

# Working to Grow Together: Horizontal Collaboration for Horticulture Production in Queensland

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## ABSTRACT

The horticulture sector in Queensland is highly diverse, producing tropical fruits, many varieties of vegetables, cucurbits and nuts. There is potential to expand horticulture production with more land and water becoming available. However, domestic demand for many horticulture products is currently saturated in peak seasons, leading to lower farmgate prices. Therefore, exporting high value horticulture produce (HVHP) to Asian destinations may offer market diversification for future growth of horticulture industries in Queensland. Currently staggering of supply of horticultural products is achieved as crops are not simultaneously grown across wide geographic regions due to the variations in weather, water availability and soil condition. For instance, farmers harvest mangoes in the far-north Queensland during August-October while Southeast Queensland's farmers harvest their mangoes between January and April each year. This study aimed to examine the potential for greater cross-regional collaboration between farmers (i.e., horizontal collaboration) to ensure a continuous and consistent supply chain of large volume of horticulture products over six- to eight-month annual window. This study particularly focused on a case study of mango production using a qualitative approach consisting of a stakeholder workshop supported by literature review and face to face scoping interviews. While some discrete collaborations among mango farmers are occurring in some regions of Queensland, a cross-regional supply chain collaboration supported by both the industry and other supply chain stakeholders would improve returns to mango producers in the short to medium term.

**Keywords:** Export, mango, collaboration mechanisms, Asian markets, Australia.

## 1. INTRODUCTION

Queensland landmass largely represent tropical and subtropical regions, featuring grassland and desert in the west, mountains and productive coastal areas to the east. Rainfall is highly variable across Queensland, with long term annual average rainfall being 628 mm (DES, 2019). These physiographic and climatic variabilities create diversity in Queensland's agricultural sector. Queensland farmers produce beef, horticulture, livestock, dairy, broadacre crop, sugar cane and aquaculture products, contributing about \$16.9 billion annually to the state's economy (RDADDSW, 2016). Currently, about 135,000 hectares of land are used for perennial and annual horticulture production, with about 34.5 million hectares of land potentially available for increased production (DAF 2018). By production tonnage, banana is by far the state's major

horticultural product, however the highest export volume occurs in mandarins, mangoes, macadamias and melons (Hort Innovation, 2019).

While the bulk of horticulture production goes to domestic markets, Queensland exports more than \$300 million worth of fruits and vegetables to Asian markets annually (Goodman, 2019). There are opportunities for potential growth of Queensland’s horticulture sector by developing better export supply chains, particularly for the high value perishable commodities (AAC, 2019; RDADDSW, 2016; Sun, 2016; DAFF, 2013, DAFF, 2014). Trade Investment Queensland (TIQ) has predicted that the export volume of Queensland agriculture products could be doubled rapidly through developing supply chain collaboration, increasing productivity, reducing business risk, offsetting seasonal risks, product innovation, new market discovery and providing tax advantages for farmers and exporters (TIQ, 2019). However, developing export markets requires consistent supply, which can be a major constraint in developing export market opportunities (Ash, 2017; Sun, 2016). This requires horizontal collaboration among the farmers across local and regional levels. Several researchers have explored the challenges of an export oriented agricultural supply chain, highlighting a range of barriers associated with production, processing, trade, transport and logistics (Ash et al 2017; Wegner, 2017; McCarthy, 2015). However, very few studies have addressed the challenges of horizontal coordination in supply chains, which is necessary to maintain consistent supply.

This study examines the horizontal collaboration issues and mechanisms that can foster exporting horticulture produces from Queensland to Asian or any other international markets. The paper provides a conceptual framework, describes the methodology and methods used for evaluation of the horizontal collaboration model, presents the findings, critically analyse the results and provides conclusions.

## 2. AGRICULTURAL SUPPLY CHAIN COLLABORATION: CONCEPTUAL FRAMEWORK

Agricultural supply chain collaboration (ASCC) refers to a joint initiative of two or more discreet organisations involves in the supply chain, that work together in order to achieve shared objectives or goals through joint planning (Armayah et al., 2019, Cao and Zhang, 2011). Agricultural supply chain collaboration can be either strategic or opportunistic (Figure 1), depending on the collaboration culture as well as the success at each level of collaboration.

