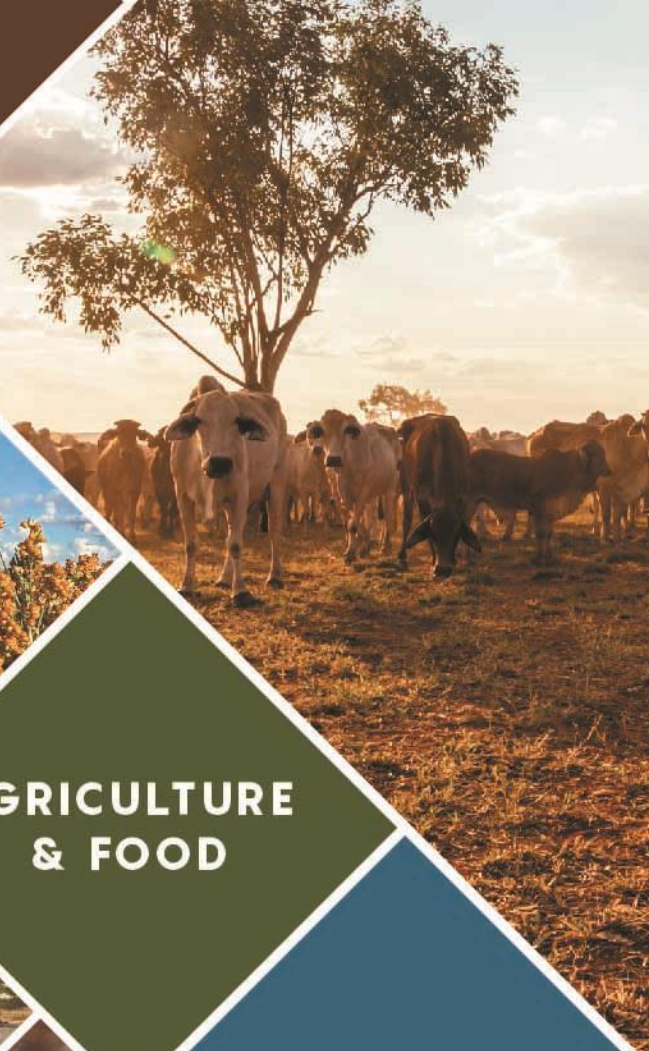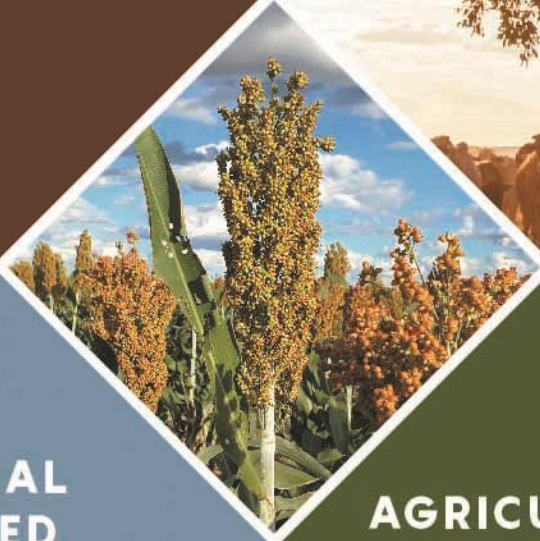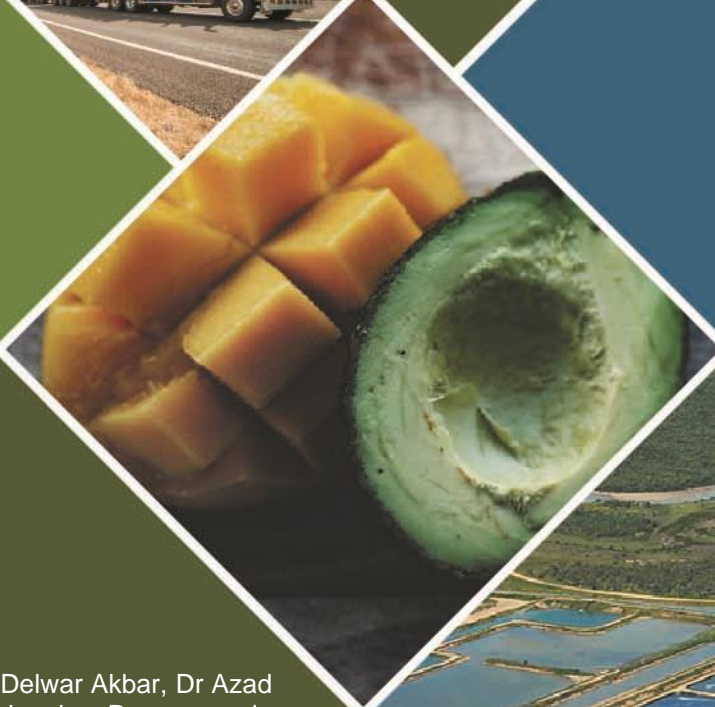NORTHERN HEALTH
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Queensland Horticulture Farmers' Willingness to Participate in Export Focused Contract-Based Supply Chain Coordination

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Acknowledgments

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The author(s) confirm(s) that this document has been reviewed and approved by the project's steering committee and by its program leader. These reviewers evaluated its:

- originality
- methodology
- rigour
- compliance with ethical guidelines
- conclusions against results
- conformity with the principles of the Australian Code for the Responsible Conduct of Research (NHMRC 2018),

and provided constructive feedback which was considered and addressed by the author(s).

Australian Government
Department of Industry, Science, Energy and Resources

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Acronyms

ASC	Alternative specific constant
ChAFTA	China-Australia Free Trade Agreement
DAF	Department of Agriculture and Forestry
QLD	Queensland
ML	Mixed logit
SAFTA	Singapore-Australia Free Trade Agreement

Executive Summary

Increasing the value of horticulture production in Queensland would bring a number of potential economic, employment and industry benefits. One important strategy identified by representatives of Queensland's horticulture industry is improving supply chain coordination to enhance export of horticulture products (e.g., vegetables, fruits, and nuts). About 16% of horticultural products grown in Queensland are currently exported (QLD DAF, 2018). This proportion could be increased by increasing the supply as well as by encouraging more farmers to participate in the export supply chain through vertical collaboration. However, limited information is available about producers' interest in the export supply chain and their engagement in vertical collaboration with different players in the supply chain. Marketing contracts with export agents, a mechanism of vertical collaboration, may develop a sustainable export supply chain and potentially generate higher returns for producers. Such initiative involves higher standards for quality assurance with associated higher production costs and more paperwork to meet these standards.

This study aims to investigate Queensland horticulture farmers' willingness to participate in export-focused contract-based marketing agreements with downstream buyers as a form of closer vertical coordination. More specifically, this study aims to identify attributes of formal agreements that would encourage farmers' participation, as well as enterprise and farmer characteristics which may explain their decision to seek closer vertical coordination with their product's supply chain.

This study utilises a discrete choice experiment embedded within an online survey to understand farmers' perceptions of export-focused contract-based supply chain coordination. The online survey was circulated among horticulture producers in different parts of Queensland firstly through the industry partner Growcom and then through a third-party survey company. Despite significant effort, the research team was only able to collect a sample of 57 fully completed responses to the online survey. The sample size represents about 2.5% of the fruit and vegetable producers in Queensland, which include representatives from different areas in the state. Due to the small sample size, the results presented in this study may not be generalised or worthy for comparing with the state data. However, the findings of that study is indicative and provide a critical insight of Queensland's horticulture producers regarding export-focused contract-based supply chain coordination. The findings of the study suggest that:

• There is heterogeneity among horticulture farmers regarding their preferences to participate in agreement-based vertical supply chains that focus on export. Some farmers tend to prefer existing (status quo) supply chains systems over new export-orientated supply chains while other farmers seem to be more open to exploring export opportunities,

• Product price, potential higher production costs and gross margin of profit are determinants identified by all farmer groups as important for their decision about changes to their supply chain,

• Farmers expressed an interest in stronger coordination within the domestic retail sector, potentially in the form of contract farming. This will not necessarily increase the supply in the domestic market but develop a strong tie among the parties involved in the supply chain, and

• The future willingness of farmers to engage in supply chain collaboration is likely to be driven by their current level of collaboration within the supply chain of their product.

Based on the results of the study the following recommendations were derived:

• Queensland's horticulture associations such as Growcom may consider identifying farmers who are not yet exporting their product but have an interest in doing so, particularly through marketing contracts with exporters. These farmers could be linked up with export agents to explore market opportunities including a potential individual export agreement,

• The horticulture industry could also consider exploring options to develop increased high-value supply chain collaborations within the domestic market. This could potentially also generate a higher production value for farmers. The horticulture industry may liaise with the retail sector to investigate potential options for streamlining supply chain coordination (e.g., contract farming). The experience gained from such an initiative could then be translated into the export supply chain, and

• Industry networks (e.g., industry-buyer forums which offer both parties an opportunity to network and develop links) could be provided by the Government, such as Austrade or Trade and Investment Queensland, to facilitate business links and encourage the development of more coordinated vertical supply chain relationships. In addition, the provision of information and training about the potential benefits and costs of improved coordination for agribusinesses would support decision-making processes about options to create higher value for their product using a supply chain approach.

A limitation of this study is the relatively small sample size of participants (2.5% of the horticulture farmer population), which could affect the robustness of the findings. However, we note that the study involved extensive consultation with industry and stakeholders, and that is useful to triangulate the survey results with other evidence.

Moreover, this study only addresses the production side of the supply chain. The exploration of export opportunities could be strengthened by complementary consumer demand analyses in potential export countries to assess future consumption drivers for Australian horticultural products.

1. Introduction

1.1 Introduction

Many rural communities in Queensland (QLD) rely on agricultural production for employment opportunities, particularly from horticulture industries (QLD DAF, 2018). The horticulture industry in Queensland is comprised of many small agricultural businesses which predominately supply to local or domestic markets. Currently about 2200 agricultural businesses in Queensland are producing fruits and vegetables, with an approximate gross value of production of about $3 billion (ABS, 2020a, 2020b). About 16% of horticultural products grown in Queensland are currently exported (QLD DAF, 2018), yet this proportion could be increased. Limited access to export markets, especifically to rapidly growing markets in Asia, has been identified as one of the major barriers for the horticulture industry in Queensland to increase production and achieve a higher product value which could contribute even further to the regional economic growth (Sun, 2016).

There have already been initiatives undertaken to improve opportunities for Queensland farmers to participate in the global supply chain by improving market access through free trade agreements with other countries (e.g., China-Australia Free Trade Agreement (ChAFTA), Singapore-Australia Free Trade Agreement (SAFTA)); as well as improvements in transport links and government incentives to support export market access (e.g., export market development grants, pilot programmes for growing Queensland's food exports). In addition to the government-to-government trade agreements, there are possibilities for agreements among other actors of the supply chain.

Yet, more could be done to increase the value that farmers receive for their product, such as, closer links between horticulture producers and other stages of the supply chain of the product (e.g., processors, wholesalers, exporters, retailers), improved quality controls to meet consumer demand and export specifications, and increased traceability and feedback from consumers. These value-adding processes could be achieved through improved vertical coordination within Queensland's horticulture supply chains. The key to the success in coordination within export supply chains depends on achieving higher production volumes and quality. Farmers are hence the key players within the distribution network and hold major responsibility for collaboration.

