

Agriproduct Supply-Chain Management in Developing Countries

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Analysis of the Constraints to Banana Industry Development in Indonesia Using the Supply Chain Concept

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Abstract

Banana is the highest production fruit in Indonesia. The fruit is sold mostly on the domestic market. A supply-chain approach was used to analyse constraints to banana industry development in Indonesia, with a view to determining research and development (R&D) priorities. Two supply chains were characterised through participatory interviews and discussions involving the research team and the respective participants in the chains. The first supply chain was a traditional banana supply chain from the Cikalong subdistrict, Cianjur district, West Java, supplying mainly the traditional markets in Bandung and Jakarta. The second supply chain was that of 'company X' supplying bananas to supermarkets in the Jakarta, Bogor, Tangerang and Bekasi metro areas. The chain characteristics were mapped to describe the flow of product, funds and information. SWOT analysis was performed to identify areas for improvement in the chains. The suggested improvements were compiled and classified under the six principles of supply-chain management (SCM): knowing customers and consumers; creating and sharing value; getting the product right; logistics and distribution; information and communication; and effective relationships. The research team and representatives of the supply chain selected the five most-important issues for both supply chains. The results indicated that the most-important constraint in both supply chains was getting the product right. This indicates that the current emphasis of research and development on improving on-farm production and postharvest practices should continue. However, there are other factors that need to be addressed, such as getting adequate supply of the right product, and making sure that improvements do not impair sociological and other aspects of the chain.

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Production of banana in Indonesia is the highest of all fruit crops. For example, banana production was 4,384,384 t in 2002, compared with 1,402,906 t for mango and 968,132 t for citrus (Badan Pusat Statistik 2002). The main banana production areas are in Java, Sumatra, Celebes, Bali and, increasingly, Kalimantan. In Java, production occurs in West, Central and East Java. West Java includes the districts of Sumedang, Tasikmalaya, Lebak and Cianjur. Central Java includes Cilacap, Grobogan, Brebes and Kendal, and East Java includes Bojonegoro, Sumenep, Jember and Pasuruan.

The markets for banana are located in cities on the producing islands, such as metropolitan Jakarta, Bandung, Semarang, Yogyakarta, Surabaya and Malang for Java. There are also holiday resort areas like Bali and, potentially, neighbours like Singapore which is close to Sumatra. Distance from the producing areas to these markets can be short, such as from West Java to Jakarta or Bandung, or long, such as from Sumatra to Java. There are two main types of market: the traditional, long-established markets, and the rapidly expanding supermarket businesses such as Matahari, Carrefour, Goro, Hero and Kemchicks.

In Indonesia, there are two broad groups of farmers. The smallholder farmer has 0.5–5 ha of banana. These farmers often use low technology. They are the main clients for the technology produced by the Indonesian Agency for Agriculture Research and Development (IAARD), in close collaboration with extension workers. The large-scale farmers have more than 5 ha (in one case up to 2000 ha). They often use more production and postharvest technology than the small farmers. In some instances, the technology is sourced through collaboration with larger producers such as Chiquita and Del Monte.

Justification

The Indonesian government is eager to improve the banana industry and incomes to growers. In the past, emphasis has been mainly on improving production practices. However, with the growing supermarket sector, it is important to reassess the R&D effort to ensure it is addressing the main areas that are affecting the performance of the industry.

The focus of the Indonesian R&D effort is on smaller growers and their supply chains. These chains involve a large number of members, with both economic and sociological characteristics. In developed countries, the supply chain or value chain is

increasingly being analysed and treated as the whole unit rather than as individual components, on the basis that the chain is an interdependence of members seeking to develop a competitive advantage for the whole chain (Woods 1999; Anon. 2003). However, in developing countries the chains have rarely been studied as a whole unit, but rather as individual links.

Methods

The method was developed by considering both the concept of supply-chain management (SCM) and the nature of the banana industry in Indonesia (empirical evidence). The supply chain concept itself is more established in the manufacturing industry sector than in agriculture. Therefore, to apply the SCM concept to the banana industry, the concept needed some adjustment, so that it could be adopted in the circumstances applying in Indonesia. Previous experience and the results of the desk study confirmed that evaluation of banana industry development required a more-comprehensive and systematic approach. Previous banana-industry studies focused heavily on the production sector (agronomy, cultivation etc.), while only some touched briefly on socioeconomic aspects (marketing, socioeconomic characteristics of the producers and consumers etc.).

