and price – as determined by market forces – is the focus of the relationship. Collaborative relationships exist where management focuses on interdependence and cooperation among supply chain participants and ensures profitability for all parties concerned. Management ensures that the chain's end products are cost competitive, continuous improvement is easier to achieve and overall cost is reduced, quality is improved and time is better managed. There is a strong

focus on developing long-term relationships between the supplier and customer in collaborative relationships and alliance relationships. These relationships also have lower total costs, likely increases in research and development expenditure, training, and procurement of newer and more efficient equipment. Supply alliances focus on physical asset and human specialisation and offer lower total costs, reduced time to market, improved quality, improved technology flow from suppliers and improved continuity of supply.

The above analysis of alternative definitions of SCM shows that the concept has two distinctive foci – tactical and strategic. Ross (1998) argued that the strategic dimension of SCM incorporates the vision for a company along with the day-to-day operational activities to exploit the competitive possibilities of the global business environment. To do this the focal company need to seek innovative ways to not only penetrate existing markets but also create new sources of value to open whole new markets and to develop strategic relationships with other chain participants so as to enhance competencies and attract resources necessary to sustain competitive survival. Burt *et al.* (2003) argued that SCM should focus on some strategic activities, including environment monitoring, integration of supply strategy, developing and updating commodity strategies, data management, corporate strategic planning and strategic sourcing, forming supply alliances supply networks, and fulfilling social responsibilities. Kauffman (2002) added further strategic components to his analysis of the SCM definition, such as product, cost, relationship and access. According to Kauffman (2002), an organisation needs to identify and select its product and service, be cost competitive, focus on the strategic relationships among supply chain members and have required access to the product, so as to have the best combination of product, cost and relationship.

SCM has evolved over recent years to take a broader functional and strategic focus. Kopczak and Johnson (2003) argued that the business trends of the 1990s have created a need for this broader SCM while advances in information technology have created the opportunity. The six shifts in business focus based on the advances in information technology, new accounting and financial measures and industry initiatives are:

- from cross-functional to cross-enterprise;
- from physical efficiency to market mediation;
- from supply focus to demand focus;
- from single-company product design to collaborative, concurrent product, process and supply-chain design;
- from cost reduction to breakthrough business models; and
- from mass-market supply to tailored offerings.

In addition to all the characteristics of SCM that have been analysed above, SCM should incorporate the environment in which the chain members operate. The physical environment has gained increased importance over the years, with both individuals and companies becoming increasingly aware of the physical environment and its effect on the business environment. It is important for any industry, and particularly for an agricultural industry, to incorporate the environmental impacts of the activities and functions of its SCM. Burt *et al.* (2003) drew attention to the importance of the physical environment in the efficient operations of SCM and proffered that the following 4 Rs can be used to reduce waste and improve sustainability:

- **R**educe the waste generation.
- **R**euse and **R**eallocate materials as much as possible.
- **R**ecycle as much as energy-efficiently possible.

These authors also pointed out that application of the 4 Rs to manage the SCM would result in economic gain for the whole supply network through cost reduction and more efficient marketing. Enforcing a production process that decreases pollution can reduce the cost. Today's customers are environmentally more conscious and incorporating this awareness into the SCM strategy and delivering an environmentally friendly product will ensure economic gain for the chain participants.

The above analysis of definitions of SCM has highlighted some strengths, weaknesses, opportunities and threats (SWOT) of the overall SCM, which are listed in Table 1:

Table 1. SWOT analysis of SCM

<p>Strengths Broad focus encompassing all the supply chain participants and members along with stakeholders both internal and external to the organisation. Offers a strategic view of the supply channel (Ross 1998, p.11). Potential to include a customer as a partner in the supply chain Improves the flow of information and integrates the product development functions with other functions focussing on internal and external customers offers several advantages (Ross 1998, Ayers 2001, Kopczak and Johnson 2003) Advances in information technology have fostered real time information sharing and knowledge management, coordination and decision making among companies of all sizes and shapes (Kopczak and Johnson, 2003). Burt <i>et al.</i> (2003) pointed out that are three principal classes of relationships in SCM enhancing the overall communication and performance of the participants and increasing competitive advantages, namely transactional, collaborative and alliances. SCM also cooperates with environmental protection factors by offering services of reduction, reuse, reallocation and recycling (Burt <i>et al.</i> 2003). Companies can achieve high level of productivity, profit and growth (Ross 1998).</p>
<p>Weaknesses Can become complex with the involvement of all the levels of the chain. Lack of proper communication among the levels of the supply chain (Ayers 2001, Kopczak and Johnson 2003) Recent trends in businesses including outsourcing, globalisation, fragmentation and business process reengineering (BPR) have made it vital for SCM to be given more importance than an individual organisation.</p>
<p>Opportunities Incorporates the philosophies of just-in-time (JIT), quick response manufacturing (QRM), vendor management (VM) and agile manufacturing (AM) (Ayers, 2001) Integration of new communication technology (Ayers 2001, Kopczak and Johnson 2003) Demand driven then supply driven (Ayers 2001, Kopczak and Johnson 2003)</p>
<p>Threats A threat arises when a competitor perceives a shortfall in the chain management (Ayers 2001). Can be a defensive weapon that is used by competitors (Ayers 2001). Small firms may lack the resources for the management of SCM.</p>

CURRENT TIMBER SUPPLY CHAIN OPERATING IN NORTH QUEENSLAND

According to the different segmentation suggested by Larson and Halldorsson (2002), as reflected in Figure 3, the current timber supply chain of north Queensland can be conceptually acknowledged as a 'unionist' structure at present, where purchasing is viewed as a part of SCM with other related activities including customer service and materials management. This paper aims to develop a more specific focus for the future supply chain of

timber industry of north Queensland and link it between the concepts of unionist's and intersectionist's structure as these concepts integrate the overall definitions and functions of supply chain.

Separate supply chains may be identified for softwoods and native hardwoods in north Queensland. When logging took place in native forests, there was a major industry based on hardwoods. Moore (1992, as cited in Herbohn *et al.* 2001) pointed out that the three-year average harvest of rainforest cabinet timbers from Crown and private land directly prior to World Heritage listing was 66,000 m³, with a further harvest of 50,000 m³ of lower grade structural timber. The Crown harvesting dropped from 52,000 m³ in 1987 (prior to the listing) to almost nil after the listing, whereas the private cut increased to about 30,000 m³ by 1992. The cut has since decreased, and only a few small hardwood mills continue to operate.

While many softwood species have been trialled on the Atherton Tableland, hoop pine has been the most successful species, with about 1000 ha being grown on government plantations, together with a small area of Caribbean pine. On coastal areas, about 13,000 ha of Caribbean pine has been established.

Figure 4 outlines the current supply chain associated with the timber industry based on the hoop pine resource on the Atherton Tableland, which is owned almost exclusively by the Department of Primary Industries–Forestry (DPI–Forestry). Seedlings are sourced from government nurseries. Currently a bilateral monopoly exists with one seller (DPI–Forestry) and one buyer (Ravenshoe Timbers Pty Ltd). Plantations are harvested and transported to the Ravenshoe mill by contractors engaged by the mill, with royalties paid to DPI–Forestry based on timber volume harvested. As part of the log sale arrangements, Ravenshoe Timbers must accept logs of all grades and sizes. The Mill processes about 30,000m³ of hoop and Caribbean pine per year. The mill has two finger jointing plants, and undertakes some further value adding, including production of mouldings and door cores. The mill is the largest single employer in the Herberton Shire, and has significant influence within the supply chain. The company has a further timber processing operation in Cairns. Hoop pine has a high customer demand because of its high quality and greater range of uses than other softwoods. Ravenshoe Timbers sell products both domestically and through export.