Vertical coordination describes cooperating relationships (e.g., trust/relationship-based, contract-based, technology-based relations) among entities within supply chains which aim at achieving a common goal (Schulze et al., 2007; Vlachos, 2014; Zhang & Aramyan, 2009). The rationale for farmers to pursue closer vertical coordination with other players in their product's supply chain is typically related to minimising input costs and transaction costs for farmers (e.g., cost of time, information, negotiation and monitoring), managing risks and uncertainties (e.g., price volatility, market imperfections, fluctuations in demand), gaining better access to inputs and technology, and ensuring high-quality food just to meet the market specification, within the distributional network (Abebe et al., 2013; Hobbs, 1996; Ochieng et al., 2017; Peterson et al., 2001; Vlachos, 2014). The major reason for downstream supply chain actors to seek closer coordination with agri-food producers is the minimisation of transaction costs related to procurement risks (e.g., uniform quality, consistency of supply, sourcing of certified produce) (Abebe et al., 2013; FAO, 2018). These benefits of vertical coordination can ultimately contribute to achieving a comparative advantage for agribusinesses, that can lead to higher incomes for producers (Liao et al., 2017).

At the industry level, one of the key challenges in supplying export markets is to coordinate and consolidate the supply of products from a large number of different producers, ranging from small scale to large scale operators. Other challenges are to maintain supply volumes over time, to ensure consistency in product supply from a variety of different producers, and to transmit timely information about consumer demands back to producers. Foods that involve a processing stage, such as dairy and meat products, have a consolidation point where these coordinating functions occur. For fresh foods such as horticultural products, however, these consolidation points (e.g., packing sheds, quarantine treatment facilities) that offer the opportunity to coordinate supply chains are missing.

Contractual agreements between upstream and downstream entities of supply chains are one form of vertical coordination which can contribute to overcoming issues linked to supply consolidation (Hobbs Jill, 2000; Peterson et al., 2001; Schulze et al., 2007; Spiller et al., 2005). However, elements of contract design can affect producer choices about whether or not to participate in such forms of supply chain coordination (Schlecht & Spiller, 2012). The literature describes a range of studies which investigate farmer's preferences towards contract-based supply chain coordination using revealed and stated preference methods (e.g., Abebe et al., 2013; Feng et al., 2018; Gelaw et al., 2016; Ochieng et al., 2017; Saenger et al., 2013; Schipmann & Qaim, 2011). The two main topics which these studies focus on are: a) contractual design attributes that affect farmers' willingness for participation, and b) socio-economic, attitude and motivational factors of farmers that influence their participation in contractual forms of supply chain coordination (e.g., Abebe et al., 2013; Feng et al., 2018; Gelaw et al., 2016; Ochieng et al., 2017).

The extant literature shows that contract design specifications particularly depend on the level of economic development and institutional settings within a country (e.g., trading norms, the maturity of the legal system to

enforce contracts) which is reflected in the diverse types of contract attributes selected in the existing case studies (e.g., Feng et al., 2018; Ochieng et al., 2017).

Contract-based forms of vertical coordination between horticulture farmers in Queensland and downstream supply chain players within the domestic market (e.g., retailers) already exist. Successful hybrid forms of vertical and horizontal supply chain coordination (e.g., integration) have also been developed in recent years. However, when it comes to exporting high-quality horticultural products to Asia, it is unclear whether farmers would be interested in marketing contracts with wholesalers or specialized export facilitators, or other mechanisms to accumulate and coordinate production into supply chains. Hence, this study focuses on the farmer's willingness to participate in a contract-based approach to improving their supply chain.

1.2 Aim, scope, and organisation of the study

This study aims to investigate Queensland horticulture farmers' willingness to participate in export-focused contract-based marketing agreements with downstream buyers as a form of closer vertical coordination. More specifically, this study aims to identify attributes of formal agreements that would encourage or discourage farmers' participation as well as farmers' individual characteristics which may affect their decision to seek closer vertical coordination with their product's supply chain.

This study mainly focuses on identifying horticulture producers' perception towards export-focused contract-based marketing agreements. Investigating the existing supply chain for domestic or export market was not the scope of this study. An online farmer survey, including a discrete choice experiment, was used to collect data to identify the farmer's willingness to participate in an export marketing agreement. The study revolves around the choice experiment developed as the survey tools. The socio-economic profile of the respondents collected from the survey is used as supplementary information to the choice modelling data.

From a practical perspective, the study offers information about farmers' preferences for closer coordination within their supply chains as well as specific contract attributes and potential trade-offs between these attributes which may encourage their participation in such contract schemes. It contributes to the literature as a case study about farmers' motivation for participation in marketing contracts for the export of fruits, vegetables, and nuts. The findings can help to develop strategies to achieve stable farmer-buyer relationships and to increase the participation of horticulture farmers in global agri-food supply chains.

The report is organised as follows: Section 1 presents the introduction. Section 2 discusses a summary of key concepts and theories relevant to supply chain coordination. Section 3 provides details of the research methods, followed by the results and analysis in Section 4 and discussion of data in Section 5. Section 6 concludes the report with some recommendations.

2. Vertical supply chain coordination

2.1 Vertical coordination

Vertical coordination describes how relationships between players in an agri-food supply chain are organised and are considered to be a central part of supply chain governance (Gellynck, 2009; Hobbs & Young, 2000; Peterson et al., 2001; Raynaud et al., 2005; Schulze et al., 2007; Zhang & Aramyan, 2009). Figure 1 offers an overview of the continuum of vertical coordination used in agri-food supply chains. Vertical coordination between supply chain actors can differ on a spectrum: at one extreme, there may be an open spot market relationship where short term selling/buying interactions are coordinated by price signals only; at the other, a fully integrated relationship may occur between actors in the supply chain (e.g., production and distribution of two or more consecutive stages are undertaken under joint management and ownership) (Denolf et al., 2015; Hobbs Jill, 2000; Peterson et al., 2001; Raynaud et al., 2005; Schulze et al., 2007; Spiller et al., 2005). The decision about the level of vertical coordination is a strategic choice of entities within a supply chain which typically depends on their perceived benefits from the relationship relative to other options (e.g., reduced transaction costs, risks and uncertainties, increased efficiencies) and the behavioural aspects of actors (e.g., attitudes towards dependency) (Peterson et al., 2001).
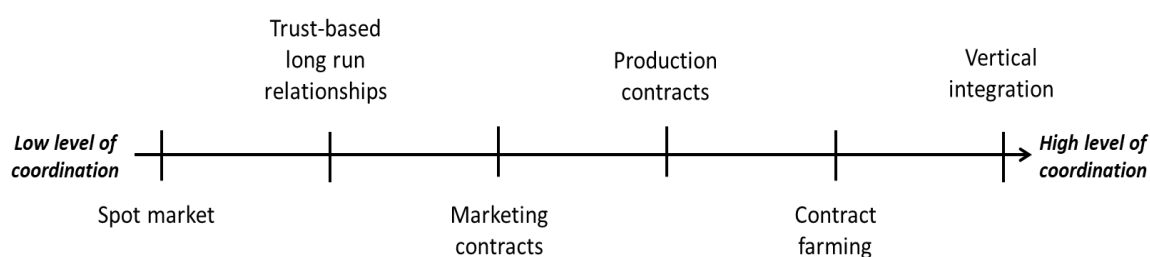

Figure 1: Vertical coordination continuum in agri-food supply chains

Source: Adapted from Hobbs (1996), Peterson et al. (2001), Schulze et al. (2007)

2.2 Contract-based forms of vertical coordination

Contract-based relationships between upstream and downstream entities of supply chains can be found within the far right of the continuum shown in Figure 1 (Denolf et al., 2015; Hobbs Jill, 2000; Peterson et al., 2001; Schulze et al., 2007; Spiller et al., 2005). Contract-based farming is understood as the production and supply of agri-food according to a contractual agreement between the buyer (e.g., processor, wholesaler, exporter, retailer) and the seller (farmer) of a product. This may stipulate the conditions for the marketing, supply and production of a farm product (FAO, 2012). Such agreements can also comprise performance, behavioural and production standards (Denolf et al., 2015). Contracts are formal agreements between supply chain actors that are legally enforceable (Denolf et al., 2015). Common forms of contract-based coordination between actors in an agri-food supply chain are marketing contracts, production contracts and contract farming (Hobbs, 1996). Marketing contracts are arrangements between buyers and sellers in which the buyer agrees to provide market access and product sale for the seller's output (Hobbs, 1996; Schulze et al., 2007; Swinnen & Maertens, 2007). By engaging in marketing contracts, the seller transfers some risks (e.g. price risk, demand risk) and the decision about where and when the product is supplied to the market to the buyer (Hobbs, 1996). Under a marketing contract, the seller remains in control over the production process (Hobbs, 1996; Swinnen & Maertens, 2007). This contract form differs to a production contract where the buyer of the product has more control over the production process, e.g., using inputs and production systems or even providing the inputs and systems (Hobbs, 1996; Schulze et al., 2007; Swinnen & Maertens, 2007). Contract farming is characterised by a high degree of coordination between farmers and buyers. Under contract farming agreements, farmers remain autonomous but significantly depend on centralised decision-making by the buyer of the product who manages the entire supply chain (Schulze et al., 2007).

Engaging in forms of contract-based farming offers a range of advantages to farmers, such as lowered transaction costs of selling their product, decreased market risks and uncertainties, market security, higher and more stable incomes due to higher product prices, and improved coordination with downstream buyers (Abebe et al., 2013; Carillo et al., 2017; FAO, 2018). Contract-based farming is also considered to contribute to improved efficiency within a supply chain (FAO, 2018). However, contract-based farming has also been criticised due to the potential loss of farmers' entrepreneurial freedom, high default rates, issues with inclusion, cheating and/or delays in payments, increase in production risks (e.g., environmental risk from monoculture cropping), and

unequal bargaining power between farmers and downstream actors (Abebe et al., 2013; Barrett et al., 2012; FAO, 2018).

From the buyer perspective, farming contracts offer the benefit of consistent product supply volume and varieties which conform with quality and safety standards established within the agreement (FAO, 2018). Risks associated with contract-based farming for downstream supply chain entities may include high transaction costs from contracting with many small producers, side-selling if producers decide to breach the contract and sell to others, loss in flexibility to seek alternative supply and reputational risks if things go wrong (Barrett et al., 2012; FAO, 2018).

Yet, contract-based forms of vertical supply chain coordination are only feasible if they prove to be beneficial to both upstream and downstream actors in a network of buyers (Feng et al., 2018).