Relatively little has been written about the process engendering chain management in Indonesian agriculture, especially in banana growing, where overall production is scattered and involves very small-scale farms.

At a first workshop, held at IAARD, Indonesia, the concept of SCM and the empirical evidence came together, which ensured that the final methods used would be relevant to smallholders and would be participatory in nature. The workshop was attended by representatives of key members of the Indonesian supply chains (small growers, traders, traditional markets, and supermarkets), as well as members of both the Indonesian and Australian project team. At the workshop, the research team strategically identified case-study locations (Cikalong representing SC1, and company X representing SC2). During the workshop, the team identified the relevant partners from each of the supply chains and collected baseline information on the nature of banana supply chains in Indonesia. It also gathered data on the banana industry, including previous R&D activities.

As a result of workshop 1, the Indonesian team developed the framework for their study. The frame-

work was then refined during discussions with the Australian project team to provide the final methods used.

In the case studies, the Cikalong supply chain (SC1) was chosen because it is the major producer of banana to Jakarta, the chain has the potential to improve, with benefits to the members, and because it is a good example of how the local government ('Pemda through Otonomi Daerah') has enthusiasm to take the initiative to create new value and greater competitiveness for the banana industry in its region.

Company X (SC2) was chosen because it is innovative and is a key driver in the chain to increase the flow of benefits to the members from any improvements made to the chain.

Information was gathered through individual discussions with members of the supply chains, and through discussion groups with representatives of several sectors of each chain.

At a second workshop, held at the Department of Primary Industries (DPI), Brisbane, Australia, the results of the two case studies were presented and dis-

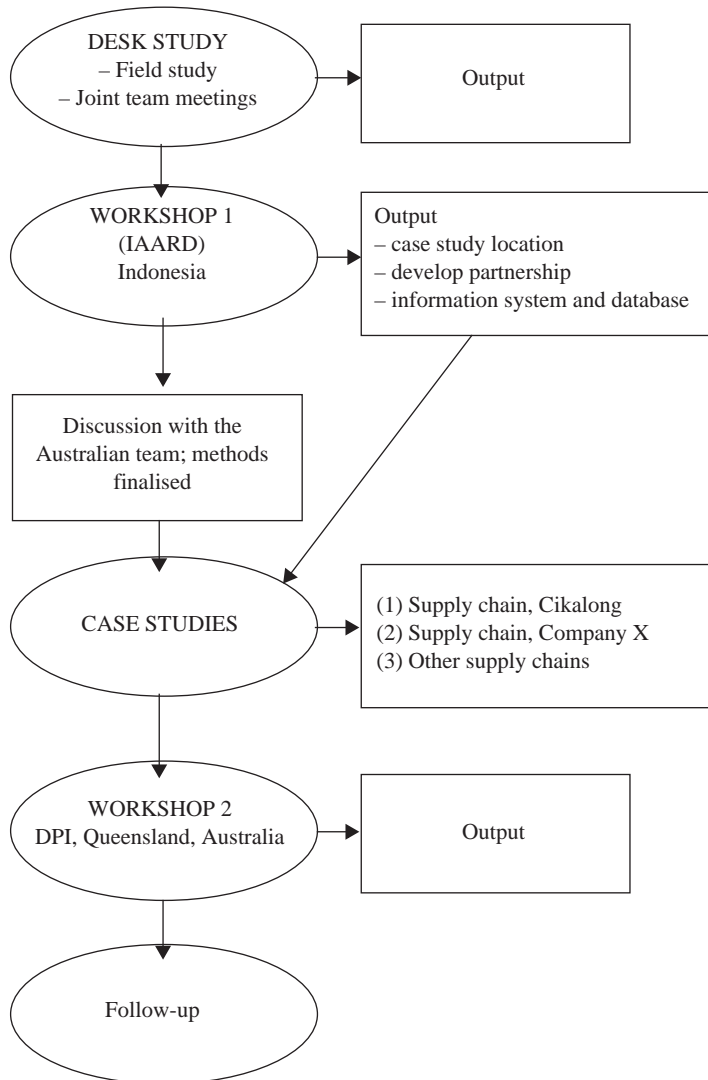


Figure 1. Outline of the methods used in the supply chain analyses.