Other factors relating to economics, existing competition, socio-economic conditions, environment and workplace health and safety have a considerable impact on the efficiency of the current supply chain of north Queensland timber industry.

POTENTIAL SUPPLY CHAIN OF NORTH QUEENSLAND

The existing supply chain for hoop pine in north Queensland discussed so far has focused on the unionist viewpoint, as described by Larson and Halldorsson (2002). As highlighted earlier, the aim is to identify a broader and more extensive supply chain for hoop pine, which can be used as a conceptual model to investigate how the hoop pine based timber industry, can be expanded. This is consistent with the definition of Ayers (2001), where other broader functions including provision of information, flows of finance, and the creation and deployment of intellectual capital are to be included. In the future, the supply chain could be enhanced in its role as the life-cycle process supporting physical, information, financial and knowledge flows for moving products and services (timber and value-added products from suppliers – public and private landowners – to end-users or ultimate customers). As per Ayers' (2001) definition, it can be presumed that the supply chain should focus on:

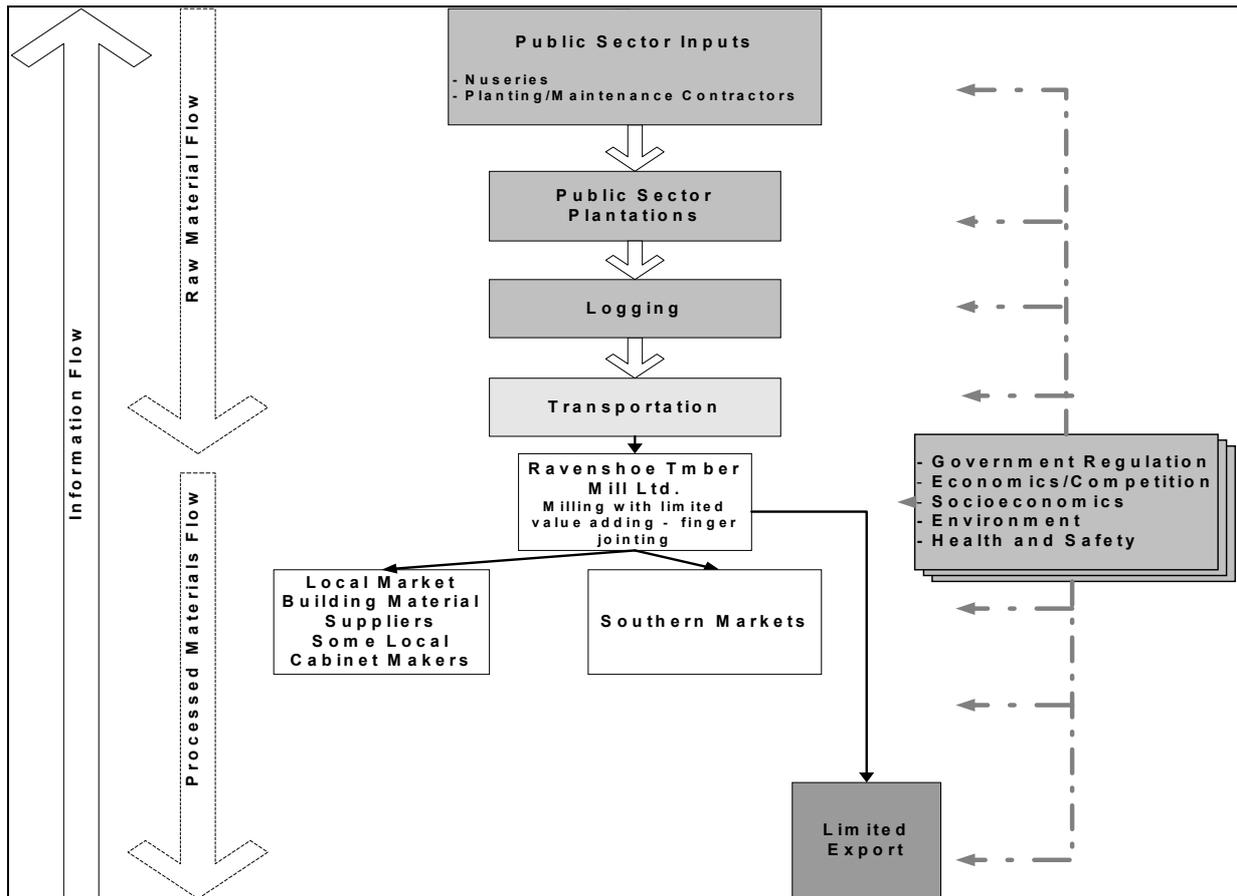


Figure 4. Supply chain associated with growing and milling of hoop pine

- **Functional** – incorporating the integrated participation of all the stakeholders and supply-chain players to establish an effective supply chain network; the customers are of utmost importance and consist of local, national and international markets;
- **Procurement** – private and public sector inputs from nurseries, planting and maintenance contractors, service and information providers so as to utilise the information and the creation and deployment of forestry-related intellectual capital of the skilled personnel; the factors incorporated here would be logging along with the log buyers;
- **Logistics and transportation** – amalgamation of the current logistics and transportation system to reduce cost, proper utilisation of the system for all the main and value adding products;
- **Information** – ensure and maintain effective information flows and utilisation of information about government regulation, economic aspects, competition, socio-economic and environmental factors, and extended health and safety measures;
- **Business process reengineering** – as an established industry there needs to be a focus on new value-added products and utilisation of the current resources so as to have long-term gain; promote the participation of other fixed-site and portable sawmiller operators to enhance market competition and profitability of all the parties involved;
- **Strategic** – all the goals and objectives should be in line with the strategic focus of forestry management in the region to make the efficient use of all the resources.

These six factors are included in Figure 5 to highlight the overall dimension of a future enhanced supply chain.

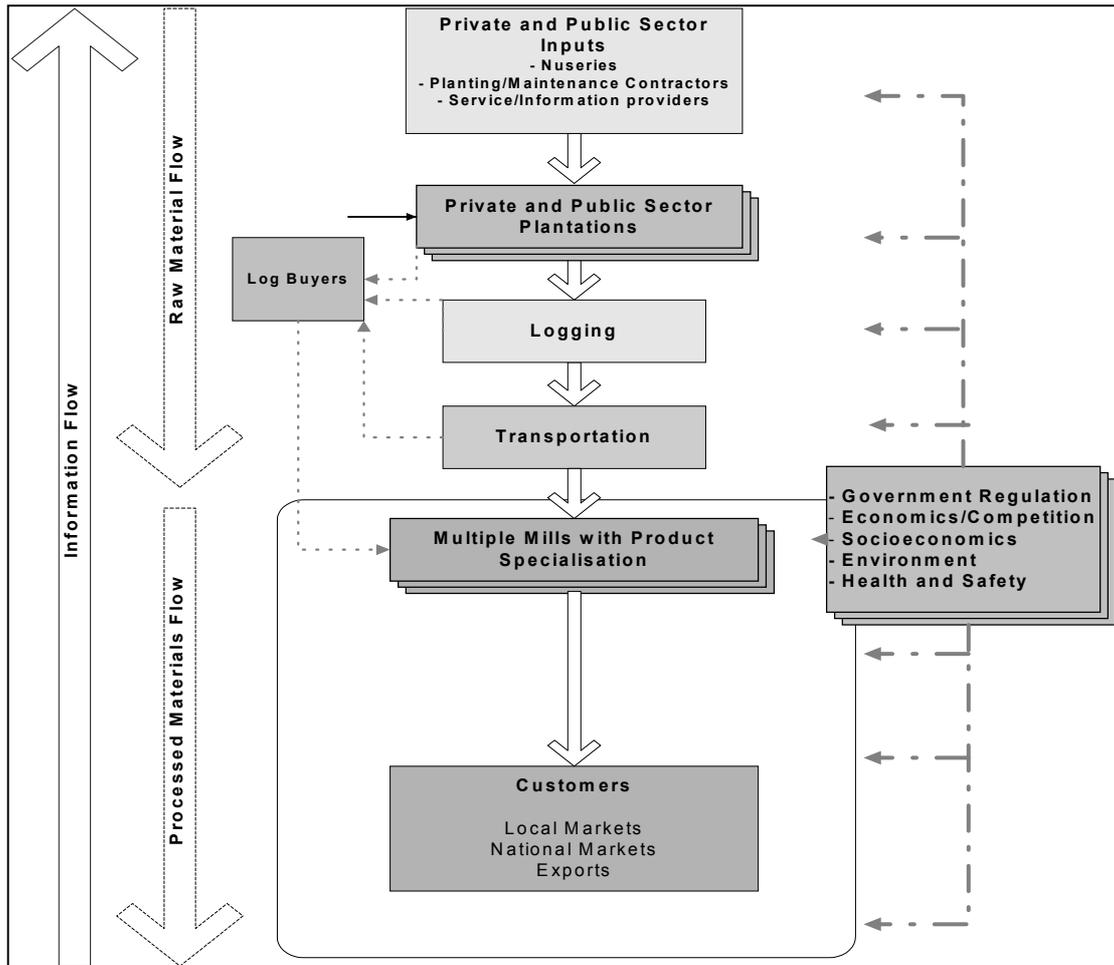


Figure 5. Potential supply chain of north Queensland

The supply chain consisting of multiple millers would add value to the products. The participation of multiple millers would allow for product differentiation. With a larger log volume available for milling, logs from plantations could be graded and then sent to different mills, which specialise in processing that particular grade or size of logs. For instance, some mills might process only high quality butt logs for veneer, with others processing lower quality head logs for pallet material. Currently, Ravenshoe Timbers Pty Ltd processes logs of varying quality and sizes. With specialised sawmillers the focus may shift to veneer, plywood and other value-added products, e.g. doors, windows, small furniture, and wooden household products. The entire sawmilling sector could again participate in the export market, as there is a demand for Australian timber in overseas market, especially in Asian markets.

CONCLUSION

The business trends of the 1990s created a need for a broader SCM even in primary industries and advances in information technology created the opportunity. The six shifts in business focus, as identified by Kopczak and Johnson (2003), and based on the advances of information technology, new accounting and financial measures, and industry initiatives can be summarised as follows for the timber industry:

- From cross-functional to cross-enterprise incorporating the different value-added products, steps, multiple sawmillers, small-scale forest farmers and the Crown plantations;

- From physical efficiency to market mediation – the overall supply chain is more market driven;
- From supply focus to demand focus – there should be a concentration on the ultimate users so as to supply products according to their demands and ensure marketability as well as financial and economic viability;
- From single-company product design to collaborative, concurrent product, process and supply-chain design with the co-operation of all the parties concerned from the input suppliers to the end users;
- From overall cost reduction to breakthrough business models – business models enhancing overall feasibility of the forest industry, as well as the economy;
- From mass-market supply to tailored offerings – this will enable the timber industry to focus on niche and specialised market so as to utilise properly the produce and reduce wastage.

These shifts need to be incorporated in the north Queensland timber industry for the efficient utilisation of public and private resources and also to encourage private landowners to engage in planting hoop pine so as to offer some financial incentive for all parties concerned by contributing to value-adding activities.

The participants of the north Queensland timber industry need to be aware of the contribution made by each one of them at each level and incorporate the importance of customers in the management of the supply chain. The overall success of the chain will also depend on the extensive utilisation of the information technology, logistics, and transportation, among other factors. Finally, it can be said that the supply chain should be demand-driven taking the needs of the final customers into consideration and aiming to establish a strong market both locally and internationally.

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