2.3 Farmers preference for contract design

The literature offers a range of case studies which explore farmers' preferences for contract design attributes. Most of these case studies are from developing countries (e.g., Abebe et al., 2013; Blandon et al., 2009; C. Fischer et al., 2010; Gelaw et al., 2016; Ochieng et al., 2017; Schipmann & Qaim, 2011) presumably due to the increasing importance of contract farming in linking small-scale farmers into the global value chain of agri-food products and the potential of such formal agreements to increase farmers income, that could elevate them out of poverty (Delgado, 1999). Conversely, contract-based farming is a relatively established form of vertical coordination in developed countries (e.g., Le Heron, 2003; Zeller & Langa, 2018), which may be a reason for the limited number of case studies from developed countries about which the literature explores farmers' preferences towards contractual design attributes (Bergtold et al., 2017; Feng et al., 2018; Schlecht & Spiller, 2012).

Except for product price, which is an important attribute in all contractual studies, the literature differs significantly in the selection of contract attributes that were offered to study participants in the various case studies (e.g. payment mode, contract form, product quantity, product quality, input supply arrangements, technical assistance, data sharing, seed quality specifications, relationship to buyer, and the timing of payment (Feng et al., 2018; C. Fischer et al., 2010; Gelaw et al., 2016; Schipmann & Qaim, 2011). This diversity in contract attributes that are used in the existing literature not only reflects the authors' consideration of local settings (e.g., trade norms, level of economic and institutional development), but also implies that findings from existing case studies are not necessarily comparable and transferable.

3. Data & Methods

To examine Queensland horticulture farmers' preferences for closer export supply chain coordination through marketing contracts with export facilitators, a survey which includes a discrete choice experiment was undertaken. A choice experiment is a popular method that has been employed in similar studies to explore agri-food producers' attitudes regarding farming contracts (e.g., Abebe et al., 2013; Feng et al., 2018; C. Fischer et al., 2010; S. Fischer & Wollni, 2018; Gelaw et al., 2016; Ochieng et al., 2017; Van den Broeck et al., 2017).

3.1 Survey and experimental design

An online survey was developed to collect data about farmers' preferences for contract design attributes and their general willingness to engage in marketing contracts. The survey includes questions about the respondent's agribusiness (e.g., type of horticulture produced, quantity produced, ownership, and current coordination levels within the supply chain), as well as the choice experiment and socio-economic information (e.g., age, educational attainment level). The survey questionnaire and data collection method were approved by the CQU Human Ethics Committee (approval number 0000021726).

The choice experiment provided participants with brief background information about export market access and considerations for closer involvement in higher value supply chains through marketing contracts. The experiment was based on a hypothetical scenario in which farmers were offered three options for their future supply chain management. These include two new supply chain options in the form of marketing contracts with exporters or wholesalers and the alternative of continuing with their current supply chain arrangement. Respondents were asked to choose the option which they most preferred.

The three different options in each choice set are described by a consistent set of 6 attributes, each of which varies across 4 or 5 levels per attribute. The attributes were chosen to represent the most important issues expected to be relevant to producer choices. Table 1 offers more detailed information about the selected attributes and their levels.

Table 1 Attributes and their level of contracts in the choice experiment

Attributes	Description	Levels
Price increase	Price increase refers to the increase in the product price compared to the market price that is offered by the alliance for your product.	• +5% of market price • +10% of market price • +20% of market price • +50% of market price
Amount of produce taken	Amount of produce taken refers to the proportion of your production volume which would be supplied to the market over the length of the agreement.	• 10% of production per annum • 20% of production per annum • 50% of production per annum • 90% of production per annum
Length of agreement	Length of the agreement refers to the time length of the contract. 0 years indicates no contract.	• 0 year • 1 year • 2 years • 5 years
Extra support	Extra support refers to different levels of additional services offered by membership to the supply chain such as access to genetics, market and industry production information, and technological innovation.	• Zero • Low • Medium • High
Increase in production costs	Higher production costs refer to additional production costs due to higher control processes and specifications to meet the market requirements.	• +5% • +10% • +20% • +50%
Increased paperwork	Increased paperwork refers to the additional administrative tasks to meet higher protocols for market requirements.	• 1 day per annum • 3 days per annum • 7 days per annum • 15days per annum

The selection of the attributes was guided by the literature (e.g., Abebe et al., 2013; Feng et al., 2018) and by consultation with representatives of the horticulture industry. These attributes were assumed to best reflect the issues relevant to Queensland horticulture producers and relevant trade-offs (e.g., price increase vs. increase in production costs) and therefore may differ from attributes selected in similar studies (e.g., Feng et al., 2018).

The NGene software (Choice Metrics, 2012) was used to derive a D-efficient experimental design with 36 choice sets. A pilot test with representatives from Growcom, the main industry association of Queensland's horticulture industry, which was generated priors for each attribute, was then used to create an upgraded design. The final design consists of 6 blocks for six sets each scenario (i.e., option 1, option 2 and option 3), which were randomly allocated to respondents. Figure 2 presents an example of one out of the 6 choice tasks that respondents were asked to choose from. More details about the survey are provided in the Appendix.

3.2 Data collection

The experiment was conducted between September 2019 and April 2020. The initial target sample size was 400, considering the total number of fruit and vegetable producers in Queensland is about 2,200 (ABS, 2020a). The survey and experiments were available in electronic form through a web-link. Growcom assisted in recruiting participants by distributing the survey within their member network. A reminder to participate was sent to farmers after the initial distribution. The research team struggled to collect sufficient data, as the response rate remained low. An additional online survey supported by phone calls was conducted with farmers who were randomly selected by a survey company to increase the number of responses. The final sample, which includes 57 farmers (2.5% of the QLD fruit and vegetable producers), is translates into 342 observations (i.e., 57 farmers who completed 6 choice sets each) for the choice experiment.

Choice Card 1	New supply chain		Continue with current system
Attribute	**Option 1**	**Option 2**	**Option 3**
Price increase	**+10%** of market price	**+5%** of market price	**No involvement in extra supply chain management** **No change in the attributes**
Amount of produce taken	**10%** of production volume	**90%** of production volume	
Length of agreement	1 year	5 years	
Extra support	Zero	High	
Higher production costs	+5%	+5%	
Increased paperwork	3 days per annum	7 days per annum	
Choose one option:	☐	☐	☐

Figure 2: Choice task example

3.3 Data description methods

Conventional data description methods (e.g., mean, standard deviations) were used to describe the collected sample data such as socio-economic characteristics of respondents (e.g., age, experience, educational level) and information about their agribusinesses (e.g., employment, sources for market information, current supply chain collaborations).

The Pearson Chi-square statistic was used to compare responses relating to farmers' stated attitude towards collaboration (e.g., membership in associations, current collaboration). Also, this access to market information to more detailed information about how respondents would likely engage in in vertical supply chain collaboration in the future. The Chi-square statistic is derived by:

$$\chi^2 = \sum \frac{(f_o - f_e)^2}{f_e}$$

with f_o being the observed frequency of variable counts and f_e the expected frequency if no relationship exists between the variables. The null hypothesis of this test is that the variables are independent of each other. If the

p-value of the derived statistic is less than 10%, it can be concluded that the variables are not independent and that there is a statistical relationship between the variables.

3.4 Mixed logit (ML) model

To estimate farmers' willingness to participate in vertical supply chain collaborations, a discrete choice experiment, as described by Hensher et al. (2015), was used. Discrete choice experiments are theoretically founded in the utility theory. Different econometric models can be used to estimate the probability that a specific alternative (or option in the context of this study) is chosen from a set of alternatives (i.e., option 1, option 2, option 3). The mixed logit (ML) model allows for random taste variations within a collected sample and permits correlations between unobserved factors over choice alternatives (Hensher et al., 2015). Random parameters that are included in the model vary among the sample population with a density function that has a specific distributional form. This captures individual deviations from the mean. The ML model can be summarised as follows:

$$Prob\ (choice_{ns} = j|x_{nsj}, z_n, v_n) = \frac{\exp\ (V_{nsj})}{\sum_{j=1}^{J_{ns}} exp\ (V_{nsj})}$$

with $V_{nsj} = \beta'_n x_{nsj}$ and $\beta_n = \beta + \Delta z_n + \Gamma v_n$. X_{nsj} is the K attributes of alternative j in the choice situation c that is offered to n individuals (Hensher et al., 2015). Z_n is a set of M characteristics of the individual n which influences the mean of the parameter (Hensher et al., 2015). v_n comprises the vector of random variables K with a zero mean and variances.

A specific feature of the ML model is that it allows for the estimation of observed and unobserved heterogeneity in the preference of individual n which is reflected in β_n, where Δz_n is the observed heterogeneity and Γv_n is the unobserved heterogeneity (Hensher et al., 2015).

The explanatory variables were modelled using the following utility specifications:

$$U_1 = \beta_1(Price) + \beta_2(Amout) + \beta_3(Length) + \beta_4(Support) + \beta_5(Cost) + \beta_6(Paperwork)$$

$$U_2 = \beta_1(Price) + \beta_2(Amout) + \beta_3(Length) + \beta_4(Support) + \beta_5(Cost) + \beta_6(Paperwork)$$

$$U_3 = ASC + \beta_1(Price) + \beta_2(Amout) + \beta_3(Length) + \beta_4(Support) + \beta_5(Cost)$$
$$+ \beta_6(Paperwork) + \beta_7(Farmer) + \beta_8(Business)$$

with U as the utility for supply chain options 1, 2 and 3, β as the estimated coefficients for the 6 contract attributes (see Table 1) and ASC as the alternative specific constant which was only included for option 3 as the status quo. Socio-economic characteristics (Farmer) and agribusiness characteristics (Business) are the covariates which indirectly affect the utility.

If the p-value of the coefficient of a parameter is less than 10%, then it is regarded as a significant influence on the choice of respondents. For the random parameters, an insignificant parameter indicates that the dispersion around the mean is statistically equal to zero, meaning that all information is captured within the mean (Hensher et al., 2015). Yet should a random parameter be found to be statistically significant (with a p-value less than 10%), the results suggest the existence of heterogeneity in the parameter estimate over the sample population around the mean. This would imply that different individuals have distinct parameter estimates that may be different from the sample population mean estimate.

3.5 Latent class model

Preferences can also be explained by categorizing respondent variations into one of several latent classes. This splits the responses into subsets of farmers with similar preferences within one class and different preferences across classes (Hensher et al., 2015). The choice probabilities determined within the class within the latent class model can be expressed as follow:

$$Prob\ [choice\ j\ by\ individual\ i\ in\ situation\ t\ |class\ q]$$

$$= \frac{\exp(x'_{it,j}\beta_q)}{\sum_{j-1}^{Ji} \exp(x'_{it,j}\beta_q)}$$

4. Findings and analysis

This section presents findings from the analysis of data collected in the survey. The first part of this section focuses on the socio-economic data of the respondents, which was collected from the supplementary information part of the choice experiment. Socio-economic variables were examined with Chi-square statistics to identify interrelationships. The second part of this section presents findings of the choice experiment analysis. This analysis addresses the research question regarding the farmers' willingness to participate in export-focused contract-based supply chain coordination.

