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Effective information access and automated traceability in fruit export chains in South Africa

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1 Introduction

The South African (SA) export fruit industry is vital to the SA economy, contributing about 20% (or 4 million tons) to agricultural production. As a one billion US dollar export industry in 2002, the country exports about 42% of its fresh fruit production (Shepherd 2003:2), contributing 75% of all farm income for fruit (Kriel 2002:4). The industry is well positioned with regard to its southern hemisphere competitors (Argentina, Australia, Chile and New Zealand) in terms of average growth in export volumes. However, the market requirements are constantly changing and competition is fierce due to the general oversupply of fruit in major markets.

The limitations of the regulated environment eventually led to deregulation in August 1997 and to the phasing out of the statutory bodies. The new deregulated market structure radically changed the competitive profile of the industry by lifting the artificial barriers that existed for fruit exports. However, there was still a major barrier to performance – having the knowledge and ability to deal with export processes (S. Rigotti, personal communication, 13 June 2003 – Manager Information Systems, Capespan, P.O. Box 505, Bellville, South Africa, 7535). Exporters experienced a combination of problems. Few had proper systems, which meant that access to critical information was severely hampered. It was, for instance, difficult to record and verify the cost, quite often resulting in serious losses. Producer payments were inaccurate and late most of the time; sometimes payments only occurred during the harvesting of the next season. Data integrity on the supply chain was suspect, because of fragmented information channels and duplicated capturing at various points in the chain.

The internal challenges were compounded by a difficult time in the markets. Strong competition, globalization and the effects of world-wide overproduction, caused prices to drop dramatically. Consequently many farmers and exporters incurred enormous debts and went bankrupt (Van der Ham, Becker and Guis 2002a; 2002b). In 2000, the third year after deregulation, the fruit export industry as a whole lost an estimated one billion rand in export earnings and declared itself in crisis (Mather 2003). SA's international image slipped because of all the negative consequences of deregulation (Symington 2003:5).

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2 Research project

2.1 Research problem

The deregulation caused a high level of information fragmentation in the SA fruit industry because the benefits of the central information system used during the regulated period were no longer available. Paltrack was privatized, and for the first time companies had to pay licensing fees for using the software. Many producers felt that since their levies during the regulated period included the use of software, they were entitled to ownership of the software (S. Rigotti, personal communication, 13 June 2003 – Manager Information Systems, Capespan, P.O. Box 505, Bellville, South Africa, 7535).

The database of the central information system became eroded as many parties independently sought new systems of their own. No single export party had the power to set standards or represent common interests because every one was competing with one another (Van der Ham *et al*. 2002a; 2002b). This led to the appearance of virtual communities and 'hub' business models. Furthermore, an increase in volume and aggression of international competition meant that the lack of timely, accurate and comprehensive information adversely

affected the fruit business in SA (SILIS 2000:4).

Industry players started to realise that to operate within this business model, especially with increasing traceability and efficiency requirements of trading partners, it is critical that pertinent information should be available. During 1999, a strong need existed in the industry for a new over-arching information system to replace existing old and new systems. Today, the industry has fully adopted the new market approach where only the strongest companies have survived and consequently the desire in the industry has shifted towards a decentralized system focusing on interfaces between existing facilities (Van der Ham *et al*. 2002a; 2002b). However, given the traceability demands, there might be a need to once again have an overview of the whole information chain (G. Foster, personal communication, 2 April, 20 May and 12 August 2003 – g.foster@mweb.co.za).

Deregulation has caused the industry to face challenges such as not being able to enforce the standardization of codes and messages. However, compared to most other fruit export industries in the world, SA has a reasonable degree of standardization across the SA supply chain (not necessarily true of the overseas supply chain). This degree of standardization applies primarily to the previously regulated sector, namely deciduous and citrus, where most products such as apples and oranges have now become mainstream commodity products. A reasonable amount of cohesion still exists across the supply chain in these sectors, since many companies still use logistical systems that were developed during the regulated era.

Being a free-market model, not all companies make use of these facilities and the systems only apply to the SA legs of the supply chain, not to overseas. Therefore, the result is that duplicate information capturing and much manual information processing is standard practice. While these factors all question and erode the reliability of the information, the degree of proprietary standardization across the supply chain is still reasonably high.