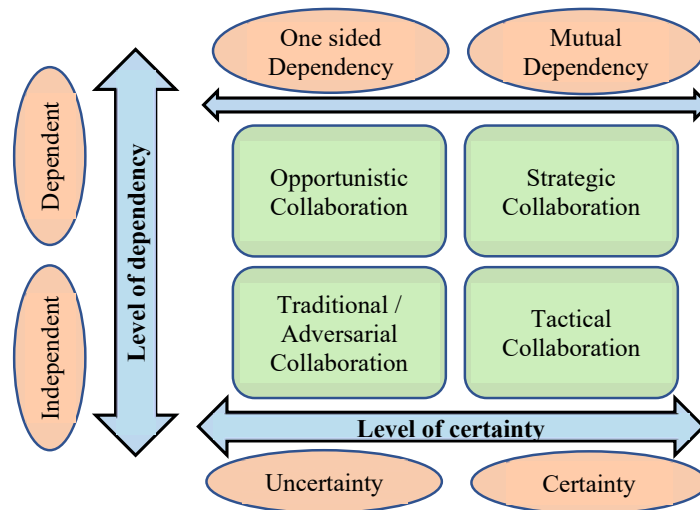


Figure 1: Purpose of supply chain collaboration (Source: Adopted from Cousins, 2002)

In the opportunistic case, the collaborators attempt to achieve short run outcomes in terms of return on investment but are unlikely to share risks and uncertainties. By comparison, strategic collaboration is built upon mutual understanding and trust developed over time, where the focus is to gain long term returns. Sharing resources and information are common actions in strategic collaboration. This model leads to a better governance approach for the supply chain, but usually takes time to establish. In addition, a framework that support both horizontal and vertical collaboration is necessary for developing a sustainable ASCC (Matopoulos et al., 2007, Dania et al., 2016). Figure 2 provides a conceptual framework of agriculture supply chain collaboration, incorporating both vertical and horizontal collaboration.

Horizontal collaboration amongst producers could be crucial to supply the right amount of produce at the right time, in a scenario not otherwise possible for individual growers. Horizontal collaboration includes growers and growers’ associations who may be involved collectively in a supply chain (Figure 2). Vertical collaboration engages growers, farm input service providers, processors, wholesalers, retailers, exporters and consumers who are directly involved with the supply chain (Figure 2).