4.1 Socio economic profile of the respondents

Based on the collected postcode data, the 57 responses to the farm survey were grouped into three horticulture growing regions in Queensland, namely the south, the central, and the north. About 42% of participants were in the south Queensland region, 35% in the north Queensland region and the remaining 23% were from the central Queensland region. The distribution of the responses by growing region shows that the central horticulture production area in Queensland is slightly underrepresented in the sample compared to the other two areas. In terms of production, the collected data show that most respondents were fruit farmers (72%) (see Figure 3). About 23% of the surveyed farmers were vegetable producers. Nut and other horticultural producers accounted for 2% and 3%, respectively in the collected sample (Figure 3). The high proportion of fruit farmers in the sample slightly overrepresents the proportion of the total value that the Queensland fruit industry contributes to the state's total horticulture production (QLD DAF, 2018). This may be caused by the distribution of the survey through Growcom to their member network and subsequently by the composition of the organisation's member base. This study is part of a bigger project which is mainly focused on three selected fruit industries, and hence the findings are more relevant to the current research project, and may not be generalised.
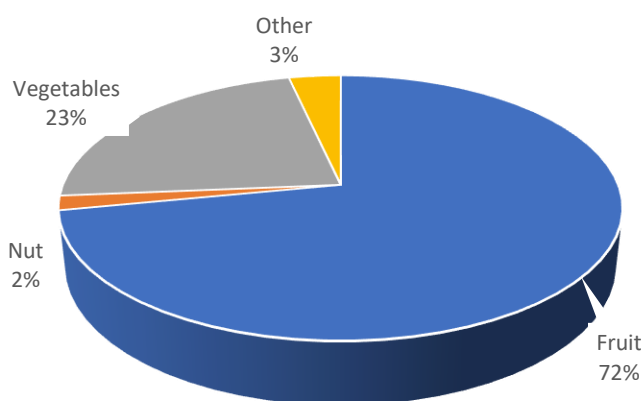

Figure 3: Sample composition of agribusinesses based on production focus

According to the socio-economic characteristics collected from respondents, over 90% of the farmers in the sample either owned or owned and managed their agribusiness (Table 2). About 75% of the respondents were male and well over half of the sample were people who had more than two decades of experience in the horticulture industry. Farmers with a history of 10-20 years in the industry appeared to be slightly underrepresented in the sample. The age profile in Table 2 shows that about 52% of the surveyed farmers were 49 years of age and younger. This suggests that the age of farmers in the sample was slightly lower compared to the industry since the average age of farmers in Queensland is 58 years (ABS, 2020). The respondents had a relatively high level of education with about 40% having completed either an undergraduate or postgraduate degree, that aligns with statistics by ABS (2012).

The proportions of farmers belonging to different household income categories (from agribusiness operations only) were relatively evenly distributed, except for the highest income segment. This suggests that the level of income that farmers received from their business varies across the industry. The results in Table 2 also show that a high proportion of farmers received most of their total household income from the agribusiness which they managed. The socio-economic data were collected to support the choice experiment data and to investigate whether the individual's profile affected their selection in the choice experiment. However, results may not be generalised and should be interpreted with caution due to the small sample size. For the same reason, the researchers restrained to compare the study results with the state context.

Table 2 Socio-economic characteristics of respondents

Description		Percentage
Role of the business	Owner	35.09
	Owner/Manager	47.37
	Family member of the owner	7.02
	Employed manager	5.26
	Employee	3.51
	Other	1.75
Gender	Male	75.44
	Female	22.81
	Prefer not to tell	1.75
Experience in the industry	0-5 years	14.04
	6-10 years	14.04
	11-15 years	7.02
	16-20 years	7.02
	More than 20 years	57.89
Age	18-29 years	12.28
	30-39 years	8.77
	40-49 years	31.58
	50-59 years	26.32
	60-69 years	12.28
	70 years and older	8.77
	Prefer not to say	0.00
Level of education	Primary school	3.51
	High school	29.82
	Post school qualification (TAFE/Trade certificate)	22.81
	Undergraduate degree	31.58
	Postgraduate degree	12.28
Household income from the business	Less than $799 per week (Less than $41,599 per year)	19.30
	$800 – $1,199 per week ($41,600 – $62,399 per year)	7.02
	$1,200 – $1,699 per week ($62,400 – $88,399 per year)	19.30
	$1,700 – $1,999 per week ($88,400 – $103,999 per year)	19.30
	$2,000 – $2,999 per week ($104,000 – $155,999 per year)	10.53
	$3,000 or more per week ($156,000 per year)	5.26
	Prefer not to say	19.30
Contribution share of the enterprise to the household income	0-24% of annual net income	14.04
	25-49% of annual net income	10.53
	50-74% of annual net income	15.79
	75-100% of annual net income	59.65

On average, the surveyed horticulturists relied on two full-time family members to operate their farming business (Table 3). Family members also appeared to be important in supporting the agribusinesses via part-time and casual labour, but this involved fewer people than full-time employed family members (Table 3). The agribusinesses appeared to employ on average about three full-time non-family staff and a high number of casual non-family staff during harvest periods (28.56 causal workers) and during the rest of the year (7.37 casual workers).

The standard deviation, as a measure of dispersion around the mean in Table 3, was found to be relatively high for full-time non-family employees (6.05), casual harvest period non-family employees (46.27) and casual rest of year non-family employees (22.55). This indicates that there is a high variation for these types of employment among agri-businesses in the sample.

The median statistics, as the value that splits the ordered observations (from lowest to highest value) in half, indicate that more than half of the surveyed agri-businesses relied on two or more full-time family member employees, 10 or more casual harvest period non-family employees and one or more casual rest of year non-

family employees. The median of zero for all other employment types suggests that more than half of the sample respondents reported zero employees for the respective categories.

Overall, the high proportion of non-family members employed confirms the important role which horticultural businesses play in the creation of employment in regional Queensland. The profile of labour employment across the horticulture farms also shows an apparent dependence on casual staff.

Table 3 Employment details for agribusinesses

Employee type	Full/Part/Casual	Median (number of people)	Mean (number of people)	Std. Dev.	Max.
Family members	Full time	2.00	2.07	1.70	10
	Part time	0.00	0.32	0.69	3
	Casual HP	0.00	0.61	1.33	5
	Casual ROY	0.00	0.25	0.71	4
Non-family employees	Full time	0.00	2.98	6.05	30
	Part time	0.00	0.68	1.81	12
	Casual HP	10.00	28.56	46.27	250
	Casual ROY	1.00	7.37	22.55	140

Notes: HP for harvest period, ROY for rest of year

A relatively large proportion (61%) of the surveyed farm businesses reported an annual income group of $0.50 - $1.99 million per annum (Figure 4**Error! Reference source not found.**). These statistics were derived from the responses to questions 3 and 4 of the questionnaire (see appendix) by the participants, which were about the production units (in tonnes or box) and the unit price. The annual income reported in Figure 4 did not include any other income sources of the respondents.
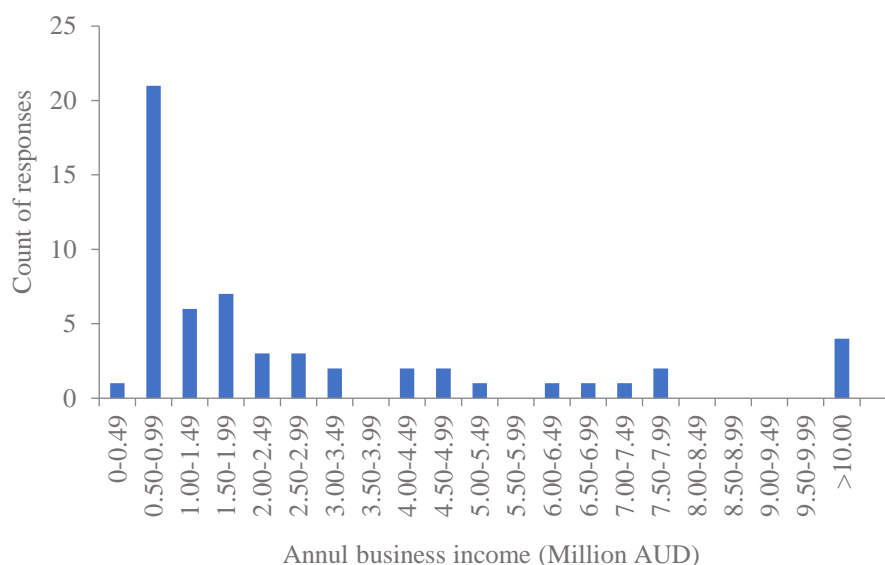

Figure 4: Income distribution for agribusinesses within the sample

The survey also asked participants to rate the profitability of their agribusiness compared with other businesses in the respective industry. Just over half of participants (54%) rated the profitability of their business as about the same compared with other businesses. The majority of the remaining proportion ranked the profitability of their business as more or much more profitable than other agribusinesses in the industry (Figure 5).
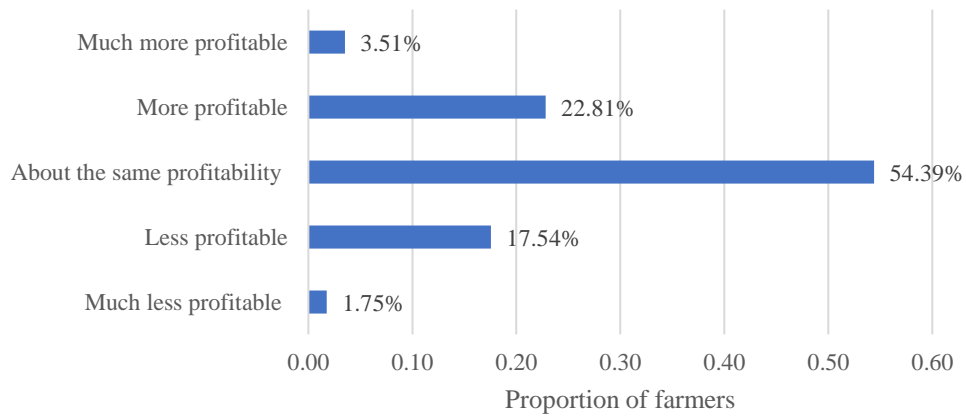
Figure 5: Farmer's perception of their profitability relative to peers

The collected data also reveal that about 33% of all farmers in the sample were involved in horticulture export, yet the total of their export volume only accounted for about 9% of the total production volume across the sample. This proposition is less than the proportion of horticultural products grown in Queensland which is currently exported (16%) (QLD DAF, 2018). Figure 6 shows that according to the collected sample, agribusinesses located in south and central Queensland were more proactive in exporting their product compared to farmers in northern regions of the state.
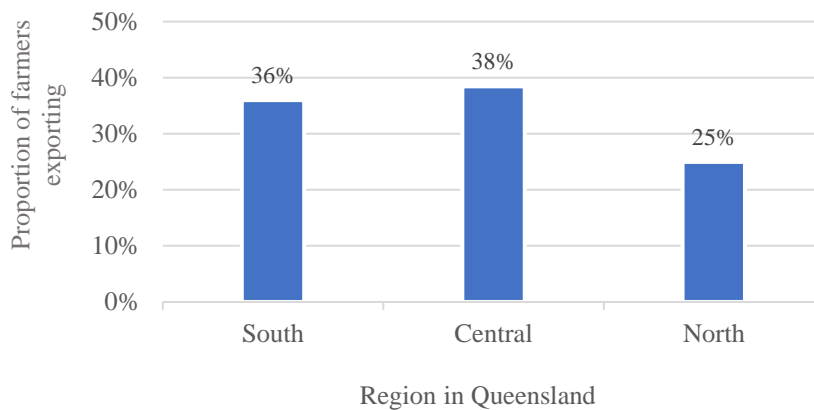