cussed. The workshop was attended by the Indonesian and Australian teams, as well as a trader representative from Cibedug, Ciawi, Indonesia, and one representative of local government from the Agriculture Service of Cianjur District, Indonesia. The objectives of the second workshop were to develop and test the SCM method for the banana industry. The six areas of SCM were used to develop a list of potential improvements for both case studies (SC1 and SC2), and prioritise these improvements in relation to their potential to improve the industry.

Results and Discussion

Background data

Desk study

Information regarding the general overview, statistical data, and previous research results on breeding, crop management, crop protection, postharvest, and agri-economics were collected during the desk study. The results are briefly presented as follows:

Indonesian banana production is mainly by smallholders, with the average area of farmers' plantations less than 0.5 ha. Banana production was about 4,384,384 t in 2002, about 68% of it from Java. Banana-production systems in Indonesia can be categorised into backyard, mixed crop, commercial smallholder and agribusiness enterprises.

Indonesia is part of the centre of origin of banana. There are more than 325 banana cultivars, with about 14 cultivars being commercially grown. Among these are Ambon Putih, Ambon Lumut, Emas, Raja Bulu, Raja Sere, Badak and Lampung (table bananas) and Tanduk, Uli, Nangka, Kepok, Siem and Kapas (plantain).

Although banana production has increased from 1997 to 2002, the production area has declined from 1997 to 1999. This has been caused by the outbreak of several pests and diseases, especially in the main areas of banana production such as Central Java, East Java, Sumatra, and Sulawesi. The major banana diseases in Indonesia are Panama disease (*Fusarium* wilt disease), blood disease and moko disease (bacterial wilt disease).

Banana research has been receiving more attention lately because of the increased domestic demand for good-quality fruit.

Research in breeding

Very little research in banana breeding has been done in Indonesia. This is understandable, considering

the wide diversity of banana germplasm existing. Breeding has been done through hybridisation, somaclonal mutation and selection. The Indonesian Fruit Research Institute (IFRURI) had established two cultivars, Ketan-01 and Raja Siem, which are tolerant to bacterial wilt. Two promising cultivars, i.e. Barifita 01 (mutant from cv. Barangan which is productive and dwarf) and Sepatu Amora (tolerant to the vector of bacterial wilt). The assessment of *Fusarium* resistance via in vitro selection has also been done to find resistant cultivars to this disease.

Crop management

The characteristics of banana production in Indonesia are small-scale, minimum technological inputs, high variability of the cultivars, little capital, no irrigation and planting material coming from suckers.

Crop protection

Reported pests are leaf curler (*Erionatha thax* L.), pseudo stem borer (*Cosmopolities sordidud*, Germar), stem borer (*Odoiporus longicollis* Oliv), thrips (*Chaetanapothrips signipennis*), scab moth (*Nacoleia adasema*), and nematodes such as *Rhizopholus similes* Cobb, *Pratylenchus* spp., *Helicotylechus multicinctus* Cobb and *Meloidogyne* spp.

The main diseases are *Fusarium* wilt, bacterial wilt, leaf spot/black sigatoka and bunchy top. The other diseases are anthracnose, Panama, Cordona and rotten young fruit.

Postharvest

In developing postharvest technologies for Indonesia, there are still some gaps for research such as the characteristics of plantains, more applied research on improvement of ripening, and disease resistance of the peel. Socioeconomic aspects have received little attention.

Agro-economy

A study of agro-economics by Sudaryanto et al. (1992) described the circumstances of the international and domestic markets in mainly Jakarta, and reported two different marketing channels for bananas coming from Lampung and from South Sumatra. This study also investigated the marketing margin in West Java and gave examples of the flow of bananas from the major producing centres in West Java to a major consuming centre in Bandung.

Field study

Both teams visited the Lampung banana-producing centre to collect additional information. They

visited the regional agriculture authority, Nusantara Tropical Fruits (NTF), a small farmer at Padang Cermin, West Lampung, a banana crisp company, and a truck driver at Bakahueni port (connecting Java and Sumatra). One aspect of improvement was more rapid movement of trucks through the port.

Workshop 1

Recommendations from the workshop were as follows:

In developing the banana industry in Indonesia, a breadth of information is required, such as knowledge of banana production, including the agro-ecological zones (AEZ), farmer behaviour and organisations in relation to improving knowledge and practices, and research on production, postharvest and processing practices.

There were two types of farmer in Indonesia: large-scale farmers such as NTF, and small-scale farmers. Large-scale farmers need little assistance, whereas the small farmer still requires assistance. Small-scale farmers had characteristics such as subsistence with little technological inputs, scattered location, low productivity and low-quality product. The main pests and diseases are Fusarium and bacterial wilt, there are many varieties of bananas grown, and low adoption of research results.

Improvement of postharvest handling practices cannot be made without considering on-farm practices. There are still research gaps. Banana-crisp processors can produce high-quality product and establish good markets even though the quality of fresh produce remains low.

The percentage of the retail price received by the farmer was considered to be low. Thus, increasing the market or retail price in the market may not increase the price to the farmer.

Cikalong, Cianjur was recommended as a location for a case study since Cianjur is a model for banana agribusiness development and there are loosely organised and structured grower groups 'Gapoktan Serba Pisang'.

Supply-chain case studies

Cikalong (Cianjur) supply chain (SC1)

Product flow. Bananas are distributed from farmers to consumers in wet markets and supermarkets in the big cities through village collectors, large traders or supermarket suppliers. Some farmers sold their best-quality product directly to street vendors.

The percentages of product sold to the wet markets, supermarkets and street vendors are ca. 95, 4 and 1%, respectively.

Cash flow. Village collectors were the primary buyers of farmers' product. They bought the product from farmers at harvest in cash, or made an advance payment before harvest and the balance at harvest. Many village collectors received funds from large traders in the consumer markets, but some used their own capital.

Information flow. The main information shared by every member of the chain was the quality required by customers and consumers, both wet market and supermarket. The quality requirements were determined by the variety and maturity. The highest prices were for varieties Tanduk and Raja Sereh, followed by Raja Bulu, Ambon Lumut, Muli and Nangka in that order. For all varieties, the more mature the harvest, the higher the price.

Information about price was limited to the large trader level. Collector-traders and farmers were price takers.

Although farmers knew that the price received for bananas was influenced by variety and maturity, most of them did not direct their production strategy to fulfil consumer demand because of the cash needed and lack of security. Farmers preferred to grow the Muli and Nangka varieties because of their early maturity and high yield, so that they can get a cash return quickly. Farmers were reluctant to delay harvesting to increase maturity because of the risk of theft of the crop.

Activities to add value. Farmers often harvested and sold their banana before they were mature. Collecting agencies and chain stores and wholesalers do most of the ripening, grading etc., but generally the collectors do very little of this (only about 5%). Two reasons why growers do not ripen their crop are because they get little increase in price for adding value, and ripening too early in the chain will result in transporting ripe fruit with greater risk of damage. Collectors were paid for the transportation costs from the farmers field to their base.

Services. Credit arrangements are the major service collectors provide to growers. Information is not a major part of the services offered.

What determines price? Size, variety, maturity (usually based on how angular the shape is) and ripeness (if the fruit are starting to colour) are the main determinants of price, with variety and size being the most important.

Relationships. Very strong relationships exist between the collecting agent at the subdistrict and district level, and between the district collector and the wholesaler. Several of the relationships are weak, but this does not always mean that they need improving.

How value is created. Most of the value is added from the collecting agency at district level and onwards. Most of the bananas stay on the bunch until they reach the wholesaler.

Key decision-makers. Wholesalers are the main determiners of price, with decreasing influence from retailers, traders and, last of all, the growers. Growers have very little control over price.

SWOT analysis: Cikalong

Strengths. There is a strong capacity to expand the supply chain, because there are many potential players in the supply chain and there is the potential to increase the number of players. There is also the capacity to increase production. Farmers are familiar with growing bananas, so they could increase production if they are rewarded for it. Local government is ready to support the expansion of banana production because banana is one of the top government priorities for further development. It is also the vision of the district government to expand banana production in the district. There is an 'association of banana farmers' in Cikalong, but this is not active at the moment. There are no such associations in other production regions.

Weaknesses. Poor cultivation techniques is a major issue. Because of the lack of capital, the farmers would need to combine resources to buy fertilisers and other inputs.

In 2001, a training program organised by the Agriculture Service's office instructed growers on the benefits of fertilising, but the farmers said it would be of little benefit since the plants would not produce good yields. They would prefer to apply the fertiliser to the higher-value inter-cropped crops directly.

Opportunities. There is an opportunity to develop larger banana orchards to increase the production of high-quality bananas for the supermarket trade, possibly by establishing a larger management structure for banana growers in the same area. This could be on a village basis or involve several villages. There is support available from local government to assist with this.

The potential market for processed banana could be expanded, including processing of other banana

varieties. At the moment, only one variety is processed.

Threats. Among the threats are poor regulation to restrict the movement of diseased plants, competition from banana imports, and the discriminatory policies on banana trade of European countries such as the application on higher import tariffs for non-EU countries.

Company X supply chain (SC2)

Product flows. Previously, bananas from Cikalong and Lebak were delivered to the collectors in bunches. However, beginning in 2003 Company X requested some of the collectors to supply fruit in hands, so as to reduce fruit damage and allow better packing of bananas in the trucks and reduced wastage at the markets. Fruit from Cikalong and Lebak represent about 70% of the fruit supplied to Company X, with the remainder coming from several growers from Cicurug. These growers have about 2–5 ha of banana, and Company X works closely with these growers to produce high-quality fruit. On occasion, Company X obtains banana fruit from the wet markets when normal supplies are low.

Company X separates the fruit according to quality at its main holding facility.

The fruit are delivered to the supermarkets as hands in plastic crates.

Some 55–60% of Company X fruit goes to about five medium-size supermarkets. The company does not supply the larger supermarkets such as Hero and Carrefour because it does not have a large enough supply. Some 5–10% of its fruit go directly to street vendors. Rejected fruit are sent to traders who supply fruit stalls, and also to local wet markets.

The retail shelf space given to local banana is very small because of the low supply of good-quality fruit, even though there is sufficient consumer demand to justify increasing the shelf space. Thus, there is a large gap between supply and demand for good-quality local banana varieties. As a result, the supermarkets give more shelf space to Cavendish and imported bananas.

Company X has started to process some of the rejected bananas suitable for processing. The processed product is sold directly to food stalls.

Cash flow. Company X usually pays cash directly to the collectors on delivery of the banana. For the growers that deliver directly to Company X, because they are larger growers, payment is normally one day later by bank transfer. One problem is that supermar-

kets promise a delay of 2 weeks between delivery and payment, but this has sometimes blown out to 6 weeks.

Prices paid by the supermarkets are set by negotiation between Company X and the supermarkets. It is not a fixed price. However, there is a fixed price for its processed product.

Some of the supermarkets require a payment from the trader to secure shelf space. This is usually a one-off payment at the beginning. Every 3 months the supermarkets asks the traders to join a discount (specials) program. The supermarkets determine the price of specials and the traders have to comply, sometimes taking a loss.

Services. Collectors collect fruit from the growers and deliver to Company X. Some of the collectors are starting to de-hand. Sometimes the collectors actually do the harvesting. Some growers harvest themselves and deliver to the market directly.

Company X provides education to collectors and traditional wet-market sellers on how to handle banana to prevent damage, and also some training to growers on how to grow well and how to the bananas for quality (in Lebak only). Company X supplies promotional material to all of its outlets. It transports the fruit to the supermarkets, and collects fruit from its larger growers and, occasionally, from the traditional markets.

Company X does not consider that it is its responsibility to educate its supply chain members, but considers it to be the role of the provincial and district public-sector staff.

Information flow. Company X considers itself as an 'information resource'. Company X had very good information flow to all supply chain members such as collectors, traders at the wet markets, and traders in Ciawi. Company X also collects information from supermarkets. However, the information flow was strong only between Company X and the street vendors. Between the company and supermarkets, traditional markets, and consumers of processed and fresh product information flow was quite good, while with traders it was marginal.

How effective are the information flows? The closer one gets to the growers the less effective is the information flow.

Having effective grower groups would make it more worthwhile and efficient providing information to these groups. Also, the grower groups could also create a larger 'production unit', which could improve security and production practices.

How well does Company X know its customers? Company X knows its customers well, but it needs to mobilise its collectors to better educate the growers. The government will facilitate this mobilisation. If the company knew its supermarket clients better it might not have to pay the shelf fee and payment for fruit might become more rapid.

How effective are the relationships? Relations between Company X and growers do not exist, except for the two larger growers that live near its facilities. These are the ones that provide good-quality fruit.

How right is the product? There are always quality and quantity problems with respect to local varieties for the supermarkets. The supply of the lower-quality fruit required for the wet markets is not a problem because of its greater supply.

Some of the larger food caterers would also like to include bananas in their food packs for factory workers etc., but they often cannot get enough good-quality fruit. This may be a potential, new client group.

Company X SWOT

Strengths. Strengths are the education provided by Company X to its supply chain members, good relationships with supermarkets and collectors, reputation for supplying good-quality fruit, short distance to the markets, good leader to develop the chain, good knowledge of fruit-quality requirements, good relationships with government institutions, a good management team and good collectors.

Weaknesses. Every supermarket in Indonesia has its own quality standards. There needs to be more standardisation.

Opportunities. There are nevertheless opportunities to provide better education to the supply chain members. It is not enough to just tell the farmers how to improve, there needs to be someone living in the villages to continually assist the farmers. Company X would like to do this but it needs assistance to do so from government or non-government organisations.

Workshop 2

The second workshop was attended by the full Indonesian and Australian team, including Dr Dimiyati (Director, Centre Research for Horticulture) and Dr Winarno (Director, Fruit Production Directorate), Ms Mega (Agriculture Service, Cianjur District), Udih Samanhudi (banana trader/supplier representative for the wet market, Cibedug, Ciawi)

and Dr Greg Johnson (ACIAR) (see Ledger et al. 2002). The objective was to develop and test the SCM method for analysing banana-industry development in Indonesia using the information collected in the above activities, with a view to identifying and prioritising the medium and long-term R&D requirements based on the market requirements and opportunities of the banana industry as a whole agribusiness unit.

The information gathered during the desk and field studies was presented. During the ensuing discus-

sions, areas for improvement were listed and grouped under the six principles of SCM: knowing customers and consumers; creating and sharing value; getting the product right; logistics and distribution; information and communication; and effective relationships.

Each workshop attendee then voted for what they considered to be the five issues that would have the biggest impact in improving the supply chain. The results are presented in Tables 1 and 2.

For the Cikalong supply chain, the issues that received the highest votes were:

Table 1. Voting on steps to improve the Cikalong banana supply chain.

Improvement	Number of persons who voted		
	Supply chain members	Indonesian team	Australian team
Getting the product right			
Village local management – grower groups to increase security, supply and quality	3	7	7
Improve standardisation of product			2
Expand area of production; existing banana growers and additional growers	1	1	1
Improve growers knowledge and practices; cultivation techniques, immaturity, orchard management	2	1	2
Improve local varieties – breed new varieties			
Improve postharvest handling	2	5	6
<ul style="list-style-type: none"> • loading and unloading systems • collecting places (temperature, sun exposure) • handling of bunches. 			
Knowing customers and consumers			
Better information about consumers	1	3	1
Develop niche markets			
Develop new processing markets e.g. baby foods and chips		2	1
Develop export markets e.g. to the Middle East and China etc.		3	
Creating and sharing value			
Growers capture more value – de-hand – ripen		1	4
Logistics/distribution			
Agribusiness terminal	1		1
Improve infrastructure – e.g. roads.	2	3	
Improve delivery system – reduce time lag			2
Information/communication			
Better information from wholesaler – market intelligence signals			2
Better information to growers – standards	1	1	3
Better information from grower up the chain		3	2
Effective relationships			
Improve wholesale × grower interaction.	1	3	1
Other			
Better regulation to protect Indonesia from imported fruit	1	3	

1. village local management – grower groups which could increase security, supply and quality (17 votes)
2. improvement of postharvest handling, loading and unloading systems, collecting places – temperature, sun exposure, and handling on bunches (13 votes)
3. all actors in the supply chain need to participate in knowing about and achieving the necessary standards for the particular markets (10 votes).
For Company X the issues that received the highest votes were as follows:

Table 2. Voting on steps to improve the Company X banana supply chain.

Improvement	Number of persons who voted		
	Supply chain member	Indonesian team	Australian team
Knowing customers and consumers			
A better understanding of what consumers want	2	4	
Educate consumers to recognise and demand higher quality	1	1	1
If growers knew the desired product and had the necessary technology and resources (Rp) they could decide whether to respond	1	2	2
Need to expand market for quality bananas (the market segment is so small it limits investment, despite the opportunity)	1	4	
Creating and sharing value			
Need more Company Xs (innovative)		4	2
Opportunity to increase supply to street vendors, traders, caterers (new customers)		6	
Need collectors to de-hand to increase supply (may be done by terminals)		1	1
Indonesian banana supply chain needs to be competitive with imported bananas/other fruit	1	1	
Getting the product right			
Increase all aspects to get high quality	1	1	3
Ability to ripen bananas more quickly and consistently	2		1
Improve supply in low-supply months (5 months)	1	2	1
All actors in the supply chain need to participate in knowing about and achieving the necessary standards for the particular markets.	1	5	4
Logistics and distribution			
Improve packaging of de-handled bananas to prevent damage during transport		2	2
Information and communication			
Need to educate/empower traders, and through them the growers, to increase high quality supply		1	6
Increase information flow to small growers by forming grower groups for improve information flow and crop management	1	3	4
Effective relationships			
Note system dynamics – not just commercial opportunities		2	1
Potential improvements for those who support/facilitate chains			
Government should facilitate easy access to financial institutions able to assist	2	3	3
Many actors limited by lack of access to capital (Company X, collectors, growers)			4
Better environment for new investments (incentives for new plantations from local government)	1	3	

1. all actors in the supply chain need to participate in knowing about and achieving the necessary standards for the particular markets (10 votes)
2. increase information flow to smallholder growers by forming grower groups to improve information flow and crop management (8 votes)
3. government should facilitate easy access to financial institutions to assist.

For both supply chains (Cikalong and Company X), most of the issues receiving the highest votes related to 'Getting the product right', using approaches such as:

1. formation of local grower groups improving post-harvest handling (loading and unloading systems, collecting places, and handling of bunches)
2. active participation of all actors to agree on the necessary standards for particular market segments.

It was interesting to note similar voting patterns between the Indonesian and Australian team members.

Conclusions

Analysing the Indonesian banana industry using a supply-chain concept provided many insights in relation to constraints to industry development. In addition, the SCM concept represents a conceptual framework within which strategies could be developed to analyse the competitiveness of the banana industry, and to identify and prioritise the R&D activities required to improve the banana industry.

According to Indrajit and Djokopranoto (2002), there are several stages in the development of supply chains:

1. independence between among the members of chains
2. integrated planning among several members of the chain
3. integrated planning and monitoring
4. supply chain integration in planning, implementation and monitoring.

On the basis of the information collected in this study, the two supply chains examined were at stage two.

The methods used in this study could be improved by getting more information and input from all members of the supply chains, and involve their rep-

resentatives in the decision process for identifying the main constraints. In the Indonesian context, this input may be better obtained by having one-on-one discussions with members, or discussion groups with peers. Discussions with several sectors of the chain may result in reduced participation from those sectors perceived to have less 'power' in the chain.

The concept developed in this study is being applied to other horticulture situations in Indonesia. The SCM concept is being combined with soft-systems methodology to analyse problems and solutions in the citrus and pepper industries in eight provinces, and the concepts are being presented and discussed in a number of different forums. Continual assessment and improvement of these methods would be valuable.

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