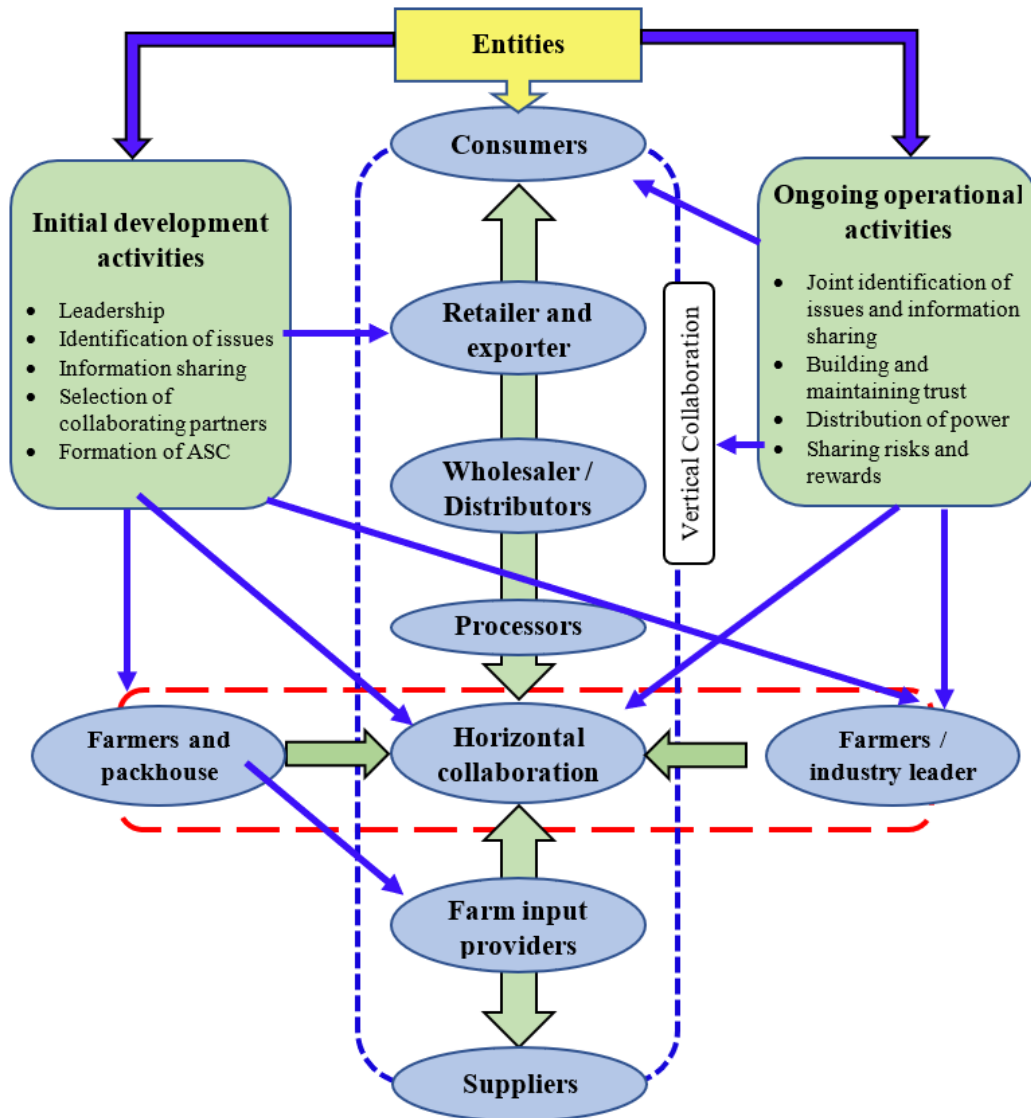


Figure 2: Conceptual framework of agricultural supply chain collaboration (Source: Based on Barratt, 2004, Matopoulos et al., 2007, Liao et al., 2017)

The next section of this study describes how this conceptual framework was used to develop and explore prospective agricultural supply chain collaboration model for a specific horticultural crop (mango) in Queensland.

### **3. METHODS AND MATERIALS**

This research involved a qualitative approach, comprising several steps:

- a literature review on theory and practice of agricultural supply chain collaboration,
- scoping interviews with farmers, industry representatives and other relevant stakeholders,
- an initial pilot test of workshop tasks and
- a stakeholder workshop to test an agricultural supply chain collaboration model for selected horticulture products in Queensland.

The conceptual framework for ASCC model (Figure 2) was used as the basis for developing and testing the workshop tools.

The workshop process was designed to analyse several key issues in forming both horizontal and vertical collaboration among the parties involved in the supply chains of three selected horticulture products of Queensland. However, this paper only reported the tasks and findings related to the case of mango. To ensure the involvement of a cross-section of stakeholders, the research team invited about 50 potential participants for the workshop.

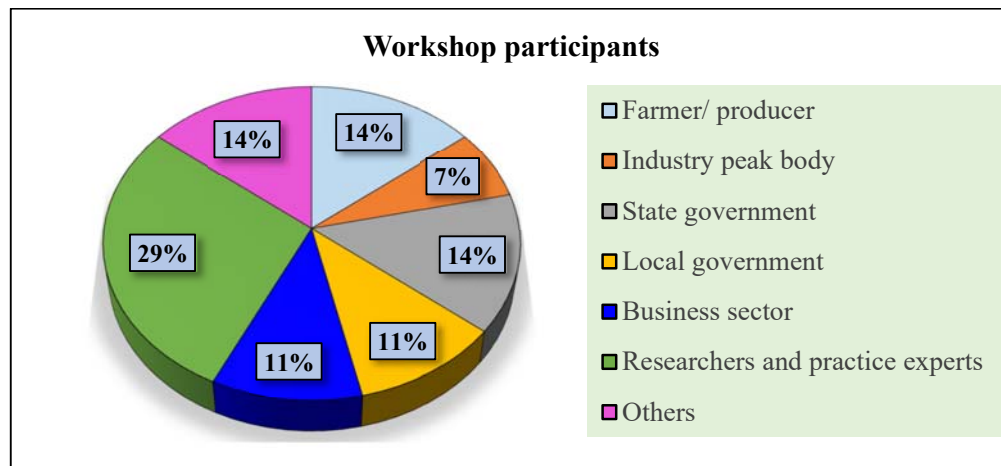
There were three segments of the workshop, commencing with expert presentations on some topics relevant to the workshop theme; and then two data collection exercises directly involving the participants with individual and group tasks. In the third stage of the workshop, the research team split participants into three groups by horticultural product depending on their expertise and interest. The participants were asked to identify the most suitable links among the entities to indicate their preference on collaboration models for the sector. The same task was repeated individually and in group form. However, this paper only reports the horizontal collaboration in case of exporting mangoes from Queensland to Asian markets.