Figure 6: Proportion of farmers exporting by region

However, the export proportion of agribusinesses' total production volumes was relatively low in all three regions in contrast to the Queensland figure (Figure 7).
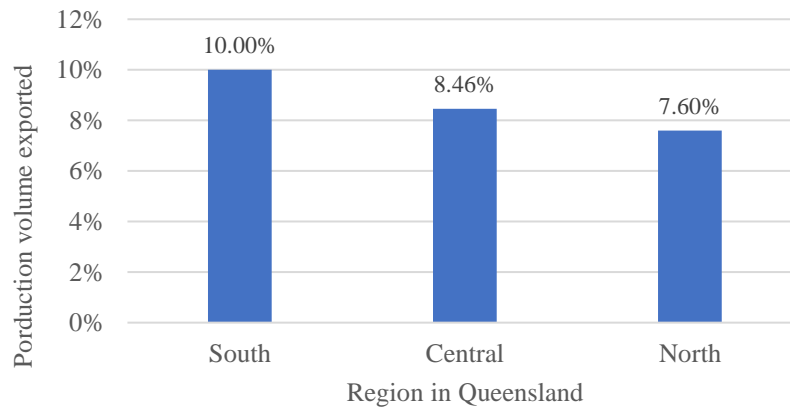

Figure 7: Proportion of produces exported by the producers in different regions

The exporting farms in the southern Queensland region were producing a major portion of the products of the region in contrast to the other two regions (central and north). In Southern Queensland, on average 4,500 tonnes of horticultural products were produced by businesses which were participating in export (Figure 8). However, not all product volume that these businesses produced was going to the export market, as suggested in Figure 7. In central and northern Queensland, the average production of non-exporting firms was higher, as suggested in Figure 8. However, exporting agribusinesses in central Queensland, which indicated their production volumes in box or tray, appeared to generate higher average production volumes (Figure 9). Sixteen of the 20 responses from north Queensland produced fruit products, which might include bananas or mangoes which were almost exclusively sold to the domestic market mostly due to strong international competition. This is explained in the findings in Figure 8 and Figure 9.
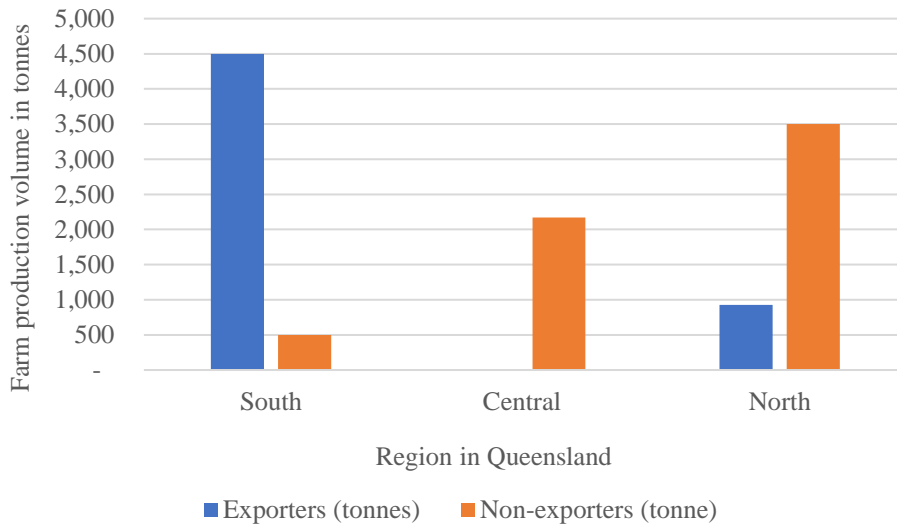

Figure 8: Average total production volumes of exporting farms compared to non-exporting farms (in tonnes)
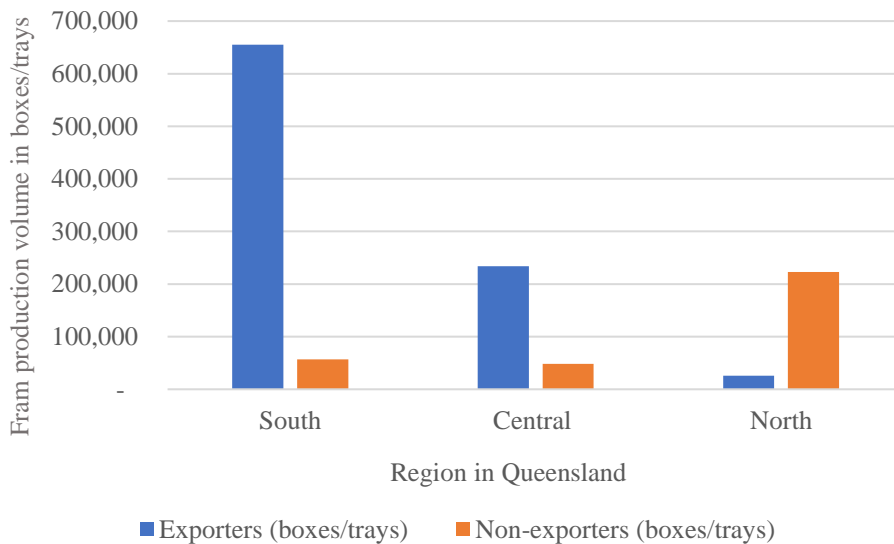

Figure 9: Average total production volumes of exporting farm compared to non-exporting farms (in box/tray)

The participants were asked about the sources through which they received market information about their product, and the respondent might choose multiple sources. This reveals that agents play a major role in the distribution of market information to horticulturists in Queensland (Figure 10). Twelve respondents did not specify the source of market information, that falls in the 'Other' category, that may indicate that they were not aware of the sources of market information.
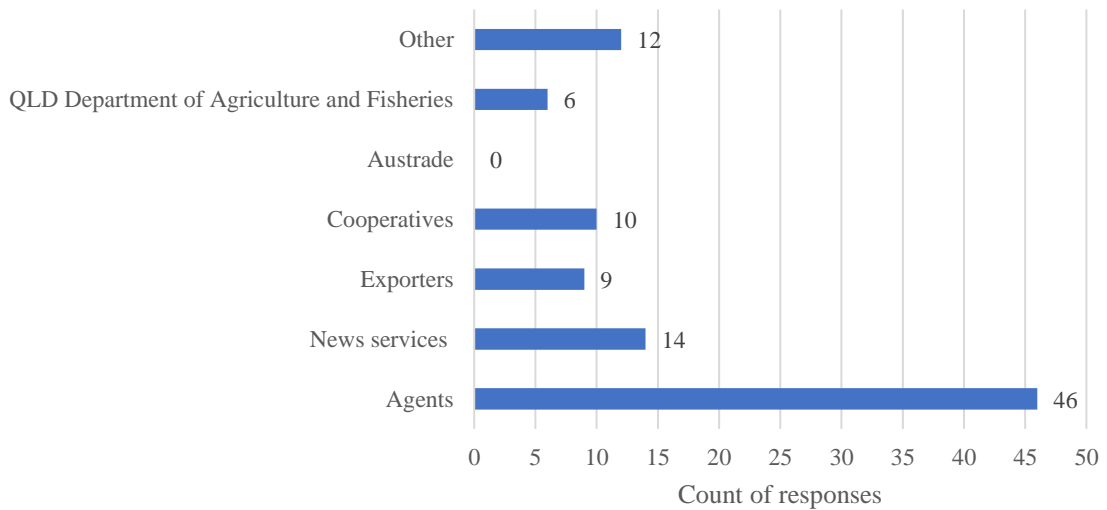
Figure 10: Sources for market information (by count of stated frequency)

The respondents were asked about their membership in industry organisations, and the question allowed them to select more than one association (i.e., multiple membership). Nearly 80% of the farmers appeared to be members of Growcom (Figure 11), while about 12% of farmers in the sample were not members of any industry association.
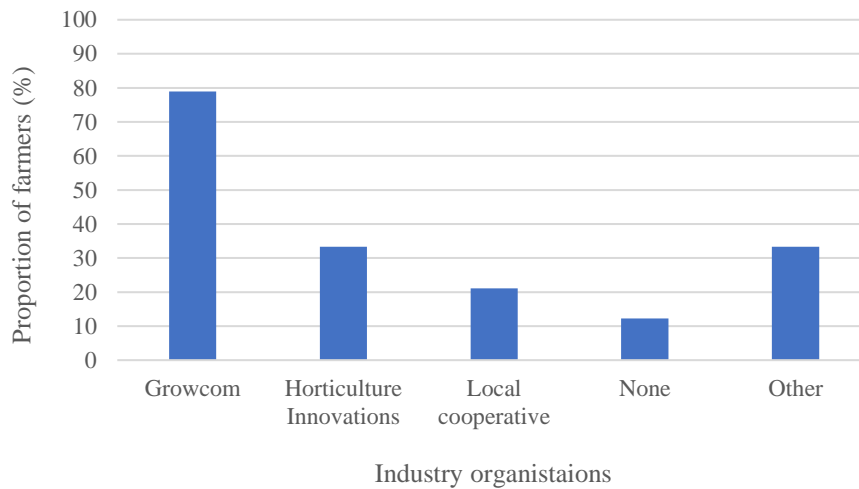

Figure 11: Membership of industry organisation(s)

Note: Other was not specified by respondents.

An important precursor to the choice experiment was to identify how producers were currently interacting with their supply chain. Nearly 37% of the surveyed farmers reported having more than one collaboration in the supply chain whereas 12% of respondents said they had no collaboration (Figure 12). Within the group of respondents who self-identified as "collaborating", relationships that had been developed with processors, retailers and consumers appeared to be the most common forms of vertical supply chain collaboration. On the other hand, contract farming with major retailers currently seemed to be a less common form of supply chain collaboration (Figure 12).
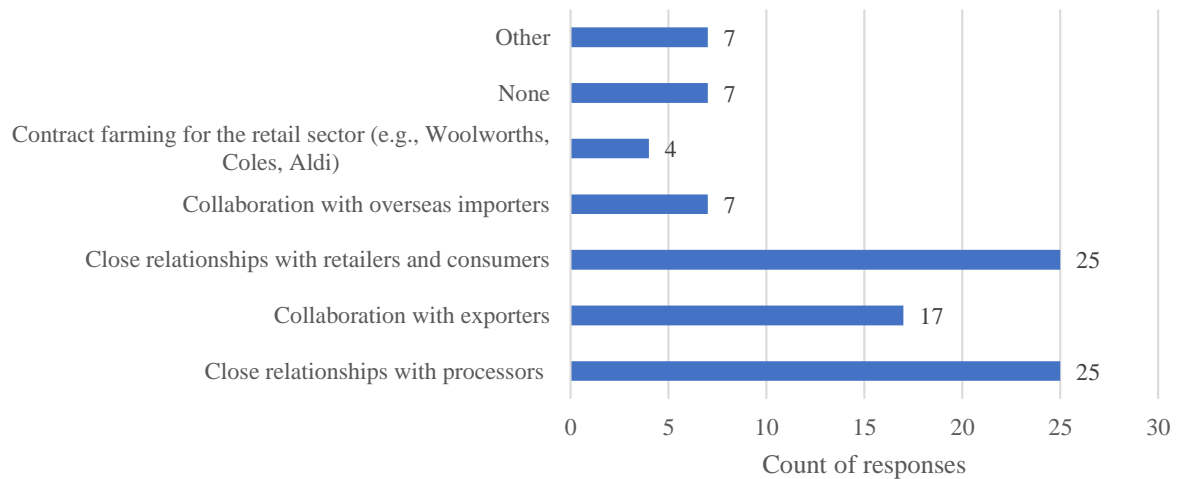
Figure 12: Farmers current collaboration / multiple collaborations in supply chain