One of the most critical choices that companies in SA are starting to face is whether they will continue to compete in a purely liberalized market structure, or collaborate in a networked environment. The problem with a strong market approach is that it is very difficult to integrate systems effectively, because trading partners are unwilling to create transparency and logistics activities are planned individually. In a networked environment, companies would strive for connectivity, transparency and collaborative planning (Van der Ham *et al*. 2002a; 2002b)

Adopting a more network-oriented approach does not mean that the industry should be regulated again. Industry players have learned valuable lessons from competing in a free market and increased competition has led to a more competitive market. Players are able to respond quicker to market demands and cater for niche markets that could not be catered for via the pooling system of the regulated era. However, the SA fruit industry could really benefit by taking the next step towards a more competitive position by promoting collaboration. This process has only just begun and there is still much room for improvement. Fortunately, the industry is at a point where it is much more receptive to closer collaboration, which is an important factor for implementing automated traceability.

2.2 Purpose of the research

The purpose of this research was to assess the feasibility of effective information access and automated traceability in the South African fruit export industry.

2.3 Research design

The research entailed an exploratory and qualitative study, mainly incorporating a background literature study, the study of relevant industry documents, for example minutes of meetings, as well as semi-structured interviews with 27 key stakeholders and experts from the industry. The interviews were followed-up by e-mail correspondence to clarify certain key issues. Three major areas were covered:

- The SA fruit export industry was reviewed to get an overview of its associated business, business information needs and environment.
- The case for traceability was examined to understand what traceability really is, to determine why it is important and to gain an appreciation of the SA fruit export industry's position in this regard.
- The technologies in the consumer packaged goods industry in the automation of supply chains and the applicability of its associated benefits to the SA fruit export industry were investigated. Experiences from the consumer packaged goods industry in the automation of supply chains were reviewed to understand why global trading standards are likely to influence the SA fruit export industry, as well as determine if these experiences set a precedent for implementing automated traceability in the SA fruit export industry.

The findings were used to make a case for the feasibility of enhancing information access by implementing automated traceability in the SA fruit export industry.

2.4 Scope and limitations

The study only examined the feasibility of implementing automated traceability in the SA fruit export industry. Therefore, while it might be useful for other countries that export fruit, the study is limited to the SA fruit export industry. Further, while the study provides an overview of traceability for all fresh produce supply chains, the feasibility of implementing automated traceability is limited to fruit supply chains.

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3 The case for traceability

3.1 What is traceability?

Over the past 10 to 15 years the traceability of food has emerged as a voluntary and regulative framework to bridge the information gaps between farmer, food producer, food retailer and consumer. Recent food crises like the BSE (mad cow disease) outbreak and H5N1 avian influenza have re-focused attention on the importance of critical information, as well as traceability, as a solution to rebuild low consumer confidence in the food supply chains (Opara and Mazaud 2001). The issues surrounding traceability are also affecting the fruit export industry in South Africa.

Many definitions, with more or less the same emphasis, exist for traceability. However, some confusion relates to the difference between the terms 'tracking' and 'tracing' and the resultant three forms of traceability. The definitions are as follows:

- ISO 8402 defines traceability as the 'ability to trace the history, application or location of an entity by means of recorded identification' (EAN International 2003b).
- European Union Regulation (EC) No 178/2002 defines traceability as the 'ability to trace and follow a food, feed, food-producing animal or substance intended to be or expected to be incorporated into a food or feed in all stages of production, processing or distribution'. The traceability clauses in this regulation came into effect on 1 January

2005.
- The Fresh Produce Traceability guidelines (FPT Guidelines) define traceability as a 'verifiable method to identify growers, fields, and produce in all its packaging and transport/storage configurations at all stages of the supply chain' (2003:7).
- *Automated traceability* can be defined as the ability to identify the movement of an item or logistics unit in the supply chain in real time via automated (without human intervention) inter-party and inter-systems data connections and interchanges, with the results reported directly to the point of enquiry (Agrícola San Bernat de Carlet Cooperative 2006).

In practice, these definitions require all food and feed business operators to have systems in place that can help them identify from whom they have received a food or feed and to whom they have sold a food or feed (one step forward and one step back), enabling quick access to all necessary records pertaining to a food or feed.

To understand these definitions more clearly, a distinction should be made between the terms 'tracking' and 'tracing'. *Tracking* is the capability of following the path of a specified unit of a product and/or batch through the supply chain as it moves between organizations towards the final point-of-sale or point-of-service. *Tracing* on the other hand is the capability to identify the origin of a particular unit and/or batch of product located within the supply chain by reference to records held upstream (FPT Guidelines 2003:7).

Any entity that requires tracking or tracing must be *uniquely identified* by a key that enables retrieval of all available data about the entity's history, application or location. Based on this key, traceability requires pre-defined *data to be captured and recorded* in the supply chain. Hence, the accuracy and speed of data capturing, recording and retrieval will determine the effectiveness of the system. The physical flow of products must be mapped to the flow of information associated with those products. For this to take place, each supply chain actor must *communicate traceability data* (information flow) to the next one allowing the next actor to apply traceability principles. All partners in the supply chain are therefore responsible for playing their respective key parts in ensuring that they are *linked to their trading partners*. If one of the links is missing between what is received, produced, packed, stored and shipped across the entire supply chain, the information chain is interrupted and traceability has failed. Traceability therefore requires a high level of supply chain co-operation (EAN International 2003b).

After establishing the definitions for traceability, tracking and tracing, it should be pointed out that traceability of fresh produce could take on three main forms (Fresh produce traceability project meeting 2003a):

- Identifying the origin of a product, and then tying the product to the farming records
- Tracking a product through a facility or internal processes such as packing, pool packing, juicing and palletizing
- Tracking and tracing products through the supply chain, typically applying a 'one step forward and one step back' approach. The supply chain aspect is the most difficult to achieve, as this involves synchronizing information systems through the supply chain, which demands a high degree of transparency and collaboration between supply chain participants.

3.2 Drivers of traceability

Consumer safety has become one of the hottest topics of discussion in the food supply chain spurred on by things like the BSE (mad cow disease) and the H5N1 avian influenza outbreaks, food poisoning from *E-coli* bacteria, chemical residues found on fresh produce

and by the genetic modification of crops. This has resulted in new regulations, in terms of which all fresh produce exported from South Africa to the United States of America (USA) and the European Union (EU) will need to be traceable throughout the supply chains (Miraglia, Berdal, Brera, Corbisier, Holst-Jensen, Kok, Marvin, Schimmel, Rentsch, Van Rie and Zagon 2004; Opara and Mazaud 2001). This will affect more than 80% of fruit exports from South Africa.

In case of a food safety incident, batch level control and recall will be required in fruit supply chains. It will therefore be necessary to receive and maintain a full history audit from the overseas retailer back to the farmer and even the orchard or block where the fruit was grown. This will require more precise operations and records than are presently applied. Further, legislation demands that traceability information be available within four to eight hours in case of a food safety incident (Van Hofwegen, Becx and Van den Broek 2005). With the high volumes of fruit exported by SA as well as the risk involved, providing traceability within this time-frame will require an effective and cost-efficient automated traceability system based on common procedures and standards.

Several compounding factors are therefore driving the need for traceability in the food chain. Many stakeholders see the main driver to be 'management of business risk and the associated need to be able to establish due diligence' (European Food Safety Authority 2002:3). Another big driver is the fear factor, not only because of food safety risks but also because the consequences of food scandals can be extremely high and painful for both those directly involved and those in positions of authority such as management or government.

In reaction to the concerns for food safety, a combination of legal and trade requirements are forcing stakeholders to implement traceability systems. While suppliers of fresh produce often view these trade and legal requirements as threats, traceability is also driven by opportunities. These opportunities include fresh produce that has become a destination category in retail stores and competitive advantage through being an early adopter of traceability systems, thereby laying the groundwork for improved supply chain collaboration and effective access to information (Bollen 2004; McLeod 2006).

In the event of a food safety problem, the advantage of tracing is the ability to react quickly. The following process would typically be followed:

- Identify the product and the problem
- Identify the origin of the product
- Identify the origin of the problem (might differ from the origin of the product)
- Identify other products at risk
- Identify where all other products at risk are located in the supply chain or market
- Take appropriate action and if necessary withdraw or recall all other products at risk from wherever they are located.

The measure of effective traceability is therefore accurate and rapid batch recalls. This process can be very complex especially if large volumes of fruit are involved. However, the tools are available for the entire process to be automated through appropriate use of information technology (Food Safety Authority of Ireland 2002).

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4 Automation of supply chains in the consumer packaged goods industry

More than 20 years of experience in the consumer packaged goods industry has shown that global standards are necessary for the automation of supply chains. Since 1999,

manufacturers and retailers in the global consumer packaged goods industry have spent almost one billion dollars on e-commerce activities that would make the supply chain more effective. Supply chain participants will benefit from standardized data formats, ranging from productivity gains and working capital reduction to revenue gains and increased customer satisfaction for companies of all sizes. The potential benefit is the same for manufacturers and retailers with an impact of 10 to 15% on the bottom line for both (Cap Gemini, Ernst & Young 2003:5).

Companies are confronted with two main challenges. The short-term challenge is to ensure that the industry completes the development of basic e-commerce building blocks and consequently capitalizes on the investment that has been made over the last five years, whereas the longer-term challenge is to quickly develop next-generation technologies in a way that avoids repeating mistakes of the past (Joint Boards of FMI and GMA 2003:1).

In the mid-1990s the Internet was established as a sound commercial service with consequent increases in global trade (globalization). The complexity of dealing with multiple private, regional and community data and messaging and technology standards was soon shown to be a limiting factor in achieving the potential of the Internet, and this logically led to a move to define and adopt global e-commerce standards. This task was taken on by international standards bodies and interested retail and manufacturing partners. Their resultant experience and mechanisms are available to the relatively immature and less sophisticated fresh produce supply chains (Fresh produce traceability project meeting 2003b).

The Global Commerce Initiative (GCI) recommends a set of basic building blocks for e-commerce that is based on the EAN.UCC system. The building blocks build on (a) common identification and numbering standards together with (b) common messaging standards, to form the basis for (c) global data synchronization through a single global registry.

4.1 Common identification and numbering standards

4.1.1 EAN.UCC global trade item numbers

The EAN.UCC numbering system identifies products and services at every stage of production and distribution by assigning a unique number to each. The barcode is the most visible part of the numbering system, but it is the actual numbering structure of the EAN.UCC system that allows for globally unique identification. All users of the EAN.UCC system follow the same coding rules, eliminating confusion, duplication and misinterpretation (FPT Guidelines 2003:9).

The global trade item number (GTIN) is the EAN/UCC 14-digit global item number for uniquely identifying products and services. The GTIN is an umbrella term used to describe the entire family of EAN.UCC data structures used for identifying a single item or different sizes and combinations of an item. For example, it can be a box, case, pallet or any other type of packaging used for shipping and handling.

4.1.2 Global location numbers

An EAN global location number (GLN) is a 'numeric code that identifies any legal, functional or physical location within a business or organisational entity such as whole companies and subsidiaries (legal), a specific department (functional), or a particular room in a building (physical)' (EAN International 2003a:6). The FPT Guidelines also recommend the use of a GLN code to identify the packhouse since identifying locations is essential for electronic data interchange (EDI) messages, transport information for logistic units and physical location marking (e.g. departments and loading docks).

4.1.3 New emerging technologies: RSS and RFID

The latest development in space-constrained identification is reduced space symbology (RSS). Apart from enabling the identification of smaller products that could not be marked with existing barcodes, it can also carry more data. Furthermore, unlike existing price look-up (PLU) codes which are only human readable, RSS is machine readable and is therefore a much more reliable way to represent data, for example, at cash-out. Areas of application include variable measure trade items, very small items, logistic applications and individual fruits and vegetables (Golan, Krissoff, Kuchler, Calvin, Nelson and Price 2004).

Radio frequency identification (RFID) or the 'smart tag' or 'electronic product code' (ePC) allows products to be tracked and monitored throughout the supply chain without human intervention. Owing to the advanced developments in microchip and radio frequency technologies, it has become feasible to implement frequency enabled microchips containing a unique code (electronic product codes or ePCs) on pallets, cases and even individual products. The systems are already available for implementation and work is currently conducted to bring tag costs into a range that is acceptable. The cost of the tag is only a small part of the total cost, since the use of RFID would require systems throughout the chain to be enhanced, for instance by installing RFID reading devices at strategic points such as cold store chamber doors and packing and palletizing points (Das and Harrop 2006; Persinos 2006).

As is the case for RSS, RFID promises numerous benefits that would result in a fundamental change in current supply chain operations and effective information access. Industry experts predict that around 2008 to 2010 the RFID 'grid' would be largely completed and RFID would be widely used (Das and Harrop 2006; Persinos 2006). However, the adoption of global data synchronization might lead to faster adoption of RFID than is predicted.

4.2 Common messaging standards

In 1987 the EAN General Assembly launched EANCOM® for electronic data interchange (EDI) and by the end of 1999 more companies in the consumer packaged goods were using it than any other national standard.

It has often not been cost effective for small and medium-sized companies to take advantage of the benefits that EDI offers (E. Lawrence, personal communication, 28 May 2003 – Programme manager of e-commerce, Pick ‘n Pay, P.O. Box 23087, Claremont, Cape Town, South Africa, 7735). The introduction of the Internet has created the potential for a financially viable 'virtual bridge' between EDI users and small and medium-sized enterprises. The catalyst that has opened up the Internet as business communication network is extensible markup language (XML). XML allows information to be encoded with meaningful structure and semantics in notation that is very accessible, by using 'tags' to instruct a computer how to handle a text file. It is both human-readable and readily processable by computers. Furthermore, it provides 'intelligent' information in a 'technology neutral' standard (Petragnani 2003:1). In July 2001, the first XML schemas based on EAN.UCC System standards were released to allow business-to-business (B2B) users to conduct Internet-based e-commerce using a global language.

Probably the most significant framework that has been developed for XML communication is electronic business XML (ebXML). ebXML requires each company to define a collaboration profile. Multiple companies then form a collaborative agreement based on their individual profiles. This enables complex, collaborative and automated relationships between multiple companies in a very flexible way that can be modified at low cost to accommodate changes in the working environment. One of the most attractive benefits of ebXML is that it requires very little cost for small companies; for example, free e-mail clients that are able to generate ebXML messages are available. Furthermore, existing XML-based processes may

be incorporated into the ebXML framework. Currently, initiatives are being considered to develop ebXML for the fresh produce industry (E. Smith, personal communication, 15 July 2003 – Eric.Smith@fruitcom.com; www.ebxml.org).

What has to be taken in consideration is that XML messages require much more bandwidth than proprietary message standards. Technically SA does have the required bandwidth available; however, the current business stance of the largely monopolistic telecommunications industry in SA might be an influencing factor not allowing the efficient use of XML messages initially.

4.3 Single global registry and continuous data synchronization

Efficient EDI requires suppliers and customers to have identical information in their trading databases, thereby ensuring that information exchanged about purchase orders, invoices and future plans are correct and reliable. This implies unique registration of each item, party, or location in the industry, facilitated by a single global registry. Brian Smith, CEO of EAN International, says that the registry can be seen as a 'white pages' telephone directory which provides the core data, enabling comprehensive information to be quickly located in the right data pool (UCCnet 2003).

In October 2002, the Uniform Code Council, Inc. (UCC), EAN International and the GCI endorsed UCCnet (a tax-exempt, neutral, electronic community) with its GLOBALregistry™ service as the 'central item data registry for international commerce' (UCCnet 2003). A governance process, under the authority of an expanded EAN International, manages the registry, but the services are delivered by UCCnet (Joint Boards of FMI and GMA 2003:2).

The SA fruit export supply chain systems do not presently provide automated traceability and the drive to explore how to improve efficiencies in fruit export supply chain information practices is diluted by the fragmentation that happened in the industry after deregulation. Implementing such an automated traceability system for fruit exports would strengthen SA's position with regard to meeting the increasing food safety and traceability requirements of the major markets. Furthermore, it could provide greater efficiencies in the supply chain, allowing the SA fruit export industry to be more responsive and competitive than is presently the case.

The consumer packaged goods industry in South Africa has also become involved in the global data synchronization process through EAN South Africa (now GS1 South Africa; refer to www.gs1za.org) and the Consumer Goods Council of South Africa. A national product data catalogue has been developed for suppliers and retailers to synchronize item and party data on a national level. The product data catalogue has been developed to enable global data synchronization. However, the process is still in its infancy, and the first goal is to get a critical mass of suppliers and retailers to synchronize data (E. Lawrence, personal communication, 28 May 2003 – Programme manager of e-commerce, Pick ‘n Pay, P.O. Box 23087, Claremont, Cape Town, South Africa, 7735).

4.4 Application of global data synchronization to fresh produce

Global data synchronization will provide a solution to the fresh produce industry's main challenges, by allowing companies: (a) to effectively access information, (b) to respond to traceability requirements thereby gaining consumer confidence, and (c) to automate supply chains for efficiency benefits.

Global data synchronization will, among other things, enable traceability by providing

generic product identification (e.g. granny smith apple packed in 18.5 kg from SA count 40). Traceability on the other hand, is primarily 'concerned with a specific "instance" or batch of a product' namely the 'particular growing, packing or dispatch batch' (E. Smith, personal communication, 2 August 2003 – Eric.Smith@fruitcom.com). Any data system that wants to support traceability needs to provide both 'generic product identification' and particular information associated to a specific 'instance' or batch of that product.

There are significant benefits associated with automated supply chains for companies of all sizes. The strong buying power of retailers dealing directly with customers allows them to lead this drive for greater supply chain benefits. Retailers are increasingly focusing on low prices, cost containment and supply chain management. By applying global data synchronization to fresh produce, thereby allowing full automation of supply chains, retailers will for the first time be able to experience advanced supply chain management benefits such as efficient consumer response (ECR) and collaborative planning, forecasting and replenishment (CPFR) in fresh produce supply chains. This is why trade requirements have been increasingly focused on demanding the use of global standards, the EAN.UCC system, from trading partners to support traceability of fresh produce. Therefore, while traceability is seen as a prerequisite to trade, the buying power of retailers enables them to demand which standards should be used for traceability purposes, thereby also enabling greater efficiency.

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5 Automated traceability in South Africa

Over 20 years of experience in the consumer packaged goods industry indicates that it is necessary to adopt global standards for the automation of supply chains. The previous sections have illustrated that much work and investment have been made to develop e-commerce building blocks that will support the automation of supply chains. These building blocks have already been implemented in the consumer packaged goods industry because of the efficiency benefits associated with it.

The e-commerce building blocks for the automation of supply chains are now also available to the relatively immature fresh produce supply chains. These building blocks provide solutions to the two main challenges faced by the fresh produce supply chains, namely traceability requirements and the need for additional efficiencies. The building blocks provide automated traceability which will enable the identification of an item or logistics unit as it moves in the supply chain, through automated (without human intervention) inter-party and inter-systems data connections and interchanges, with the results reported directly to the point of enquiry.

SA is exporting high volumes of fruit to the EU that is of significant value to the SA economy (Da Luz 2005) and therefore cannot afford the risk of not having an effective and efficient traceability system in case of a major food scare or batch recalls. Implementing automated traceability based on the abovementioned building blocks will allow the industry to build consumer confidence and gain a competitive advantage over other exporting countries that are not able to provide traceability to these major markets.

The SA fruit export industry will also be able to experience much needed efficiency benefits from an automated supply chain (Bollen 2004). A general global oversupply of fruit has caused fruit varieties such as apples and citrus to become commodity items (Du Toit 2000). The increasingly price-driven markets together with the increased cost pressure from traceability requirements have created a need for efficiencies in especially these sectors, which comprise the highest export volumes by far, to stay competitive. Automation based on global standards will enable an integrated and synchronized information chain for planning

and optimization to match the supply and demand of information solving most of the bottleneck problems in the logistics chain. Good examples of the outcomes of automation are shorter inventory cycles and optimized shipping plans. A more competitive supply chain will provide strategic advantage as competition has changed from within supply chains to competing against supply chains (Mouritsen, Skjøtt-Larsen and Kotzab 2003). The SA fruit export industry could use this strategic advantage as a weapon against other southern hemisphere competitors.

Depending on their commercial environments, companies of all sizes will be able to experience the benefits associated with an automated supply chain. A large proportion of SA fruit is supplied to retailers and much competition exists among suppliers worldwide to get the attention of retailers who are looking for efficient and effective suppliers. This explains why trading partners of some suppliers in the SA fruit export industry are demanding the EAN.UCC system. SA suppliers who are able to take advantage of enhanced supply chain benefits like ECR and CPFR, could secure long-term, mutually beneficial relationships with retailers receiving a premium for their products.

Regardless of deregulation, much cohesion in terms of proprietary standards still exists in the previously regulated deciduous and citrus industries. Therefore, cohesion as well as the business need and high production volumes should create willing participants, thereby making adoption of automated traceability in these industries much easier.

Interviews with major stakeholders in the SA fruit export industry indicated that stakeholders view traceability requirements as significant and are open to the adoption of global standards and technologies. More specific results indicate that the SA fruit export industry should adopt the EAN.UCC system. Some major exporters have already adopted the EAN.UCC system.

The SA fruit export industry will benefit from being an early adopter of the global standards and technologies. Stakeholders believe that the industry would adopt these standards and technologies within the next few years. This will allow the industry to proactively participate in the possible incorporation of necessary local standards through the GSMP of GCI while the adoption of these technologies in the fresh produce industry is still in its early stages. Early adoption of these technologies will allow the industry to once again position itself as a leader in the innovative use of information technologies against other southern hemisphere competitors.

While cost of implementation could be an inhibitor to early adoption of these standards and technologies, it seems that adoption will mainly depend on trading partner requirements and traceability pressures, as well as the leadership role that industry and government bodies play to communicate the benefits of these technologies and standards to stakeholders.

It can be expected that growers-exporters, along-side with Fruit SA, would lead the momentum in the adoption of these standards and technologies. However, industry stakeholders believe that it is the responsibility of Fruit SA to take on a more prominent leadership role in this momentum. Recent industry and national level support is promising: the National Department of Agriculture (NDA) and the Boards of Fruit SA and the Fresh Produce Exporters Forum (FPEF) have shown serious commitment by supporting customized traceability courses offered by the SA Agri-Academy and the Consumer Goods Council of SA; Fruit SA has commissioned an information technology (IT) guide and has committed itself to develop a five year industry plan; and the industry is participating in international fresh produce discussions.

Other supportive thinking, such as Operation Synergy, the Information Communications

Procedure developed by the Council of Scientific and Industrial Research (CSIR), the starting of the Citrus South Africa Information Work Pool, and the EDI strategy of the Perishable Products Export Control Board (PPECB), will also offer very useful support for the implementation of an automated traceability system.

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6 Conclusions

Based on inter alia the above research, including numerous interviews with key stakeholders and experts in the industry, the following conclusions can be deduced:

- Serious information fragmentation since deregulation of the industry in the previous decade, as well as the need to manage costs very carefully in a highly competitive market, created the need for effective access to information of the whole supply chain and all activities.
- Legal and trade-related traceability pressures require the SA fruit export industry to have automated traceability in place, based on global procedures and standards.
- The business need for greater efficiency benefits in the SA fruit export industry requires automation of the industry's supply chains based on global procedures and standards.
- Already developed and tested technologies in the consumer packaged goods industry, that will provide automated traceability and significant efficiency benefits, are available for implementation in the SA fruit export industry.
- The SA fruit export industry will have a competitive advantage over its southern hemisphere competitors by being an early adopter of these global standards and technologies.
- Enough cohesion, willing participants and supportive thinking seem to exist in the previously regulated deciduous and citrus environments to create the necessary critical mass for the implementation of these global standards and technologies.

Hence, given the need for effective access to integrated information, automated traceability, the need for efficiency benefits through automated supply chains, available technologies based on global standards and procedures, the opportunity to gain a competitive advantage over southern hemisphere competitors, and enough cohesion, willing participants and supportive thinking, it is concluded that more effective access to information and automated traceability are feasible for the SA fruit export industry.

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