During the group task, participants were encouraged to contribute to open discussion and develop a combined ASCC model for one of the three chosen commodities. Participants also took part in a discussion on horizontal and vertical collaboration could be coordinated. The research team subsequently undertook a narrative and thematic analysis to evaluate the qualitative data collected during the workshop.

### **4. FINDINGS AND ANALYSIS**

#### **4.1 Participants**

The research team invited 50 potential participants for a six-hour workshop. However, only 28 persons attended face to face on site and one through a virtual platform (Figure 3). Most of the participants represented farmers groups, state government officials and researchers.



**Figure 3: Percentage of workshop participants**

#### 4.2 Expert presentation

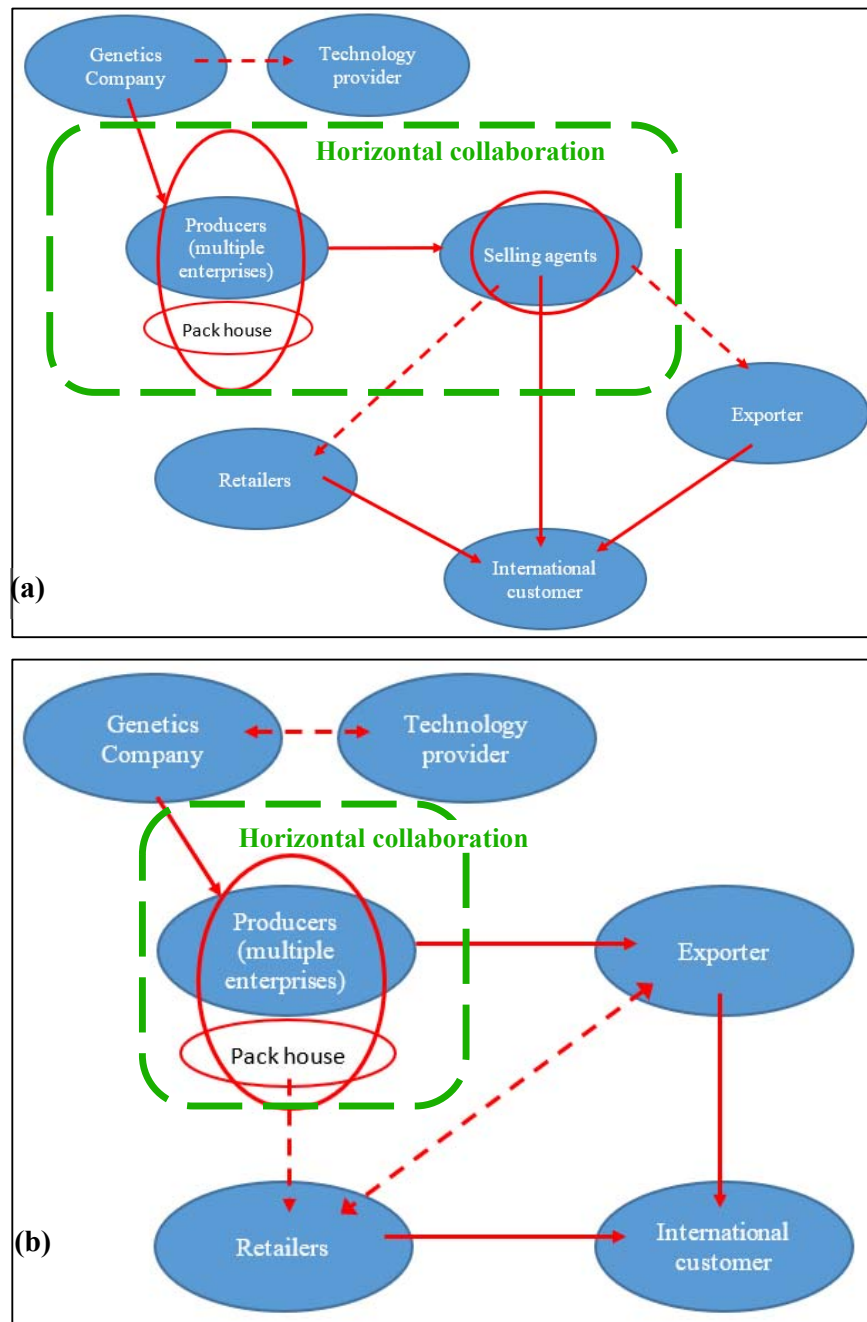
The research team invited four experts to deliver short presentations on the policies, opportunities and mechanism of agricultural supply chain collaboration for exporting high value perishable agricultural commodities (HVPACs) to the Asian markets. This discussion emphasized industry-led research collaborations with a strategic focus to increase wealth and employment opportunities and to improve production and supply chain efficiencies through ASCC. It was noted that there is significant demand for Australian horticulture products in Asian markets, but that in any given year, the entire horticultural production of Australia could only meet the demand of Tokyo (not Japan), and supply fluctuates substantially. So, a challenge for Australia is to develop horizontal collaboration models to coordinate supply into targeted markets. The experts recommended improving horizontal collaboration to improve volume and consistency of supply and flexible collaboration/collaboratives in supply chain design.