Figure 13 provides a summary of the findings about farmers' willingness to collaborate with other entities within the supply chain of their products, in the future. The findings indicate that there was some degree of hesitation to engage with other supply chain entities, with approximately one-third responding that they would collaborate with 'none' of the listed options. The results in Figure 13 (in comparison to Figure 12) also suggest that they appeared to be interest in expanding collaborations with the domestic retail sector, potentially through contract farming. Their willingness to engage with exporters was among the three highest-rated options for which farmers expressed interest in future collaboration (Figure 13).
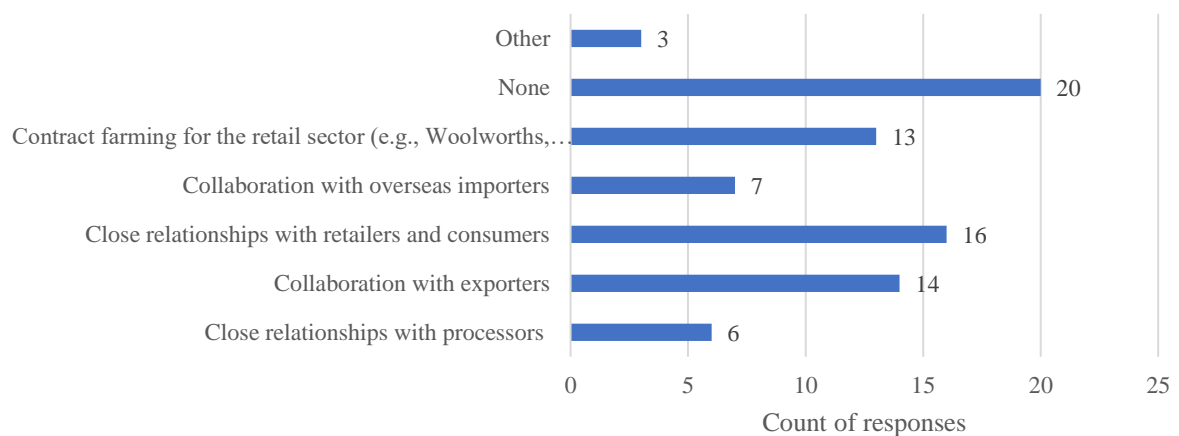

Figure 13: Farmer's willingness to engage in extra supply chain collaboration in future

4.2 The likelihood of farmers to collaborate in future

The data presented in Figure 10-13 were used to identify any interrelationship among the data. The Chi-squared statistic was applied to test the relationship between participants' responses to questions about their membership in industry associations (see Figure 11), access to market information (see Figure 10), their current supply chain collaborations (see Figure 12), and their stated likelihood in engaging in future supply chain collaborations (see Figure 13). The analysis reveals that only the current pattern of supply chain collaboration was significant in explaining their stated future likelihood of engaging in supply chain collaborations (Pearson Chi-squared (35) = 73.154, p-value: 0.002). This finding suggests that farmers' current supply chain engagements might, to some degree, be a driver for their willingness to take part in future collaborations.

4.3 Choice experiment results

4.3.1 Mixed logit (ML) model

To analyse the data from the choice experiment, several specifications were tested using different possibilities for random and non-random parameters. The ML models which had the best model fit are shown in Table 4. In the model, the parameters for the amount taken, higher product price and increased paperwork were treated as random, but only the coefficients for the amount taken and higher product price were significant. However, the distributions were significant for each parameter, implying that there was substantial variation in the way that farmers viewed these attributes.

Table 4: ML model estimation results

Parameters	Coefficient		Standard Error
Random parameters			
Amount of produce taken	0.015	***	0.004
Higher production costs	-0.040	***	0.011
Increased paperwork	-0.034		0.024
Non-random parameters			
ASC	-5.846	***	1.762
Price	0.036	***	0.009
Amount of produce taken			
Length of agreement	0.163	***	0.054
Extra Support	0.421	*	0.235
Higher production costs			
Increased paperwork			
Domestic Market Sales	0.064	***	0.017
Information through agent	1.080	*	0.588
Engage with importer	-2.768	***	0.914
No engagement	1.644	***	0.502
Engage with retailers	-0.942	*	0.522
Distribution of random parameters (triangular)			
Amount of produce taken	0.018	***	0.004
Higher production costs	0.027	***	0.010
Increased paperwork	0.075	**	0.035
Model fit statistics			
Log Likelihood	-279.929		
Log Likelihood (ASC only)	-370.721		
Adjusted R-squared	0.228		
Restricted Log Likelihood	-375.725		
AIC/n	1.725		
Chi squared	191.593		
McFadden Pseudo R-squared	0.255		
Sample			
Number of respondents	57		
Number of observations (n)	342		

Notes: *** indicates significance at 1% level, ** indicates significance at 5% level, * indicates significance at 10% level.

The coefficients for the non-random parameters all had the expected signs and were significant. The derived standard errors provide an indication that the deviation from the mean coefficients is relatively small. The negative sign of the alternative specific constant (ASC) suggests that respondents tended to select option 1 and option 2 (new supply chains) more often relative to option 3. This finding implies that farmers generally preferred to engage in new contract-based export supply chains over their existing supply chain system. In addition, the positive and significant coefficient for the price parameter implies that farmers favoured a higher product price. Farmers also appeared to receive a higher utility from longer agreement lengths and extra support which is inducted by the positive coefficient for both parameters. It should be noted that the levels for the extra support attribute were dummy coded and that only the highest level was included in the estimation as it was the only one found to be significant. This suggests that farmers only preferred a very high level of extra support in more coordinated supply chain management.

Farmers who chose the status quo options were more likely to be selling to domestic markets and using agents for market information. Seven out of 57 respondents preferred not to change their supply chain management by always choosing option 3 in the choice experiment. These farmers did not want to engage with export markets. A closer examination of the response from seven participants reveals that they did not have existing collaborations with exporters. This confirms findings from above (section 4.2) that farmers' likelihood of changing their approach to future supply chain coordination may be driven by their level of current supply chain engagement.

Six out of the seven respondents who always selected option 3 in the survey had an annual farm income of less than two million Australian Dollars and one participant reported a farm income of 6.5-6.99 million Australian dollars. These findings suggest that smaller agri-businesses may not have an intention to explore export opportunities, and that there is also some hesitation to explore export prospects among larger agri-businesses.

4.3.2 Latent class model

The presence of preference diversity within the sample of farmers for export marketing contracts was further explored by estimating a latent class model. The results reveal the existence of three latent classes or clusters of farmers with similar preferences for the suggested supply chain management options (Table 5). There were similar proportions of farmers in each class, at 31.5%, 44.8% and 23.8% for Classes 1, 2 and 3, respectively.

The large negative ASC for Class 1 indicates that participants within this cluster were strongly in favour of a new supply chain model over the status quo system (Table 5). Farmers belonging to Class 1 indicated that higher product prices, larger amounts of produce taken, and longer agreement times were positive influences on their choices, while higher production costs and increased paperwork had negative impacts on their choices. The results for Class 1 also indicate that farmers who were younger and already involved in export markets were more likely to prefer new supply options.

For Class 2, the ASC was not significant, and this is an indication that farmers in this group were indecisive about their preference for option 3 (no changes to current supply chain management) relative to new supply chain options. This group preferred options with higher product prices, longer agreements, and extra support, but were averse to higher production costs. However, those who had longer experience in the industry were more likely to support new options for supply chain management.

The third identified class had an ASC which was not significant, suggesting, similar to Class 2, that farmers in this cluster were indecisive regarding the three proposed supply chain options. Members of this group preferred to engage in options that deliver higher product prices and larger amounts of produce taken and were less likely to support options with higher production costs. Farmers in this group who focused on domestic sales were less likely to be interested in new supply chain options.

When comparing the results across the three classes, it can be seen that the product price and higher production costs are the only parameters which consistently influenced the choice of farmers. This suggests that product prices and production costs are the two main attributes which farmers can consider in their choice of a supply chain model.

Table 5: Latent class model estimation results

Parameters	Class 1 Coefficient		Class 2 Coefficient		Class 3 Coefficient	
Price	0.247	***	0.017	*	0.107	***
Amount of produce taken	0.015	**	0.004		0.169	**
Length of agreement	0.463	***	0.118	**	0.295	
Extra Support	-0.546		0.736	***	-1.400	
Higher production costs	-0.254	***	-0.017	*	-0.131	***
Increased paperwork	-0.310	***	-0.012		-0.089	
ASC	-21.805	***	0.390		-101.551	
Experience	-0.149		-0.043	*	2.557	
Age	0.228	***	-0.016		-0.033	
Domestic Market Sales	0.192	***	0.014		0.421	**
Class probabilities						
Probability of Class 1	0.315	***				
Probability of Class 2	0.448	***				
Probability of Class 3	0.238	***				
Model fit statistics						
Log Likelihood	-375.725					
Log Likelihood (ASC only)	-370.721					
Chi-squared	232.809					
Adjusted R-squared	0.276					
AIC/n	1.704					
Sample						
Number of respondents	57					
Number of observations (n)	342					

Notes: *** indicates significance at 1% level, ** indicates significance at 5% level, * indicates significance at 10% level. The identified three classes refer to groups or clusters of farmers within the sample who exhibited similar preferences and characteristics according to their responses in the survey.

5. Discussion & Recommendations

The results of this study suggest that there was a degree of heterogeneity (or diversity) among horticulture farmers' preferences for participation in agreement-based vertical supply chains, which focus on product export (see Table 4 and Table 5). The study has identified three groups of farmers, of which one group appeared to open to engaging in export markets while the other two groups seemed to be more hesitant in engaging in these markets. This finding is also supported by the farmers' statements about their willingness to engage with different supply chain entities in future, which were collected through the survey, where a large proportion of respondents indicated that they would either prefer not to collaborate with other supply chain entities or to seek collaborations within the domestic supply chain. Yet, another cohort within the sample indicated a willingness to collaborate with export agents in future (see Figure 13). This suggests that engaging the groups who are hesitant to collaborate with or participate in the export supply chain is a big challenge for the industry. Hence, further research identifying opportunities and strategies to increase the participation rate of farmers in export-oriented supply chain collaboration is needed.

The reasons why some farmer groups within the horticulture industry may be hesitant to engage in export and supply chain coordination could be related to manyfold (e.g., age, risk perception, trust, attitude, competence of entrepreneurs, networks embeddedness, business size and bad experiences with collaborations) (e.g., Akbar et al., 2019; Carillo et al., 2017; Schlecht & Spiller, 2012). Furthermore, horticulture farmers may also lack detailed information about the export supply chain and the associated procedures of which a marketing contract is only one component.

Substantial variation was evidenced by the ways that farmers viewed contract attributes, particularly for the variables volume taken, higher product price and increased paperwork (Table 5). This suggests that the design of export marketing contracts may need to be negotiated individually with farmers rather than offering all interested agribusinesses a uniform contract. As the mindset and the circumstances of individual farmers are different, and a uniform contract may not attract the interest of all potential parties. Alternatively, a contract which offers a basic framework but provides flexibility within the terms for farmers, that best suits their operations and preferences, may be considered. This is important to ensure farmers' interest in contractual agreements is met and that their needs are not being bypassed (Schlecht & Spiller, 2012).

The product price and potential for higher production costs were the determinants that were identified by all farmer groups as being very important for their decision about changes to their supply chain (Table 5). This may not be surprising as these attributes directly affect their agribusiness' profits.

Furthermore, an attribute, which was not included in the experiment of this study but is an important element in agreement-based relationships, is trust. Trust among contracting parties can determine their desire to enter a long-term relationship (e.g., Abdulai & Birachi, 2009; Batt, 2003; Roe et al., 2004). Hence, parties who are interested in engaging in increased supply chain coordination should be aware of the critical role of trust in mutual relationships.

The results reveal that farmers expressed substantial interest in stronger coordination with the domestic retail sector (compared with the export sector), potentially in the form of contract farming. A reason for this could potentially be that farmers would have more direct access to retailers and consumers within a domestic supply chain than in an export chain. Another reason could be the lower perceived risk in the domestic supply chain compared to the export one.

Furthermore, farmers' future willingness to engage in supply chain collaborations was likely driven by their current level of collaboration within the supply chain of their product (Table 5).

The presence of differences in producers' attitudes towards marketing contracts and contractual design has also been observed in previous case studies in the literature (e.g., Feng et al., 2018; Schlecht & Spiller, 2012). However, as outlined in section 2, the case studies in this field of research are not directly comparable with respect to respondents' preferences for contract attributes, except for the product price, since the proposed attributes differ substantially depending on the industry, country and specific context in the case studies.

Given the findings of this study, the following recommendations are derived:

• Queensland's horticulture associations may consider identifying farmers, through a rigorous in-person survey, who are not yet exporting their product but have an interest in doing so, particularly through marketing contracts with export agents (see Table 5). These farmers could be linked up with export agents to explore market opportunities and a potential individual export agreement.

• The horticulture industry could also consider exploring options to develop high-value supply chain collaborations within the domestic market. The horticulture industry may liaise with the retail sector to investigate potential alternatives for increased supply chain coordination (e.g., production contracts or contract farming, see Figure 1). This would also include an initial investigation of the retail sector's interest in expanding this form of supply chain coordination to farmers. While the horticulture industry may be aware of possible advantages linked to close supply coordination with the retail sector (e.g., high price, lower transaction cost, decreased market risks and uncertainties), potential disadvantages (e.g., loss in entrepreneurial freedom, unequal bargaining power) should not be ignored in considering farmers' decision about changes to current supply chain systems.

• Since horticulture producers may also lack information about various forms of vertical supply chain coordination (see Figure 1), the industry associations may consider providing awareness-raising sessions or short courses to enable farmers to gain a better understanding of the forms of supply chain management.

• Industry support (e.g., industry-buyer forums which offer the opportunity for both parties to network and develop links) could be provided by the Government to facilitate business links to encourage the development of more coordinated vertical supply chain relationships. In addition, the provision of information and training about the potential benefits and costs from improved coordination for agribusinesses would support their decision-making process about options to create higher value for their product.

A limitation of this study is the relatively small sample size which may affect the robustness of the results. This bias is likely present in the sample, given the distribution of age groups (diversity in age and experience of farmers) and the relatively high educational attainment level within the sample (Table 2). Hence, the findings of this study should be interpreted with caution.

The information collected in the survey about Queensland's horticulture agribusinesses, including farmers' characteristics, could not be compared to previously collected data, as this information could not be made available by industry associations like Growcom.

Furthermore, farmers' characteristics such as ethnicity could also affect their decisions for supply chain collaborations. Unfortunately, such detailed information about the respondents were not collected as part of the survey.

The location of agribusinesses within Queensland could explain farmer's choice to become engaged in export marketing contracts. Although post code data were collected, the number of observations within each growing region (e.g., 24 for south, 13 for central and 20 for north) was too small for a vigorous statistical analysis.

An understanding of consumer demand for horticultural products from Queensland/Australia in potential export countries could offer producers additional information which may affect their decision to engage in product export. Yet, there is currently limited information available (mostly only through export agents) about consumer demand in Asia for horticultural products from Australia, which offers scope for further research.

6. Conclusion

This study aims to investigate Queensland horticulture farmers' willingness to participate in export-focused marketing agreements as a form of closer vertical supply chain coordination. The study also aims to identify attributes of formal agreements that would encourage farmers' participation as well as farmers' individual characteristics which may affect their decision to seek closer vertical coordination with their product's supply chains.

Using a farmer's survey which includes a discrete choice experiment, the findings of this study suggest that there exists a degree of heterogeneity in the preference of farmers for export marketing agreements which are not only linked to contract attributes, but also influenced by farmers socio-economic characteristics and features related to their agribusiness. Contract attributes that were identified as important to all participants include product price and potential increased costs of production. The results also identify that farmers were interested in closer coordination with the domestic retail sector such as through contract-based farming.

Based on the findings of this study, it is recommended that industry associations should assist farmers who are interested in export marketing contract by linking them up with export agents. Within the domestic market, links between the retail sector and farmers could be facilitated to improve supply chain coordination. Moreover, information and training about the advantages and potential disadvantages of closely coordinated agri-food supply chains may assist farmers in their decision-making process about changes to their existing supply chain systems. These recommendations are expected to not only improve coordination within the horticulture supply chains, but more importantly, create value for agribusinesses and subsequently increased income for local rural economies.

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Appendices

Using improved supply chains to achieve higher returns for horticulture producers in Queensland

This survey is undertaken by researchers from CQ University in association with Growcom, Tropical Pines and Passionfruit Australia. It is funded by the Cooperative Research Centre for Developing Northern Australia (CRCNA Project No. A.1.1718.97).

The aim of this survey is to investigate horticulture producer's interest in achieving higher product returns by participating in improved supply chains.

It is expected that the findings from this research will provide the horticulture industry with information about the trade-offs that producers perceive between higher product value and improved supply chain management (e.g., coordination, collaboration). The results from this research may benefit the industry and the farmers through recommendations about how improved supply chain management could be achieved through an enabling environment (e.g., price setting, agreement length and additional support).

The survey will take about 20 minutes to complete and includes three parts:

- Part A: Questions about your agri-business
- Part B: Choice experiment
- Part C: Questions about you

Your participation in this study is entirely voluntary and we respect your right to withdraw from the survey at any time. There is no risk to participants from withdrawing from this survey.

All collected data will be unidentifiable ensuring your participation is anonymous. The collected data will not be shared with any other organisation or individual and will be treated as confidential.

The survey is not expected to cause any discomfort nor are there any risk associated with the participation in this survey. It is unlikely that this survey will raise any personal or upsetting issues but if it does participants may wish to contact Lifeline (phone: 13 11 14).

This research is expected to be completed in June 2020. Information from this survey may be made used for publicly available reports, journal articles or conference presentation. Results from this work will only be available in a summary manner to ensure that no individual business or person can be identified. Survey participants will receive a summary report on the findings of this survey.

Findings of this research will be made available through Growcom, Tropical Pines, Passionfruit Australia and the Cooperative Research Centre for Developing Northern Australia (CRCNA).

As a thank you for your participation in this survey you will be provided a $100 gift voucher to one in every five participants chosen randomly. To enter the drawn, you will need to provide your details at the end of the survey. If your name will be chosen in the draw, the voucher will be mailed to you.

The principal research officer for this project is Dr Delwar Akbar. You may contact him by email at: d.akbar@cqu.edu.au or phone: 07 4923 2316.

Please contact the CQUniversity Office of Research (phone: 07 4923 2603 or email: ethics@cqu.edu.au) should there be any concerns about the nature and/or conduct of this research project. Your concerns will be treated confidentially.

Consent From

To provide us with your consent to participate in this study please read the information below and indicate your consent by checking the box at the bottom at this page:

1. An Information Sheet about the survey "Using supply chains to achieve higher returns for horticulture producers in Queensland." has been provided to me which I have read and understood;

2. I have been advised about the potential risks associated with this survey and that I have the opportunity to ask the research team any questions I may have about the survey and my participation;

3. I understand that my participation in this research is entirely voluntary. I have been invited to participate and I am free to withdraw from the survey at any time. My non-participation or withdrawal of consent will have no consequences;

4. I understand that I will have the right not to provide information which is of personal nature and/or commercially sensitive;

5. I understand that any information or personal details gathered during the study will remain confidential and that all responses are anonymous;

6. I understand that findings from this survey will be made available through Growcom, Tropical Pines, Passionfruit Australia and the Cooperative Research Centre for Developing Northern Australia (CRCNA).

7. I am aware that I can contact the research team directly should I have any questions or concerns about my participation in the survey. Their contact details are: Dr Delwar Akbar, School of Business and Law, CQUniversity, Rockhampton, Qld 4702. Phone: 07 4923 2316, Email: d.akbar@cqu.edu.au;

8. If I have concerns or complaints regarding the way the research is or has been conducted, I can contact the Ethics Officer at CQ University via phone: 07 4923 2603 or email: ethics@cqu.edu.au.

☐ By checking this box, I am indicating that I have read and agree with the consent form and would like to continue to take the survey.

PART A: Questions about your business

Q1: Which is the main horticulture industry that your business belongs to?

☐ Fruits

☐ Nuts

☐ Vegetables

☐ Other, please specify: _____

Q2: How many people are on average employed in your agri-business? Please enter:

	Full time	Part time	Casual (Harvest period)	Casual (Rest of the year)
A. Family members				
B. Employees				

Q3: What is the approximate annual production volume of your agri-business? Please enter answer in applicable unit field:

☐ Tonnes **OR**

☐ Boxes/Trays

Q4: What is the average price for the selected unit of your product that you received in the past year? Please enter answer in the same applicable unit field:

☐ $/Tonnes **OR**

☐ $/Box/Tray

Q5: What proportion of your total crop is your business currently supplying to the following markets? Please enter (the total needs to add up to 100%):

	% Domestic
	% Export

Q6: How would you rate the profitability of your agri-business compared to other businesses in your industry? Please circle the relevant option:

	Much less profitable	Less profitable	About the same profitability	More profitable	Much more profitable
Profitability of your business compared to other local businesses in the industry	1	2	3	4	5

Q7: Please enter the post code where your main agri-business is located:

Q8: What is the ownership structure of your agri-business?