#### 4.3 Individual tasks and the model

In the second segment of the workshop all the participants were provided with a questionnaire to complete. They were asked to draw the linkages among key actors in the supply chain to indicate their preferred form of a collaboration model. The participant responses indicated several critical issues in the production stage, with water availability, cost of production and quality of products identified as the three most critical issues across the regions for production of selected horticultural crops. Transportation and technologies were also identified as major issues. Interestingly, none of the participants thought that direct government support and foreign investment were very important for the future growth of the horticulture sector. However, on average 48% of respondents believed that domestic investment is vital for this sector, and about 75% of respondents rated market access as the most critical issue.

The outcome of the Mango-specific data collection exercise is illustrated in Figure 4, which indicates the preference of two major groups of participants. Most participants identified producers, selling agents, exporters and retailers as the key actors to reach international consumers. About 41% of respondents indicated that selling agents would be vital to draw a linkage among the producers and exporter and/or retailer (Figure 4a). They also indicated that the selling agent could act as an exporter to supply the product directly to the consumers via retailers. However, 27% of participants acknowledged a similar relationship but unlike the first group they considered that the selling agent is not an essential actor in an export supply chain (Figure 4b). Both groups recognized the importance of genetic companies and technology providers in the ASCC.

One interesting outcome of this exercise was the addition of packhouses into the model which was not initially included by the research team. The research team considered that the processors would be more appropriate actor for the export supply chain, however, the participants thought differently. Most participants indicated that packhouse facility should be linked with the producers and act as a single actor within the horizontal collaboration. This exercise also reflected the preference of the participants to avoid wholesalers and distributors in the supply chain. The results did not indicate any relationship between the producers and government and/or industry body.



**Figure 4: ASCC for Mango a) response of 42% participants, b) response of other 27% participants** (Note: The solid lines in the figure indicate a strong relationship while the dotted line indicates a moderate relationship)

#### 4.4 Group discussion and the proposed models

In the final segment of the workshop, the research team formed three separate groups focused on individual crops. Each group was tasked to develop a prospective agricultural supply chain collaboration model for one of the selected horticultural products. This paper only reports the group discussion on the structure and mechanism of ASCC for the mango industry in Queensland. The model presented in Figure 5 was developed by the agreement of all or most of the participants within this group.

In developing this model, the discussion was based on an authentic example of collaboration that is currently used to export HVPACs to the Asian markets. The group provided examples such as Manbulloo mangoes, who are currently exporting mangoes to the Asian markets. However, this single company-led vertical supply chain model may not necessarily be applicable in the context of small and medium scale mango growers in Queensland. The group members suggested horizontal collaboration among the small and medium-scale farmers may be more appropriate (Figure 5), together with a strong partnership or collaboration with the fruit grading and/or protocol processors (Figure 5). The mango producers in this group particularly wanted to bypass the wholesaler in an attempt to avoid unnecessary costs or sharing of profits.

The group emphasized that a medium-scale grower can afford to operate grading and processing infrastructure, and this can be offered to smaller growers on fee basis. As such, the growers can work together and communicate with the exporter or export fruit processors (e.g. where heat treatment or radiation treatment is applied). That will allow the producers to avoid unnecessary commission costs that are commonly paid to the wholesalers. The group suggested that leadership is required to initiate this type of collaboration among smaller mango growers.

All the participants agreed that the producers should initiate any supply chain collaboration. However, they added that producers should also have direct access to the exporter and not through other ‘middlemen’ (Box 1). It was also argued that it could be a multiple leader-led collaboration, so will not necessarily rely on an individual to initiate the collaboration (Box 1).

##### Box 1: Key comments

**From a researcher:** *“So either it goes on the corporate systems or any corporate governance systems whatever the system is, but we really need to link them (producers and processors), so the processor can directly access to the exporters”.*

**From a government officer:** *“So I think the question is not who's going to lead it because at different points everyone has a different leadership role. It's not one leader. It's multiple leaders. But when do you rise to be the leader at this point?”*

The participants agreed that collaboration needs to be developed amongst like-minded mango growers even if they are from different regions. Emphasis was also given on the transparency of the collaboration model in terms of pricing, information sharing and risk-sharing. Participants also agreed that achieving better prices for lower graded mangoes should be a key feature of any supply chain development work. Furthermore, during the discussion on the supply chain mechanism, participants noted that it is important to collect reliable data and analyse those data to create better forecasting models for demand, production and weather events.

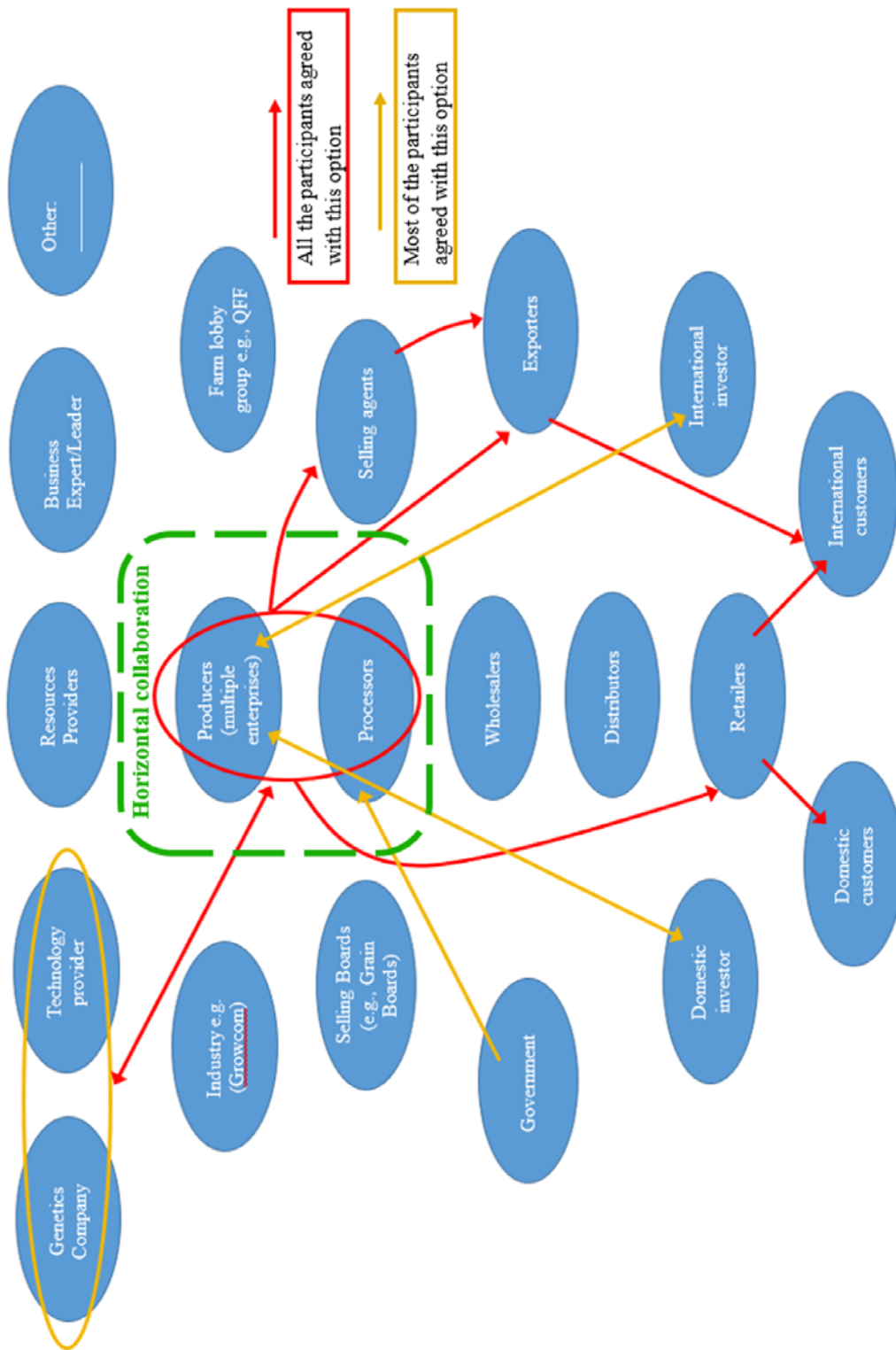


Figure 5: Prospective or existing linkages amongst actors involved in a collaborative supply chain for mango industry, as identified during the workshop activity



#### 4.5 Discussion on issues and mechanisms of horizontal collaboration

One of the purposes of the stakeholders' workshop was to identify the issues and mechanisms of agricultural supply chain collaboration (ASCC) for the avocado, lychee and mango industries in Queensland. During a series of group tasks, the participants provided their in-depth understanding and developed a consensus on the issues and mechanisms. Key findings from discussion groups regarding issues in ASSC are presented in Table 1. This table summarise the issues of ASSC into a few categories: quality, resources, collaboration, market access, infrastructure, risk and support.

**Table 1:** Stakeholders' perception of key issues in agricultural supply chain

Key issues	Specific issues
Quality of product	Appearance (Colour & size)
	Taste
	Combination of appearance and taste
	Consistent yield
	Shelf life
	Disease freeness
	Quality control
Resources	Water
	Information & training
	Labour (sourcing)
Collaboration	Selecting partner
	Leadership
	Management role
Market Access	Export readiness
	Domestic vs International
	Market exposure / Premium market
	Market power
Infrastructure	Facility sharing
	Fruit treatment facility
Risk	Investment
	Price
	Cost of production
	Market saturation
	Extreme weather
	Disruption in supply chain
	Conflict management
Support	Long term business plan
	Financial stability

Most participants identified product quality as a major issue. Quality can be defined based on its physical appearance, taste, shelf life and disease status. Consistent yield and quality control systems are two relevant issues, which can affect product quality. Lack of resources is also a major issue in ASSC. Insufficient information and limited effort in research and development are common phenomena in all three industries. Currently, Australia is exporting mangoes in small volumes, but there is significant international competition in the premium markets.

All participants of the workshop recognised that there is currently limited collaboration among farmers and the other actors involved in the exports of perishable commodities into the Asian markets. In horizontal collaboration, leadership and the selection of partners are the starting points to initiate collaboration. Market access was also identified as a major limitation. One of

the key questions participants raised was whether the selected horticultural industries have all the elements required to achieve export readiness. Price fluctuations and disruptions in the supply chain were frequently mentioned during the workshop. Other limitations identified were lack of long-term business plans and limited financial stability of the farms.

The framework of collaboration presented in figure 5 (i.e., collaboration structure) was developed based on the responses of participants during the individual and group tasks. Apart from the structure of the collaboration, several mechanisms for developing and maintaining collaboration have been drawn from the group discussion. Broadly they are identifying and reaching consensus on collaborative tasks, coordination, marketing and governance and adhering to policy and planning. All discussed mechanisms for horizontal collaboration are listed in Table 2. These mechanisms indicate the pathways for developing and maintaining collaboration. Firstly, at least a few leaders or actors need to understand the structure of the collaboration, which includes the identification of potential collaborator at all levels of the supply chains. The most important actors are producers, processors, genetics companies and technology providers. Cross-regional collaboration was suggested as options to achieve more coordinated supply.

**Table 2:** Functions and mechanisms to achieve horizontal collaboration for ASCC models

Key function	Specific mechanism
Collaborative initiations	Initiator to lead and partner selection
	Framework for collaboration
	Cross regional collaboration
Collaborative activities	Communication among the collaborators
	Information sharing: production inputs and standard
	Information sharing: market access and demand
	Price setting
	Risk sharing
	Profit sharing among growers
Coordination	Business network among growers
	Role of industry (or government) in horizontal collaboration
Governance	Government supported R&D program
	Equity in power distribution
	Joint venture
	Corporate governance
Marketing	Clean, green and fresh slogan
	Global brand for Australian produce
	Regional brand
	Trademark property rights and brand security
	Traceability and quality control
Others	Lesson learned from the existing models of other horticulture industry
	Commercial behaviour of producers

Several collaborative activities were identified through the thematic analysis. In horizontal collaboration, sharing is identified as the main mechanism. This includes information sharing,

resource sharing, risk sharing and profit sharing. In vertical collaboration, some other activities were discussed, and one common structure suggested by the participants of all three groups was a joint venture. Getting support from government and industry was also categorised as a collaborative task. Negotiation with the potential importer for a reasonable product and price contract is also a part of the collaborative activities in vertical supply chain collaboration.

Coordination and good governance are two essential mechanisms to deliver a successful collaboration. The role of the industry groups in devising or developing coordination and a governance framework is essential for both horizontal and vertical collaboration. Equity in power distribution and transparency are very important for the sustainability of the collaboration. The workshop participants also placed emphasis on government-supported R&D programs for both collaboration and supply chain enabling infrastructure. In vertical collaboration, development and adherence to policies and regulations are one of the key governance mechanisms. Policies and regulation could relate to agricultural production, biosecurity and/or exports. Some drivers that can affect collaboration mechanisms either positively or negatively were discussed in the workshop (Table 3).

**Table 3:** Drivers affecting the mechanism of ASCC

Collaboration	Drivers
Horizontal	Government and industry: engagement and incentive
	Counter seasonal advantages
	Foreign direct investment
	Attract domestic investors

The engagement of government and industry could be important in network development, training, developing enabling infrastructure and providing incentives. Investment from domestic and international market players could inject cash flow and trigger collaboration in each of these selected industries.

## 5. CONCLUSION AND RECOMMENDATIONS

This study identified three categories of issues. The first category includes production inputs, their cost, quality and water supply required to grow the commodities. The second category is related to use of technologies in transport and technology needs including logistics, advanced agricultural technology and innovation in genetics and value-added products. The third category is related to marketing, including market access to certain medium and high-income Asian countries, brand development and recognition, traceability and market discovery. This study identified a number of possible mechanisms for horizontal supply chain collaboration for exporting perishable commodities from Queensland. This study highlights the role of an individual horticultural industry association (such as Growcom) or a processor is crucial for horizontal collaboration among the farmers.

The stakeholders identified that mango supply chains for international markets are reasonably established in Queensland. However, horizontal collaboration is needed between the small and medium scale farmers to ensure consistent supply of product into the international markets. Value-added production facilities are also suggested to process any excess production during peak harvest period (November-January) across Queensland. The mango industry already employs several supply chains to export to international markets, however, further strategic

collaboration amongst the genetic industry, primary producers, processors and exporters is suggested for the longer-term market gains. This could represent both process and management-oriented collaboration.

The workshop participants identified that horizontal collaboration among farmers may play an integral and important role in agricultural supply chain collaboration (ASCC) to increase the export volume of the selected fruits from QLD. Participating stakeholders presented various views about the governance mechanisms, however, majority suggested that government (state and/federal) should facilitate the industry bodies in the process of horizontal collaboration, particularly for product and contract standards, market access, and conflict resolutions. The workshop proposed models for three fruit industries of QLD (i.e., avocado, lychee and mango), and we suggest that these models may well be relevant for other tropical fruit industries of Queensland.

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