	Family owned
	Mix of family owned and commercial entities
	Corporate
	Other, please specify:_____

Q9: Is your business a member of industry organisations? Please select all options that apply:

☐ Growcom

☐ Horticulture Innovations

☐ Local cooperative, please specify which: _____

☐ None

☐ Other, please specify:_____

Q10: How does your agri-business get most access to market information? Please select all possible options being used.

☐ Agents

☐ News services

☐ Exporters

☐ Cooperatives

☐ Austrade

☐ QLD Department of Agriculture and Fisheries

☐ Other, please specify: _____

Q11: Supply chain collaboration refers to interactions between businesses and organisations for the purposes of improving market access.

Which form(s) of supply chain collaboration is your agri-business CURRENTLY UNDERTAKING? Select all important options:

☐ Close relationships with processors

☐ Collaboration with exporters

☐ Close relationships with retailers and consumers

☐ Collaboration with overseas importers

☐ Contract farming for the retail sector (e.g., Woolworths, Coles, Aldi)

☐ None

☐ Other, please specify: _____

Q12: Which EXTRA form(s) of supply chain collaboration would your agri-business potentially LIKE TO ENGAGE WITH IN FUTURE? Select all relevant options: *[Note: Option(s) selected on Q9 should not show up in Q10]*

- [ ] Close relationships with processors
- [ ] Collaboration with exporters
- [ ] Close relationships with retailers and consumers
- [ ] Collaboration with overseas importers
- [ ] Contract farming for the retail sector (e.g., Woolworths, Coles, Aldi)
- [ ] None
- [ ] Other, please specify: _____

PART B: Choice Experiment

Market Access Context

Improved market access can generate higher returns for agricultural products. Limited access to domestic and export markets has been identified as one of the major barriers for the horticulture industry in Queensland to achieve a higher product value.

There have already been steps taken to improve market access through:

- Free trade agreements with overseas countries
- Improvements in transport links
- Government incentives to support market access

However, more could be done. Supply chain management actions that are likely to result in higher product value include:

- Closer links between producers and other stages of the supply chain (e.g., processors, wholesalers, and exporters),
- Improved quality controls to meet consumer demand,
- Increased traceability and feedback from consumers.

This survey investigates horticulture producer's interest in achieving higher product returns by participating in improved supply chains. The research question to be investigated is:

What is the extent of producer interest in higher value supply chains?

To better understand this relationship, we need your participation.

Considerations

As part of this survey, we would like you to make some choices about potential supply chain management options.

On the following pages you will be shown different scenarios which offer options for close involvement in higher value supply chains for your product.

Most of the options would improve access to higher value markets but would involve changes to your supply chain management, cost and control.

We want to identify if you would be interested in joining supply chains that would offer higher prices for some of your product; but would also involve higher standards for quality assurance with higher costs and more paperwork to meet these standards.

When making your choices please consider that:

- Involvement in higher value supply chains has both costs and benefits,
- We are just presenting the most relevant factors that might be involved,
- There may be other important issues for your farm operation,
- Each farming operation is different, and there are no right or wrong answers,
- The scenarios are hypothetical, but are based on current knowledge about what could happen,
- Please make your choices as if they were real.

Choice Tasks

This experiment involves six choice tasks about potential involvement in a new supply chain. The choices for each task may look very similar, but they do differ. **Please treat each page separately.**

CHOICE CARD EXAMPLE

Price increase *refers to the increase in the product price compared to the market price that is offered by the alliance for your* product.

Amount of produce taken *refers to the proportion of your production volume which would be supplied to the market over the length of the agreement.*

Length of agreement *refers to the time length of the contract.0 years indicates no contract.*

Attribute levels for Option 1 and Option 2 *will change for each Choice Card.*

Choice Card 1		New supply chain		Continue with current system
Attribute		**Option 1**	**Option 2**	**Option 3**
Price increase		+10% of market price	+5% of market price	
Amount of produce taken		10% of production volume	90% of production volume	No involvement in extra supply chain management No change in the attributes
Length of agreement		1 year	5 years	
Extra support		Zero	High	
Higher production costs		+5%	+5%	
Increased paperwork		3 days per annum	2 days per annum	
Choose one option:		☐	☐	☐

Increased paperwork *refers to the additional administrative tasks to meet higher protocols for market requirements*

Higher production costs *refers to additional production costs due to higher control processes and specifications to meet the market requirements.*

Extra support *refers to different levels of additional services offered by membership to the supply chain such as access to genetics, market and industry production information, and technological innovation.*

Attribute levels for Option 3 *will remain the same for each Choice Card. Selecting this option means no extra involvement in supply chain management would be preferred, or you are unsure about the options.*

Please select the option that you most prefer based on your experiences in your agri-business.

Choice Card 1	New supply chain		Continue with current system
Attribute	**Option 1**	**Option 2**	**Option 3**
Price increase	**+10%** of market price	**+5%** of market price	**No involvement in extra supply chain management** **No change in the attributes**
Amount of produce taken	**10%** of production volume	**90%** of production volume	
Length of agreement	**1 year**	**5 years**	
Extra support	**Zero**	**High**	
Higher production costs	**+5%**	**+5%**	
Increased paperwork	**3 days per annum**	**2 days per annum**	
Choose one option:	☐	☐	☐

CHOICE CARD 2 (Q14)

Please select the option that you most prefer based on your experiences in your agri-business.

Choice Card 2		New supply chain		Continue with current system
Attribute		**Option 1**	**Option 2**	**Option 3**
Price increase		**+50%** of market price	**+20%** of market price	**No involvement in extra supply chain management** **No change in the attributes**
Amount of produce taken		**90%** of production volume	**10%** of production volume	
Length of agreement		**0 years**	**5 years**	
Extra support		**High**	**Zero**	
Higher production costs		**+20%**	**+10%**	
Increased paperwork		**15 days per annum**	**1 day per annum**	
Choose one option:		☐	☐	☐

Please select the option that you most prefer based on your experiences in your agri-business.

Choice Card 3	New supply chain		Continue with current system
Attribute	**Option 1**	**Option 2**	**Option 3**
Price increase	**+10%** of market price	**+5%** of market price	**No involvement in extra supply chain management** **No change in the attributes**
Amount of produce taken	**50%** of production volume	**90%** of production volume	
Length of agreement	**2 years**	**0 years**	
Extra support	**High**	**Zero**	
Higher production costs	**+5%**	**+10%**	
Increased paperwork	**15 days per annum**	**3 days per annum**	
Choose one option:	☐	☐	☐

CHOICE CARD 4 (Q16)

Please select the option that you most prefer based on your experiences in your agri-business.

Choice Card 4		New supply chain		Continue with current system
Attribute		**Option 1**	**Option 2**	**Option 3**
Price increase		**+20%** of market price	**+50%** of market price	**No involvement in extra supply chain management** **No change in the attributes**
Amount of produce taken		**90%** of production volume	**20%** of production volume	
Length of agreement		**5 years**	**0 years**	
Extra support		**Low**	**Medium**	
Higher production costs		**+10%**	**+20%**	
Increased paperwork		**3 days per annum**	**15 days per annum**	
Choose one option:		☐	☐	☐

CHOICE CARD 5 (Q17)

Please select the option that you most prefer based on your experiences in your agri-business.

Choice Card 5	New supply chain		Continue with current system
Attribute	**Option 1**	**Option 2**	**Option 3**
Price increase	**+5%** of market price	**+20%** of market price	**No involvement in extra supply chain management** **No change in the attributes**
Amount of produce taken	**10%** of production volume	**10%** of production volume	
Length of agreement	**2 years**	**1 year**	
Extra support	**Medium**	**Low**	
Higher production costs	**+5%**	**+50%**	
Increased paperwork	**2 days per annum**	**2 days per annum**	
Choose one option:	☐	☐	☐

CHOICE CARD 6 (Q18)

Please select the option that you most prefer based on your experiences in your agri-business.

Choice Card 6	New supply chain		Continue with current system
Attribute	**Option 1**	**Option 2**	**Option 3**
Price increase	+5% of market price	+10% of market price	**No involvement in extra supply chain management** **No change in the attributes**
Amount of produce taken	10% of production volume	50% of production volume	
Length of agreement	0 years	2 years	
Extra support	Zero	High	
Higher production costs	+10%	+5%	
Increased paperwork	3 days per annum	15 days per annum	
Choose one option:	☐	☐	☐

Your experience in completing the choice tasks

Q19. For the choices you have just made, please score the following statements from (1) STRONGLY AGREE to (5) STRONGLY DISAGREE. Circle the relevant number.

	Strongly agree	Agree	Do not know	Disagree	Strongly disagree
A. I am confident that I made the correct choices.	1	2	3	4	5
B. I understood the information in the questionnaire.	1	2	3	4	5
C. I needed more information than was provided.	1	2	3	4	5
D. I found the choice options to be credible.	1	2	3	4	5
E. I found the choice options confusing.	1	2	3	4	5

Q20. When answering each of the choice situations, did you ALWAYS choose the "No involvement in extra management" option? If yes, which of the following most closely represents your reasons? Tick one box only.

- ☐ Making supply chain improvements is not important.
- ☐ I support supply chain improvements but do not like to collaborating with others.
- ☐ I support supply chain improvements but worry about costs involved.
- ☐ I found the choice options confusing.
- ☐ I prefer my current option to continue as it is.
- ☐ Other reason. Please specify: _____

PART C: Questions about you

Q21: Which position best describes your role in the agri-business?

☐ Owner

☐ Owner/Manager

☐ Family member of the owner

☐ Employed manager

☐ Employee

☐ Other, please specify:_____

Q22. What is your gender?

☐ Male ☐ Female ☐ Prefer not to tell

Q23: How long have you been working in the industry?

☐ 0-5 years

☐ 6-10 years

☐ 11-15 years

☐ 16-20 years

☐ More than 20 years

Q24. How old are you?

- ☐ 18-29
- ☐ 30-39
- ☐ 40-49
- ☐ 50-59
- ☐ 60-69
- ☐ 70 and older
- ☐ Prefer not to say

Q25. What is the highest level of education you have obtained?

- ☐ Primary school
- ☐ High school
- ☐ Post school qualification (TAFE/Trade certificate)
- ☐ Undergraduate degree
- ☐ Postgraduate degree

Q26. Please indicate the total weekly income (before taxes) that you and your partner (if applicable) currently earn.

- ☐
- ☐ Less than $799 per week (Less than$41,599 per year)
- ☐ $800 – $1,199 per week ($41,600 – $62,399 per year)
- ☐ $1,200 – $1,699 per week ($62,400 – $88,399 per year)
- ☐ $1,700 – $1,999 per week ($88,400 – $103,999 per year)
- ☐ $2,000 – $2,999 per week ($104,000 – $155,999 per year)
- ☐ $3,000 or more per week ($156,000 per year)
- ☐ Prefer not to say

Q27. What is the proportion of your household income from your employment in the agri-business?

☐	0-24% of annual net income
☐	25-49% of annual net income
☐	50-74% of annual net income
☐	75-100% of annual net income

You have fully completed this survey!

Thank you very much for your time.

If you have questions about this survey, you can address them to Dr Delwar Akbar – see details below.

Dr Delwar Akbar
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CQUniversity, Rockhampton, Qld 4702.
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To enter the draw for random selection of survey participants for a $100 shopping voucher, please enter your mail address here: