National Farmers Federation's

ON-FARM FINANCIAL RISK MANAGEMENT PROJECT: **SUB-PROJECT TWO**

Physical, Forward contracts, futures, options, swap-markets, and associated product options for Australian farmers.

2020

USQ CelsiusPro

Table of Contents

Section one: Executive Summary

1.1 Introduction and Purpose of this report

Risks confronting primary producers are increasingly volatile and numerous. Price risk is just one of many risk factors and in many cases these risk factors are interrelated. The way risk is managed impacts on profitability, sustainability, farm & sector production volumes, wellbeing and competitive standing. Price and market risks refers to uncertainty around price exposures on inputs and commodity output, and physical market access.

While there is a general awareness of financial market risk transfer by farmers, there is a lack of applied understanding and, therefore, such products are underutilised in Australia. Despite possessing unique building blocks, such as a mature financial sector, for a robust price risk management regime that could be a competitive advantage for the Australian agriculture industry, price risk management tools for the sector is in its infancy.

A key finding of this report is the shortcomings of price data recording in many Australian agri sectors. The report examines international standards and initiatives, and examines price-risk management alternatives including: - physical sales, forward contracts, futures, options, swap markets and associated complementary product alternatives, such as weather derivatives and index derivatives. It also identifies and assess barriers to uptake of existing and potential new products and makes recommendations regarding the preconditions needed to address barriers in Australia.

This Report is a sub-project of the National Farmers' Federation (NFF) On-farm Financial Risk Management Project, which is being funded by the NSW Government. Agree Commodities Pty Ltd (AgRee) was engaged to revise and review in the final stages of this Sub-Project. In addition to applied commercial experience in commodity price risk advisory and trading/sales, AgRee provided access to leading international exchanges, banks and data service providers.

1.2 Overview of our approach

The Project has adopted both qualitative and quantitative approaches to address the deliverables while drawing on commercial experience in physical commodity trade and financial commodity price risk management.

Price data recording was central to the project, as it relates to spot sales transparency, traditional price risk management, along with a cursory overview of data for future technology-led solutions to price risk management.

A Farmer Reference Group (FRG) was established to contribute and respond to the findings and provide feedback on products that will be of most benefit for farm management decision-making. We developed worked examples and case studies to draw lessons for different commodity groups and illustrate how simple tools and practices in financial markets may be extended into the farming sector. Three FRG workshops were conducted to (i) obtain feedback on the different price risk

management tools used by the industry; (ii) the perceptions of the FRG, and their respective industries, related to demand and supply barriers, which prevent wider use of price risk management products; (iii) strategies to overcome these inhibitors; and (iv) perceptions of the FRG, and their represented industry, related to the government policies toward price risk management tools and their stance on subsidies, programs, concessions and rebates.

Two sets of national surveys were conducted: a program level national survey involving 302 respondents; and a project level survey with 95 respondents. The aims of these surveys were to understand respondents' (i) behaviours; (ii) use of different price risk management alternatives; (iii) appetite and willingness to pay for different price risk management alternatives; (iv) adoption and non-adoption factors; and (v) perceptions of current and potential roles of government in data collection and risk management.

A literature review was conducted on scholarly papers along with commercial, industry group and government material on price risk management products. This included considering the use of physical commodity spot or forward sales and the combining of commodity and weather/yield. Identified price risk management products were then classified and discussed in regard to their potential to transfer risk, to deliver benefit, affordability, and sustainability, across a range of economic and social scales (e.g. enterprise to industry, individual to community to the region and farm enterprises).

1.3 *Summary of the findings*

- Our report identifies the historical regulation and structures of the specific sub-sector, and related factors such as price data recording practices, are a major determinant of price transparency and risk transfer. Sectors with accepted benchmarks, certainty of production and price risk alternatives are best placed to manage income stream volatility, such as irrigated cotton and sugar cane. The price risk transfer market currently available remains largely underutilised despite over two thirds of those surveyed suggesting that financial risk management and products are important.

- There is price opacity in most agricultural markets, reducing the farmer's ability to make informed decisions and effectively manage risk. Given the backdrop of climate variability and export market dependence, effective 'prices paid' data recording is an increasing obstacle to both orderly physical markets and derivative risk transfer market development. The project highlighted the following with regards to this critical and common shortcoming:
    - Australian and State Government policy focuses on creating an environment of self-reliance and encourages farmers to adopt better risk management practices. The clear gap in prices paid data is incongruous with this policy stance because producers and other industry stakeholders do not have the metrics to identify, measure or manage risk.
    - With a relatively constant domestic demand base for agri products, our export markets are responsible for taking the 'equity' or surplus production. It is therefore critical to managing and growing export relationships that suitable and appropriate action is taken on price transparency and managing volatility in both supply and price.

- Risk awareness, price discovery and risk transfer are all adversely affected by a lack of "prices paid" data recording in many Australian agri markets, such as cattle and horticulture. The well-publicised difficulties in the Australian Dairy sector around price transparency and viability, for example, has now been recognised by consumers and government; steps are now being taken to create transparency that will help rectify this situation.
- The survey found that financial risk transfer solutions for horticulture, livestock, and viticulture are virtually non-existent.
- Markets, such as wheat, cotton and more recently sugar, that have historically been regulated and subsequently deregulated, have vastly superior risk transfer alternatives via both physical and derivative contracts, and related close-out mechanisms.
- Markets that have evolved unchecked in this regard have a more 'adversarial supply chain' – where there is distrust between producer and buyer (e.g. processor) – and are more vulnerable to risks. For example, large export-focused sectors such as beef cattle, which evidence suggests faces a situation of declining 'prices paid' data for both cattle and beef products has been reported as 'adversarial'. This sector is showing symptoms of large and increasing margin swings between producer and processor and supply/throughput issues. Typically, this supply volatility and associated ESG impacts is assigned by the industry to climate variability (e.g. drought) and most recently COVID-19, with the potential benefits of transparency and price risk management largely ignored by industry.
- Advances in transparency and risk transfer are being more effectively identified in other major exporters in the region, such as Thailand.
- The ASX offers a futures contract that is a transparent price risk management tool for wheat and barley. However, volume is relatively thin and users of this market are typically restricted to trade and professionals who understand and can manage initial and variation margins to secure and maintain positions.
- The consensus was that it is critical to have some degree of certainty of production before committing to any forward contract, derivative or physical; and that there is a role for weather risk transfer as an enabler of price risk product uptake.
- The Project found consensus on the value of risk management, including: access to capital, uplift in enterprise value and an enabler of succession, resilience, and innovation. Furthermore, innovation and risk management have a lead role in meeting industry growth objectives. The commercial impact on the Australian farming sector in this respect is enormous, the potential benefit to the beef cattle sector alone may be in the multi-billions of dollars.
- Modern and forward-looking topics arose throughout the Project that require further investigation, such as the opportunity for blended price risk and yield products, potential use of digitisation and digital assets in transparency and risk transfer, technology enabled data recording and the rise of environmental, social and governance (ESG) considerations - as it relates to risk management.

- Future focused customers and investors, domestic and international, are increasingly using ESG analysis, including carbon, as part of their decision making. Price transparency of agri produce is therefore important to measure and report embedded carbon values within underlying agri products and other future ESG metrics. Consumers also expressed that price stability is as important as price itself when considering supply partners.
- Farmers are willing to spend some time to increase their business skills, although in sub-sectors with too little price data recording (no metrics for decision making), this is difficult.
- As also detailed in Sub-Project 4, the literature review, especially focussed on research and development corporations (RDCs) and educational platforms, revealed that RDCs and universities do not include modules that increase grower education and awareness about risk transfer products, and that while RDCs and universities are appropriate platforms to arrange risk management training, such training should be conducted with input from those with most applied commercial knowledge.
- Of those producers that have not used price risk management tools to transfer risk, the majority said it was a lack of education that stopped them from using them.
- The project survey indicates a lack of independent and objective advice to farmers; a finding also evidenced by major national agency and input merchandising franchises funding their own markets research and advisory teams.

1.4 Summary of key recommendations

Following industry consultation, FRG and commercial expert advice, three complementary, overarching recommendations have been identified that would provide commercial returns to the agricultural sector as a whole through:

i. More informed decision making via price data recording and appropriate sharing, providing stability to physical, financial and ESG industry performance

ii. Transparency in the supply chain to build trust, and bring consumer and producer closer

iii. Transfer price and market risk to creditworthy counterparts, and

iv. Access capital, particularly professional/institutional capital.

Recommendation 1. Increasing awareness of the value of risk management and role financial market products

The paper recommends the development of the knowledge-base across major agricultural products to better understand and evaluate alternative approaches to risk management. This will equip and future-proof the wider agricultural sector with respect to climate variability, labour and skills shortages, market or supply chain disruption, environmental sustainability, shifting consumer preferences, global markets and increased international competition. Increasing awareness of the risk management and financial products should increase uptake of these products. In terms of increased awareness, we recommend:

- Encourage skills in innovation and risk disciplines onto boards and executives within RDCs, government departments and government supported programs to enable the **growth of infrastructure, products and mechanisms that protects agriculture against risks**. A risk and innovation culture would be most effective where there exists human capital with a applied commercial track record in agriculture or adjacent industries such as commodity trading, financial services, private equity, venture capital and commercial science R&D.
- Critical to the success of any awareness projects, and as stipulated by international risk standards, is the need for **people with most knowledge of risk transfer to develop content** and lead dissemination where possible. In this respect, applied commercial experience, integrity and track record should be given priority, this concurs with International Standards.
    - **Government should:** Recognise and develop **risk awareness within government**, federal and state departments and RDCs as to the benefits of price data recording and sharing, as it relates to market transparency and development of risk transfer tools.
- Use current industry extension networks, especially the RDCs, to coordinate and, in some cases, conduct appropriate information and training on price risk transfer products. Where the government matches grower levies for industry groups for research, development, and extension, that a stipulation is made, or policy constructed that a certain **percentage of these funds are spent on educating** their members on business and market risk, including the value of market transparency and risk transfer products.

RDCs such as GRDC have an excellent framework for dissemination of research on grain production. Extending this infrastructure to include awareness, education and training on risk transfer products is just a continuation of current practices with potential to add greater cost-benefit to a business enterprise. **Develop commercialisation metrics** for such education programs.

  - **Government should:** Develop a framework that starts from a risk taker's perspective via a government policy to **incentivise risk capital and risk transfer** that addresses price risk and combine or potentially integrate price risk products with risk mitigation against drought, frost and excess rain. This could be done via tax incentives and grants.

- Universities and educational training centres, who receive agricultural-based government funding and are already interacting with growers and students, should include awareness, education and training on risk transfer products in appropriate courses, provided they have regular content input from knowledgeable commercial practitioners of risk management and risk transfer. Academic content should be **reviewed and updated by commercial risk professionals** periodically (annually) to ensure the risk management curriculum reflects current and future challenges. Education facilities, such as UNE, USQ and others, that have roots in agriculture, have existing frameworks for interactions with stakeholders and as an educator, although not always adult or on-farm education, more at an undergraduate student level. Dissemination of training and educating on risk transfer products is just a continuation of existing work practices.
- As an initial step, agriculture and primary industry departments, RDCs and industry representative groups should be resourced to conduct coordinated sub-sector industry-wide risk assessment information, programs and tools to highlight producer and processor-level policy gaps and opportunities. This will include development of:

  i. Risk principles, framework and process, aligned to recognised international standards (ISO31000);

  ii. An industry-developed risk scorecard, to identify areas of weakness and opportunities. For example, the Beef Sustainability Framework but with a greater focus on price data, markets and risk management;

  iii. A series of supply chain or processing 'models' to be kept updated collaboratively between a combination of RDCs, universities and industry, allowing for better industry-wide appreciation of national and global price signals.

Recommendation 2. Recording and digitisation of price data - enabling the democratisation of risk.

- **Price recording and transparency:** Data-driven transformation and the adoption of digital transformation programs is now a major driver of change across many of Australia's agri supply chains. Many industries, including red meat, are very quickly applying technologies and practices that place data as central in identifying opportunities for production efficiencies, traceability, customer preferences and quality improvements. This modernisation should also provide real-time or **timely price information and transparency across the entire supply chain, noting farmers currently have very little visibility of prices.** Support this evolution by explicitly placing **data - and insight-driven decision making as a strategic focus** across government and industry, including mandating price recording where industry is not showing leadership / coordination.

Beyond more efficient spot markets, data and benchmarks are essential as a feedback loop for any successful futures contract.

  - **Government should:** Develop awareness with policy makers to the **benefits** of benchmarks and risk transfer, including transparency, risk transfer, enterprise value uplift and access to capital; and, social benefits including mental wellbeing and resilience of our farming communities. This may have to include **mandating price recording and sharing**. There are international examples of this being done successfully.

- **Quantitative analysis of the value of price data:** Determine which sub-sectors have the greatest need by considering frameworks and scorecards, as per Recommendation 1, but also by **engaging specialist commodity quantitative analysts and agri commodity and finance specialists to value the subsector benefits of transparency and risk transfer,** based on appropriate assumptions relating to price data, more orderly markets, uptake of risk transfer, enterprise value uplift and other factors. A relevant sub-sector to start with would likely be the beef cattle sector.
- **Innovation and new business models:** Relevant price data will be the catalyst for innovation in business models, supply chain arrangements and price risk management adoption within existing business models, and will deliver enormous value to the industry in the form of access to capital, enterprise value uplift, and wider social and environmental benefits. For example, there is a leadership **role for the major Australian retailers** to play in price data, the creation and use of futures contracts in supply agreements – *separating pricing and supply*. Policy setting and regulation should encourage supply and demand signals to flow appropriately, and that such benchmarks can **also be used to support export focused trade.**
  - **Government should:** Identify and resource risk experts with applied experience to analyse price data recording in comparable developed markets, and emerging markets with export dependency. This could be addressed by allocating appropriate departments of agriculture and **RDC resources towards risk management and 'risk innovation'**.
  - **Government should:** Develop policy to invigorate innovation in the development of **products that integrate price and production risk**, such as contingency interest loans, commodity stream financing and physical contracts with suitable and appropriate force majeure clauses. Then allow regulated distribution networks to advise and disseminate on products to the end user.
- Encourage a **culture** that looks to appropriately share price data across every point in the supply chain; this would be in a deidentified manner. Success will be defined by the adoption of a data culture wherein the supply chain (including producers) perform their decision-making in an environment of greater transparency (including price) and so deliver **greater certainty of outcomes**.
  - **Government should: Encourage index creation** and dissemination to bring transparency to spot/cash sales, and potentially allow for risk transfer product development, for example, in the horticulture sector.
- Digital assets should be explored in terms of the potential for risk transfer and improved access to capital. As has recently happened with gold digitisation, there would seem to be the potential to use distributed, decentralised finance to **digitise and democratise**

risk transfer, financing and trade of agri commodities. Commentary in the blockchain space indicates the 'old world' is 'lumpy' in the sense that the fractionalisation of assets is much more cumbersome than in the 'digital world'. For agricultural commodities, this may mean issues such as basis risk can be dealt with more easily i.e. there can be a greater number of **more bespoke indices** that market makers can offer producers.

- **Government should:** Consider policy that reduces (the risk) or enhances **awareness of basis risk** (grade and location versus industry benchmarks). Support **deployment of hardware infrastructure and software that provides data** acceptable to financial markets to supports digitisation and/or index creation and reduces basis risk, as it relates to production/yields and price risks.

Recommendation 3. Create three futures contracts with the highest value impact to industry

Domestic risk transfer markets need to be developed that serve producer and consumer (including export markets), are inclusive, suitable and appropriate. An industry-led approach is needed, to seek 'skin in the game' from both the buy and sell side – as well as relevant stakeholders, such as agency businesses, market makers, financial institutions and exchanges.

The Project identified stakeholders with knowledge of and access to data for the creation of benchmarks, futures contract creation and mechanisms for participants to participate in pilot trades. The Project has also identified and examined international examples of recent future contract development in the region, such as the CME Thai Rice contract.

The report recognises the lack of local experience and success (human capital) domestically in the development of futures markets, as such, a due diligence strategy needs to be carefully developed to ensure convergence (and effective close-out mechanisms), which is a large factor in uptake and liquidity. Specifically, for cash settled contracts - data collection (auditable, credible etc.) needs to be appropriate and, for delivered contracts - logistics, with tight quality-control standards, to create a meaningful linkage to the end user needs to be considered from the outset.

In the early stage of listing (of a new futures product) extensive training for risk management education should be carried out, to avoid a lack of industry participation and to ensure convergence of futures prices and physical sales prices. Effective close-out mechanisms must be in place to ensure no timing mismatch or slippage between exiting a derivative position and entering a physical sale (or the pricing of a basis/supply contract).

Based on this Project and other recent RDC papers on risk, a further deep dive is required on potential commodity underlyings, although early indications suggest feeder cattle, sheep, almonds, possibly some mainstream horticulture products and further development of the existing wool OTC market.

Enhance participation and use of ASX Futures Contracts: A more targeted recommendation on the enhanced use of ASX Futures Contracts has been suggested based on the FRG recommendations and discussions with ASX, clearing and grower brokers. In order to encourage more participants to use this market, we recommend:

- Education – As a short-term priority, ASX have indicated a willingness to partner with grower brokers, banks (OTC) and clearing brokers on education to increase uptake;
- Cash and administration – of futures positions (margin calls) is likely to be difficult for most farmers, so delivery channels and product innovation needs to occur e.g. accessing farm management deposits, greater use of OTC's with clean lines and greater use of options;
- Inventory finance development – encourage development of access to non-land asset security such as grain and livestock that will support cash or collateral requirements for servicing margin calls e.g. Repo style products supported by warehouse receipts and development of on-farm financing. In addition, wider awareness of the use of the Personal Property Security Registry (PPSR) to open channels to capital.
- Liquidity – in terms of futures, turnover will encourage more participants, options market makers and larger positions. Some participants, e.g. banks, are concerned unwinding their position may move the market too much;
- Price Data Recording - Similar to all other futures contracts, data recording of physical sales to create a benchmark is an important feedback loop for futures. ASX may also be able to have a cash settled mechanism if better reference prices where available; this may involve structuring auctions to deliver additional data.

1.5 List of Figures

1.6 List of Tables

1.7 List of Examples

1.8 List of Case Studies

Section two: Price Risk Management Alternatives for Australian Farmers

2.1 Existing price-risk management Alternatives for Producers in Australia

The objectives for Sub-Project 2 are to:

- Describe and assess current and potential future price risk transfer mechanisms other than insurance used in the domestic and international Agriculture markets.
- Analyse these markets and report on their usefulness and industry engagement.
- Understand the inhibitors to use and suggest means to increase adaptation and help to activate, increase or establish the use of effective risk transfer markets.

Whether it is domestically or internationally, risk mitigation markets in agriculture are generally understood to be underutilised despite the uncertainties inherent in weather, yields, prices, government policies, global markets, and other factors that impact farming. ABARES (2012) concluded that the volatility in Australian agriculture industry was twice that of any other industry. Risk management involves choosing among alternative risk management strategies or products that reduce the financial effects that can result from such uncertainties. In mitigating these risks, the World Bank has suggested that a fully integrated approach is necessary (World Bank 2016). In doing so they have established a conceptual framework that provides a holistic and integrated approach to agricultural risk management (Choudhary et al., 2016).

i. To engage all stakeholders who are affected by agricultural risks and who take actions to manage them;

ii. consider the full range of risks;

iii. analyse different strategies to manage risk;

iv. understand the different steps in the risk management process.

v. NB. International Standards (ISO31000) can also be used to manage risk via Principles, Frameworks and Process.

The market for risk management in Australia is underutilised and possibly inefficient due to the size of the commodity markets, lack of awareness on-farm & at processor level, lack of buy-side interest and lack of speculative community. The history of agricultural financial price and production risk management in Australia is littered with examples of programs that have tried to alleviate this risk but did not persist (NRAC 2012, Grain Growers 2019). Reasons for this non-persistence will be further discussed under the topic of Demand and Supply side barriers.

Generally, there are five types of risks that are associated with farming:

i. production/yield risk,

ii. price or market risk (the focus of this project),

iii. financial risk,

iv. institutional risk, and

v. human or personal risk (Kahan, 2008).

Price or market risk refers to uncertainty about the prices producers will receive for commodities or the prices they must pay for inputs. The nature of price risk varies significantly from commodity to commodity.

Yield/production risk refers to the ability of the farmer to produce off a selection of inputs. Failure to produce, when affecting sufficient numbers of producers, can also affect supply hence can be symbiotic with price risk, varying the degree of local demand, relative to world production.

Techniques/instruments and emerging tools that can be acquired or implemented to manage risk:

- Farm Management Deposits (FMDs) – important and effective strategy particularly for small to medium sized farming businesses. Allows for profits to be transferred to low income years and reportedly 'clarity of thought and objectivity' when making decisions i.e. tax considerations do not play a large factor in good farm planning / decision making.
- **Insurance** – General, public liability, health, life, income, machinery etc. There are many established channels to get advice on and access these traditional insurance products, many of these types of insurance are conditions of finance products.
    - Crop insurance – Traditional crop insurance has reportedly ~75% cereal and oilseed crops nationally covered by fire and hail insurance. Around half of Australia's cotton crop is insured from a single peril (hail). This is not the case in other weather insurance offerings despite insurers being very willing to cater for parametric or index-based products.
    - Multi-Peril - Insurance companies have largely exited Australia in the multi-peril market because of lack of data, uptake, moral hazard, climate variability and on consideration of risk/reward. Given the multi-peril crop insurance in Australia is reportedly expensive – strategies are needed to 'cheapen' insurance. Overseas governments often underwrite crop insurance in various forms to support farmers but requests for such measures in Australia have been resisted by Australian State and Federal Governments for reasons including:
        - Climate variability – 2nd highest globally (behind Antarctica);
        - Much of Australia's agri produce is exported;
        - Trade (barrier) related reasons;
        - Relative large size of Australia's agriculture industry on a per capita GDP basis.

Further development of parametric insurance and weather derivatives is the logical pathway to progress given the obstacles to multi-peril – as detailed in Sub Project 1.

- Parametric weather insurance and weather derivatives - Remain supported by the same insurers that have offered them in Australia for 20+ years – on a per-capita basis, Australia is reportedly the largest buyer of weather derivatives in the world. Products based on weather or production indices include crop volume and yield cover. Parametric (index based) insurance is a well-established market internationally, on the back of the energy market e.g. wind farms. There are clear gaps in education and know-how both at grower and industry level about this type of insurance. There is huge potential to both stabilise earnings and increase the total volume and revenue from agriculture if these gaps are addressed effectively.
- The Australian crop insurance market is still underdeveloped and therefore could glean useful lessons from government/aid supported international experiences and the more mature and structured derivative and physical commodity sector; already products and structures developed in the energy sector that manage income stream volatility are being adapted into agriculture. With private, government and RDC investment in data collection and related hardware infrastructure – there is a large opportunity to miniaturise 'zero premium' products such as those executed by the below GrainCorp example.

GrainCorp 'producer collar' on production variability
(production risk management - grain receivals)

Insurance company derivative based on ABARES data to protect against (drought) grain receival income. This structure provides a guaranteed income buffer against poor harvests when dry seasons undermine grain yields; conversely, in good harvest seasons, Graincorp would pay the insurer a cash settlement. The announcement of this structured deal led to Graincorp shares rallying ~25% or ~AUD500,000,000. Originally structured by Long Term Asset Partners and Goldman Sachs, this simple structure achieves predictable and stable earnings enabling lower cost finance and higher leverage – leading to a re-rating in Graincorp equity value, demonstrating that with appropriate data, planning and process - effective risk management is recognised by the market as having hard dollar value.

Could insurance and derivative structures also stabilise income and add value to producers and other stakeholders? The deployment of these powerful structures faces the following Obstacles

- Data capture and access
- Financial literacy e.g. basis risk
- Research and Development of human resources, platforms and products
- Access to credit lines to enable 'selling upside optionality' to fund 'downside protection' i.e. enabling zero cost structures, rather than, for example, the current high premium cost insurance products
- Adoption, particularly industry structure, entrenched practices and culture.

Chart below illustrates similar production variability between wheat production and cattle slaughter, to substantiate the direct relevance of the Graincorp example.

- **Derivatives** - Interest Rate, Foreign Exchange and Commodity - Exchange trade (ETD) and Over-The-Counter (OTC) e.g. Futures, Options, Swap and Swaptions. For commodity producers, ETD products are difficult both in terms of liquidity (depth of long dated bids) in longer dated futures and options contracts, and servicing daily variation margins is problematic from an administrative and cashflow perspective. Commodity OTC swaps and option structures are therefore more prevalent within the primary producer market, typically leaving the producer with basis risk only (basis risk – is the difference between the price of a benchmark and physical commodity due to location and grade) . Effectiveness of derivative hedges in Australia is mixed. For example, in more recent years with the expansion of the feedlot and other intensive livestock sectors, less grain is exported, hence the correlation of east coast Australian wheat prices and Chicago wheat futures (CME) has been poor, meaning CME referenced AUD wheat swaps have declined in popularity. In contrast, in USD terms, the correlation of Australian raw sugar and New York #11 sugar futures is very high (a good hedge).

- **Spot Contract Physical Market** – least risk of all the tools, with the major risk being short term credit or payment risk of the buyer. Numerous grain traders operating in Queensland in recent history have become insolvent, leaving producers with losses by relying on the spot market. A better understanding of credit risk is required.
- **Forward Contract Physical Market** – The creditworthiness of trader/buyer counterparty is particularly important for producers to consider, particularly for fixed price contracts. Price movement between contracting date and delivery date can create considerable mark-to-market movements – 'in the money' or 'out of the money' contracts.

Recommended Strategy to avoid this credit risk is to 'separate pricing and supply' by buyers and sellers agreeing terms (e.g. a basis contract) indexed to a benchmark or futures contract, leaving each party to price the benchmark independently. This is typically not possible where there is a lack of data, benchmarks and overall transparency (e.g. the Australian beef cattle sector) leaving producers unnecessarily exposed to risk, less bankable and less attractive to professional local and foreign investment.

- **Legal structures** – All legal matters should be treated by legal or financial professionals to guide and advise on specific situations, as they may related to the legal ownership and family structure of land, machinery, livestock or operating business. How structures are used in the business, owned, or if there are arrangements between parties connected by a deed of arrangement can affect risk management and funding. The common legal structures used by primary producer do not easily allow outside equity into the farm business.

Common legal structures in Queensland agriculture include:

i. Sole Trader

ii. Partnership – joint or by partnership agreement

iii. Trusts – family trust or unit trust supported by a trust deed. Trustees can include individuals, partnerships and company's

iv. Pty Ltd structures e.g. Pastoral Companies

v. Joint Venture

vi. Sale and lease back

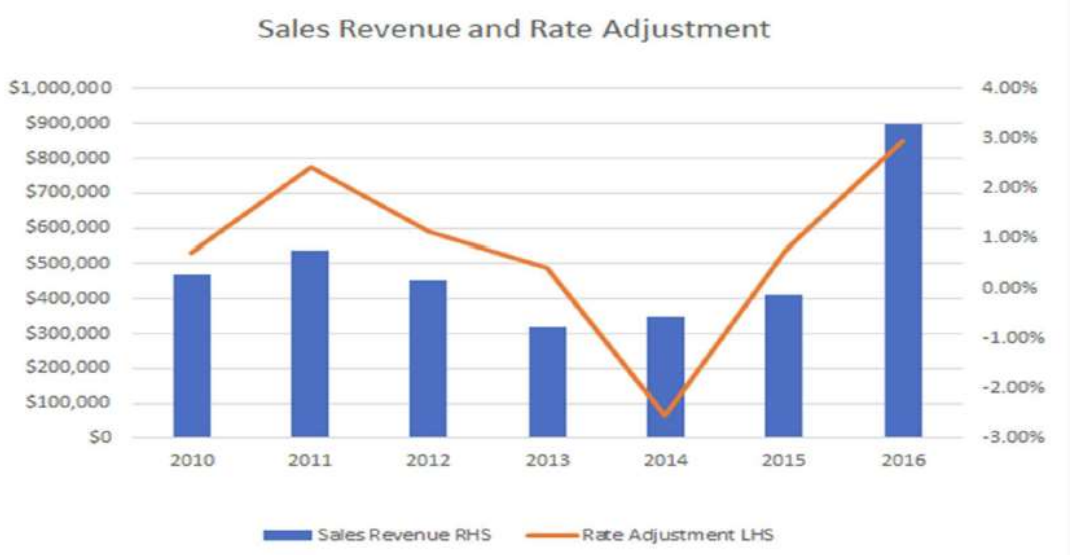
vii. Share Farming

viii. Co-Operatives

ix. Managed Investment Schemes

2.2 Newer concepts and tools, basis risk, liquid currency advantage and practical examples

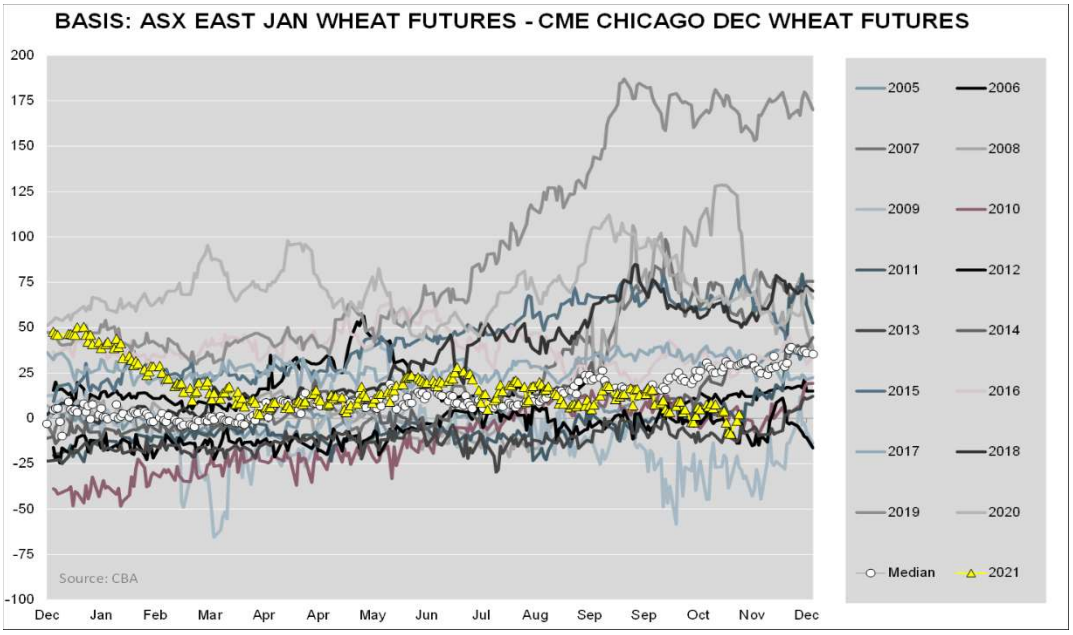
- **Commodity Streaming** – a "Partnership" between producer and stream financier where a producer receives cash payment upfront in exchange for a multi-year delivery obligation to the streamer – where price and production risk is shared via mechanisms in the stream agreement. An equitable way for outsiders (non-farmers / investors) to participate in production and price exposure; although a stream financier does not gain/lose from land price movements. Challenges with agri-commodity streaming has been deal/agreement complexity, lack of data (around yield sharing) and lack of security available for a streamer to balance risk and return. With education and advancements in machine/yield data & security and enforcement structuring, this alternate finance and risk transfer structure may become viable in the future.
- **Contingency interest loans (CIL)** - CIL loan structures with embedded index or benchmark (commodity and or weather) linked cashflow hedges. In other words, a normal term loan but with the additional feature of a rate adjustment that is calculated from a tailored index combining relevant data points on major risk factors, such as weather and price.
- **Grazier Contingency Interest Loan (concept**) – factors in Rainfall (Lagged SPI) & Price (major local cattle saleyard data) to generate a 'contingency factor' (rate adjustment) reflective of trading conditions over the long term for a grazier. While this is a prototype – below chart is data from a real grazier's normalised financials and model based on real BOM and MLA saleyard data. Source: AgRee Commodities Pty Ltd.



- **Contingency premium put/call options** - Contingency premium puts/calls are cashflow friendly option products, where premiums are only payable in positive event outcomes.
- **Basis Risk Education** – Basis risk is a major issue in terms of effectiveness with both Derivatives and Crop Insurance in Australia. Basis Risk is simply the difference in location and grade of a commodity relative to a benchmark or derivative contract. In crop insurance, basis risk is the difference between the performance of an index (e.g. BOM rain gauge) and actual farm performance. More resources should be allocated to

understanding and education of basis risk in order for risk transfer tools to be better adopted.

Chart below illustrates the AUD/mt difference between ASX East Coast Wheat and CME wheat.



FX (AUD) Competitive Advantage – for both insurance and derivatives: An underutilised competitive advantage Australia has over competing primary producers in Latin America is the depth and long dated tenor of the AUD interest rate market, which underpins long dated AUD/USD forward exchange rates. There are also more recent positive developments in the CNY market, meaning consumers in China (CNY) and Asia can buy Australian origin product at a fixed price in their local currency (CNY) or USD. (This is not aimed directly at primary producers, rather structured finance providers, risk managers, marketers and processors.) The Queensland sugar industry has made good use of this competitive advantage over Brazil with its use of long dated AUD Sugar Swaps. Similarly, deep international financial markets that provide long dated insurance products based in USD can be converted into AUD for practical use domestically, this would increase access to capital and therefor likely increase the chances of achieving growth objectives both on-farm and as an industry.

Decision matrix approach can also be used to align forward sales with prevailing prices in a historical context. Reliable sugar cane producer example: -

Tenor (Mths)	Delivered	3	6	12	24	36	48	60
Price (percentile)								
99	100%	70%	60%	50%	40%	30%	20%	10%
90	90%	60%	50%	40%	30%	20%	10%	0%
80	80%	50%	40%	30%	20%	10%	0%	0%
70	70%	40%	30%	20%	10%	0%	0%	0%
60	60%	30%	20%	10%	0%	0%	0%	0%
50	50%	20%	10%	0%	0%	0%	0%	0%
40	40%	10%	0%	0%	0%	0%	0%	0%
30	30%	0%	0%	0%	0%	0%	0%	0%
20	20%	0%	0%	0%	0%	0%	0%	0%
10	10%	0%	0%	0%	0%	0%	0%	0%

Notes: -

Percentile of relevant forward price; strikes may be different (outside the percentile) in option structures

Percentage refers to upside margin exposure from a producer (short) hedge

Price (percentile) refers to physical or AUD/mt swap bid price over a time series of no less than 5 years

This is a guide only

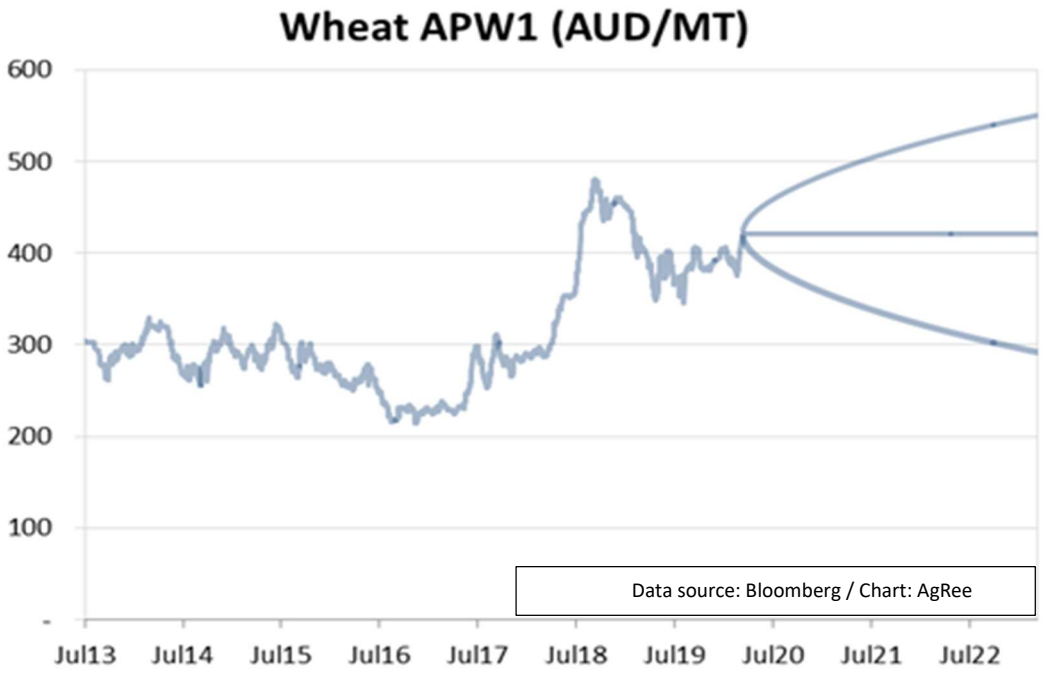
Although yield risk tends to be of higher significance than price risk and input risk, it is generally accepted that it is easier for the market to find solutions for managing price risk. Yield risk has seen products come and go (MPCI, Yield Shield) and solutions for input risk are limited or perhaps almost non-existent. Yield, input and price risks all need to be measured prior to a season and where available tools exist are used in order to de-risk the production. Once a solution is found then its appropriateness, and usefulness need to be considered before implementation.

Practical examples of risk management

The following examples provide some context for major agri-sectors in Australia.

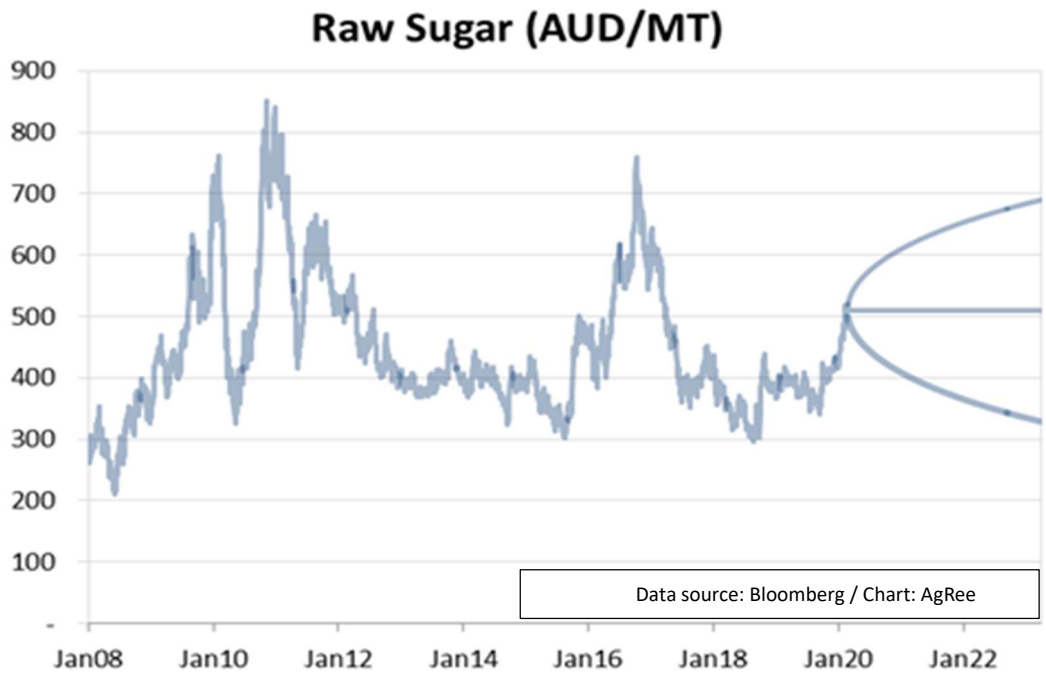
- **Wheat & Grain Example** – Fixed price forward contract, drought and crop insurance – Production and Market Risk: Wheat producers can enter fixed forward prices (e.g. multi grade contracts) to protect their income stream and margins, however, this can increase financial exposure in the event of drought and resultant rising grain markets (particularly local strengthening local basis levels in drought). Crop insurance protection may not cover the magnitude of the 'wash out' cost of having to buy back the fixed forward contract i.e. production risk insurance may not cover the market risk created by failure to perform on the fixed price contract but may help mitigate the impact.

Bank approach to market risk – maximum potential exposure (MPE) diagram



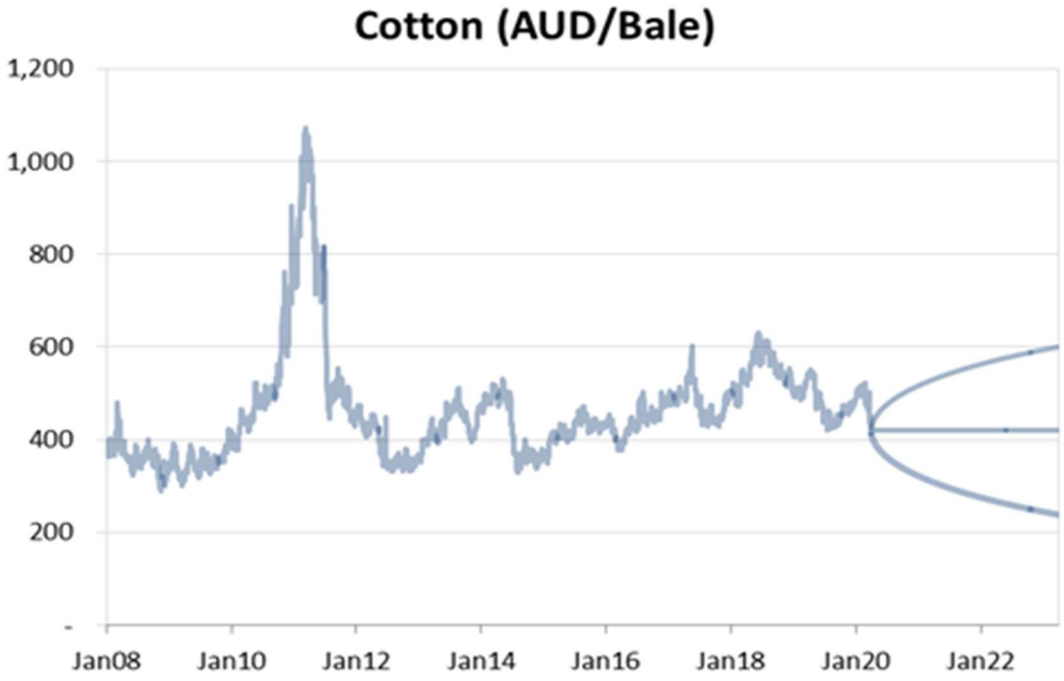
- **Sugar Example** – Use of long dated Over-The-Counter (OTC) derivatives – Price Risk: Until recent years, sugar producers received pool returns that evidence suggests was a rolling average of sugar futures and the AUD/USD. To the extent producers are comfortable with production risk or can insure against this risk, most producers can now take advantage of forward sugar prices that are above their individual production costs. Like other cropping sectors, the mismatch between insurance payout against poor production and market risk commitments relating to fixed forward pricing presently need to be managed by the cane farmer.

Raw sugar prices in AUD terms are extremely volatile – MPE Diagram



- **Cotton Example** – Fixed price forward physical sale – Credit Risk: Irrigated cotton producers often take advantage of favourable forward prices by selling to merchants on fixed price per bale (ex gin yard) terms out 3 years and beyond. For such long dated transaction, two risks combine – market risk and credit risk. Cotton futures and AUD/USD levels (and Australian cotton basis levels) can swing significantly over this time period. By selling forward at a fixed price to a cotton merchant, the producer has transferred an income stream market risk into a performance and/or credit risk against the cotton merchant. Cotton merchants have vastly different performance and credit risk profiles, as illustrated by the credit insurance market cost to insure their performance. Producers should consider this credit risk factor when comparing bids; they should also consider spreading this credit (or bilateral counterparty) risk between several merchants. An alternate strategy is to mitigate this risk is to do an OTC (e.g. sell an AUD cotton swap) with a creditworthy bank, leaving basis risk only (generally implied long dated basis levels are not strong, a further benefit to this strategy).

Many fixed forward contracts are sold at ~AUD550/bale VS Potential downside if contract does not perform – Consider this credit risk event – MPE Diagram



NB This cotton example is precisely what happened this (2020) season when an overseas based cotton merchant defaulted on high prices forward contracts. This highlights the need for comprehensive risk factor awareness e.g. Individual Business Risk Management Plan project recently completed by Queensland Department of Agriculture – that considers all risk, including commodity price risk, in the context of drought.

Since market deregulation in Australia, as has occurred in cotton, wheat and sugar, growers have had to take a more active role in price risk management (Sinclair, Curtis, Mendham & Mitchell, 2014). Farming enterprises are structurally variable, so risk management solutions need to be accordingly multiple and flexible. Hence a product suite of agricultural risk management products better serves the individual needs and risk appetites for the producer.

Price risk products available globally Image:

Successful price risk management alternatives require growers, sellers and buyers to identify key factors that affect profitability, viability and sustainability. Once identified, an appropriate and useful risk transfer market needs to be found. These risk transfer markets exist for many commodities such as wheat, cotton, and sugar but are largely non-existent for other commodities such as sectors involving Livestock, Horticulture and Viticulture. Sectors without price data, benchmarks (transparency) and risk transfer are more likely to be 'adversarial', inefficient, and disorderly.

International example of mandated price reporting:
Cattle and meat data – US example.

Prior to 1999 there was considerable distrust between producers and packers due to a lack of transparency. Following government (USDA) mandating of price reporting in 1999, there are now reportedly 20-30 data points daily, including meat products, available to allow transparency and efficiency in the US red meat industry:

- The red meat sector can learn from the best practices of their US industry peers and other sectors;
- In 1999, the US beef industry came together to establish benchmarks and compulsory reporting of data that has resulted in improved trust and efficiency.
- This led to the development of futures contracts (and OTC instruments) which is widely used today by US producers, processors and end users active manage risk and institutional investors wishing to trade this market.

Participants in many agricultural sectors (e.g. cotton, sugar, NZ dairy, natural rubber) actively engage in hedge activity. These sectors have open and transparent market benchmarks which are used to evaluate expansion projects, price physical contracts and facilitate risk management activity.

Pricing for agricultural commodities is reliant on factors affecting global supply and demand dynamics. Factors can be broken up into groups such as global issues like the encompassing impact of the value of the USD on all commodities, block and sub-block factors like different varieties of broadacre crops traded on different markets, and commodity specific issues like a local drought that affects the "basis" risk of regionally produced wheat (Delle Chiaie et al., 2017).

Price setting of a commodity is generally done in the broad sense by market interactions and then specifically by treaty between buyer and seller. In Australia, crops such as wheat, sugar and cotton have international benchmarks for pricing which are derived from foreign futures markets. Most major agricultural contracts are traded on the CME (Chicago Mercantile Exchange) and ICE (Intercontinental Exchange) with the bourses establishing the global benchmarks. This benchmark price then trickles down to a domestic price at the farm gate. For example, an Australian wheat producer needs to consider the value of the AUD against the USD when pricing the profitability of a crop.

Example 1: Wheat Pricing Equation

$$Price\ (\$AU/t) = \frac{(USc/bu\ futures + USc/bu\ basis) \times 0.3674371}{Australian/US\ Exchange\ rate\ (\$AU\ /\$US)}$$

It is expressed this way as US futures are quoted in US cents per bushel (USc/bu) and there are 36.74371 bushels in one tonne of wheat.

Each component of the price has an independent impact on price with movements in the futures market being the main influencer on price, accounting for up to 70% of price volatility, then other influences such as the foreign exchange rate and local and international basis come into play. Futures are a standardised contract and are traded on an exchange, enabling commodities to be sold at a fixed time in the future, foreign exchange is the exchange rate of different currencies and price basis risk is the difference between the US futures price and the price offered for Australian grain.

Example 2: Change of US Futures price, Basis and Foreign exchange

Futures Price (CBOT - Sep):	520 USc/bu
Basis:	10 USc/bu
Exchange Rate	$AU = $US 0.65
Australian price ($AU/t)	$= \frac{(520 + 10) \times 0.3674371}{0.65}$
	=$300/t

Example 3: Futures price drops to 400 USc/bu

Futures Price (CBOT - Sep):	400 USc/bu
Basis:	10 USc/bu
Exchange Rate	$AU = $US 0.65
Australian price ($AU/t)	$= \frac{(400 + 10) \times 0.3674371}{0.65}$
	=$232/t

Example 4: Basis drops to -50 USc/bu

Futures Price (CBOT - Sep):	520 USc/bu
Basis:	-50 USc/bu
Exchange Rate	$AU = $US 0.65
Australian price ($AU/t)	$= \frac{(520 - 50) \times 0.3674371}{0.65}$
	=$266/t

Example 5: Example 5: Exchange Rate increases to $AU = $US 0.70

Futures Price (CBOT - Sep):	520 USc/bu
Basis:	10 USc/bu
Exchange Rate	$AU = $US 0.70
Australian price ($AU/t)	$= \frac{(520 + 10) \times 0.3674371}{0.70}$
	=$278/t

Futures prices are obtained from what the expected supply and demand of a commodity is in the future, this is no different to ASX Futures. A fair value for an ASX Futures would be derived from what the expected supply and demand of a commodity is in the global market reflected by a US Futures price component, then the AUD/USD exchange rate as well as the domestic basis plus the cost of carry.

The farmer has to decide if the current future price for the commodity will cover the costs of production and if prices at the farm gate make producing the commodity profitable. Then as the season progresses the producer would need to make marketing decisions to protect downside price risk/profit margin. In doing so making marketing decisions around the price that may involve the use of:

i. Physical sales

ii. Exchange Traded Derivatives - Futures and Options

iii. Over The Counter – Swaps and Swaptions

Outlined below are the descriptions of the key products that producers can use to transfer price risk from their balance sheet and into the market. An example on how a producer may use them to mitigate price risk. Together with strategic summary / findings based on experience and input from the Farmers Reference groups.

2.2 Physical Commodity market to mitigate Price Risk

2.2.1. Domestic Spot Markets

Growers can use the spot (or cash) market for quick cash flow. The spot price is the price that the commodity could be traded in the marketplace at the time of delivery. With the spot market as there is price certainty there is no short-run price risk for the seller or the buyer, but the grower must have the commodity available for immediate delivery. There are five different criteria that must be met when dealing with the spot market, quality, quantity, time, place and price are agreed on the spot.

If a farmer wanted to sell their cattle today they could check the spot price at the local delivery point, the farmer would have to meet criteria, depending on the criteria the cattle meets reflects the price the farmer receives. In the case of cattle, this is determined on age, weight, breed, number of cattle, time of delivery and location of delivery. This is stated in c/kg lwt or cents per kilogram live weight.

This is similar to grain spot sales where spot price received is determined quality, based on protein content and other factors, amount of delivered grain as specified in the sales contract in tonnage, time and place of delivery and price of delivery are agreed.

Example 6: Spot Market: Wheat Producer

A grower has an early harvest and needs quick cash flow, they decide that the cash price for grain is reasonable and sell it on the spot market.

Price Journey	AU$/t
Benchmark price	$230
Local price today	$200
Cost of production	$180
Basis risk loss	($30)
Net profit if sold today	$20

With selling the grain on the cash market the grower forgoes any potential rise in price, however, mitigates any extra costs of storage or potential market fall.

2.2.2. On Farm Storage

On farm storage is a price risk management option where produce can be stored without loss of significant value (minimising perishability). This option is mainly used in the grain industry and its use has increased in recent years (Kingwell, 2017), as farmers have had to take greater control over handling and marketing. On farm storage is used for either or both logistical reasons at harvest or to hold for sale at a later date in anticipation of higher prices or income spreading across financial years. This storage can require significant up-front costs, but marginal gains can offset that, as set out in the example below.

Example 7: On farm storage

At harvest a grower decides the cash price for grain is too low after a large volume of local sales (reducing the overall local basis). In order to gain a higher return, the grower does a cost benefit analysis and decides to store the grain on-farm until the local sales have been completed which may see local prices climb.

Price Journey	AU$/t
Benchmark price	$230
Local price today	$200
Cost of production	$180
Basis risk loss	($30)
Net profit if sold today	$20

Price Journey	AU$/t
Benchmark price	$230
Local price today	$200
Cost of production	$180
Cost of Storage	$14*
Basis risk loss	($30)
New Net Profit	$34

After holding grain in a large flat bottom silo for three months the local price recovers. By holding off on the sale of their crop the grower has received a better price for his production. By selling his produce at $230/t he has managed to make an extra $16/t.

2.2.3. Domestic Off Farm and Bulk Storage

Off farm and bulk storage options are similar to holding the commodity on the farm with the advantage of not requiring up-front capital costs. A commodity storage program allows growers to deposit the commodity at bulk storage facilities so they can establish a price at a later time. The producer maintains ownership of the grain while it is in storage.

Comparing different bulk handlers requires the seller to take into account the risk management strategy, accuracy of estimates, cash flow and tax implications, supply chain costs, management fees and payment systems and costs.

In Australia the major commodities that can be stored include grains, cotton and wool.

Example 8: Off farm storage grain

At harvest a grower decides the cash price for grain is too low after a large volume of local sales (reducing the overall local basis). In order to gain a higher return, the grower does a cost benefit analysis and decides to store the grain in bulk at a local receival site until the local sales have been completed which may see local prices climb.

Price Journey	AU$/t
Benchmark price	$230
Local price today	$200
Cost of production	$180
Basis risk loss	($30)
Net profit if sold today	$20

Price Journey	AU$/t
Benchmark price	$240
Local price today	$230
Cost of production	$180
Cost of Storage*	$20
Basis risk loss	($10)
New Net Profit	$30

After holding grain Cargill GrainFlow NSW site for three months the local price recovers. By holding off on the sale of their crop the grower has received a better price for his production. By *selling his produce at $230/t he has managed to make an extra $10/t.*

For farmers whose produce can be stored, on-farm and bulk handling storage represent good strategies for post-production price (and therefore income) management. In particular it is good for grain production as growers can wait until the low harvest basis comes back. Also, it provides flexibility for sales to help manage cash flows and even taxation. If bulk storage options where available for other commodities it would be utilised. In addition, some growers use storage options as a means to gain financial leverage for projects and for premium funding arrangements on insurances used for current seasonal risks. On farm storage does however require an initial extensive capital outlay and where products are more perishable, storage has limited life and therefore limited risk management benefit.

2.2.4. Commodity Pools

Pools are aggregations of supply from a number of producers, with the aggregation then being sold without discrimination amongst participating producers. This also allows commodities to be marketed over a longer period of time, while providing cash flow to the grower throughout the process. The process of managing the pool is similar for both domestic and international programs.

It is mainly used in the grain, cotton and sugar markets by growers looking to have a professional trader manage the sale. Pools are very popular in the sugar industry and have been a very successful way to manage price risk.

The commodity can be hedged when delivered using national and international hedging options that include futures and options to gain the best market position whilst simultaneously minimising risk. The commodity is then sold into export or domestic markets over the course of the pool program, this can vary from 2 to 12 months. In the case of sugar, price risk up to 5 years out can be covered via OTC derivatives that are ultimately exchanged for physical (EFP) into a pool.

Cultural Example: Price risk management example – Tully Sugar Mill - The Tully board were culturally very conservative (similar to other agri sectors and associated boards), it was not until their corporate executives properly analysed the scenarios and positive impact a more stable income stream would have on their business and community did they fully appreciate the value proposition and agree to execute a comprehensive risk transfer strategy. In other words, a conservative culture, once educated, is a hedging (risk management) culture. (See Tully Mill testimonial below). Interestingly, the volatility of AUD/ICE#11 sugar and the other agri commodities in AUD terms is similar.

Tully Sugar Testimonial

> *MAY, 2020. The Queensland Sugar industry operated under a single-desk marketer until deregulation around 15 years ago. Decisions around finance and price risk management of raw sugar output was largely centralized downstream of the mill. The original State-wide sugar pool typically returned season average results. Soon after deregulation, the Tully Sugar board was approached to hedge (by John Reeve - CBA) and, following a period of education, executed a series of long dated sugar swaps that protected our income stream above our cost of production. We remain active in this risk management activity - it has helped the mill maintain a clean balance sheet and added to the resilience of growers, mill, other stakeholders and the community.*
> *- Gerry Borgna.*
> *Board member - Tully Sugar Limited (a COFCO company)*

Example 9: Types of Commodity Pools – Grain

- **Harvest Pools:** Harvest Pools are a good mechanism for farmers to use where they are unsure of the future price direction of their produce. In the grain market farmers deliver grain into the pool at harvest. Once the pool is full the Manager starts his marketing program with the view to achieve a better sales price for the grain that the farmer could have received at the time of harvest on the spot market. He is paid a fee for achieving results but there is no guarantee.
- **Contract Pools**: In a Contract Pool, Growers contract a tonnage into pools pre-harvest. So, the manager of the pool can commence a pre harvest marketing campaign. The main reason for this is that prices often dip as a result of spot sales. Managers may pay a premium to the grower as a reward to making a commitment. This allows the pool manager to start marketing before harvest.

Commodity pools are good for spreading risk and having a professional look after the sales. The use of Pools in the Sugar and Cotton markets comes down to the fact that the basis risk in the commodity is very low.

2.3 Domestic Exchange Traded Products

Domestic and International Exchange Traded products tend to focus on the use of Futures and Options. Futures, Options and many other derivative instruments have been developed for a wide range of agricultural, non-agricultural commodities, and financial assets. These are traded on derivative exchanges across the world. They offer a means to trade in contracts that are transparent and centrally cleared. The participants in the exchange include physical market traders who participate in futures trading for hedging purposes and speculators (both, physical and non-physical traders) who take a position on the course of future movements on the price of the underlying asset.

2.3.1 Australian Securities Exchange - ASX Futures

Futures are involved in almost every aspect of commodity marketing, understanding how futures work and how to utilise them to growers' advantage is key when mitigating price risk, increasing profitability and future sustainability (Pannell, Hailu, Weersink & Burt, 2008). Futures Markets are anticipatory markets and Futures contracts are derivative instruments that are legally binding agreements, guaranteed by a clearing house, that allow farmers and buyers to lock in an agreed-upon price of a commodity for delivery in the future/at a later date. Futures contracts are standardised by the futures exchange, such as the Australian Securities Exchange (ASX), as to the quantity, quality, time and place of delivery of the commodity, similar to the Spot Market requirements. Futures contracts express a price that's a balance between buyers and sellers and incorporate the anticipated supply and demand at the time of expiration, futures values can also be interpreted but the current market price of a commodity plus the cost of carry (ASX, 2020). ASX Futures are, however, only available to Australian farmers for wheat and barley.

Price is not specified in futures contracts; each month's futures contract price is determined by sellers and buyers placing bids through licensed futures brokers.

A written futures contract has five common features: price, time, quality, quantity and place of delivery. Futures contracts allow buyers and sellers to shut down price risk to the difference between the underlying futures and the price of the underlying commodity, the basis price (Laurie et al., 2018).

Before the introduction of more diversified and easier hedging tools international futures were one of the only mechanisms for grower's hedge price risk, but using international futures means that you still have to manage basis risk and foreign exchange risk. The introduction of ASX futures standardised in Australian dollars helped manage basis risk. ASX Futures overcome basis risk compared to international futures by reducing the price movement in Australia compared to overseas, for instance, if there was a drought in Australia and high yield crops internationally, reducing the value of the basis. The ASX Futures NSW Wheat (VW); WA Wheat (WK); Eastern Australia Feed Barley (UB); and Eastern Australia Canola (VC).

On the usefulness of ASX Futures, 42% of respondents said they had better alternatives. We found from the FRG that the typical farming enterprise shies away from these contracts due to basis risk (difference between a commodity price and a benchmark due to location and grade) and the administration / maintenance of the futures position (variation margins or margin calls). The sentiment was that cash needed to maintain the contracts could be deployed to more useful purposes, with concerns around being stripped of cash (margin calls) in a rising market which are

often accompanied by dryness/drought. Importantly, the physical grain delivery process required under these contracts is not necessarily easy for farmers. The more fungible (easily delivered in exchange for cash) track grain market, however, was highlighted by the commodity trade (e.g. grain traders and feedlot commodity buyers) and farmers as a useful and effective mechanism to transfer price risk, including basis risk.

Dealing with futures contracts farmers need to take into consideration brokerage fees and interest fees on margin calls and interest surrendered on initial deposits when taking out a futures contract.

A clear advantage to dealing in Futures is that the clearing of the contracts is guaranteed. Buyers and sellers meet their contractual obligations by depositing funds into a margin account. These funds then cover movements in the market. If the funds in the margin account can't cover large movements more funds are requested to be deposited into the margin account and is referred to as a margin call.

When a futures contract expires it is either cash settled or settled through physical delivery. When a futures contract expires or is exercised it is understood that the holder of the contract will deliver the physical commodity to the location stipulated this is known as physical delivery and is much more cumbersome than cash settlement. Most contracts are cash settled. Cash settlement has allowed the entry of speculators into the futures market and hence more liquidity. Futures contracts can be physically delivered if the Exchange allows it however only about 1% of futures contracts in Australia are settled through physical delivery (Laurie, et al., 2018).

Example 10: Futures Contract

Mid-season a grower decides he has a good potential yield and wants to hedge their price risk. They decide to use a futures contract.

The price received at harvest using the spot market	
Price Journey	AU$/t
Benchmark price	$230
Local price today	$200
Cost of production	$180
Basis risk loss	($30)
Net profit if sold today	$20

Price received after using futures contract	
Price Journey	AU$/t
Futures Price	$270
Cost of Production	$180
New Net Profit	$90

By using a futures contract for their crop, the grower has received a better price for his production. By selling his produce at $270/t he has managed to make an extra $50/t.

2.3.2. Australian Securities Exchange – Options

An Exchange Traded Option is a standardised derivative contract that is traded on an exchange, derives its value from the underlying commodity that settles in a clearing house and is guaranteed.

If the user is only going long/buying the option, it provides them the opportunity to benefit from favourable price movements with a limited outlay ie the premium paid for the product.

There are two types of Options; Put and Call Options. Put options give the option buyer the right but not the obligation to sell a futures contract at an agreed price on or before a set date. Call options give the option buyer the right but not the obligation to buy a futures contract at an agreed price on or before an agreed date.

Producers who buy options see them as insurance against adverse movements in the underlying. The options buyer effectively pays a premium to the option writer to take on the risk for unfavourable price movement. Put options provide protection for commodity sellers against price falls by establishing a floor price. Call options provide protection for commodity buyers from price rises by locking in a price ceiling (Laurie, A. et al., 2018).

Options have four key components underlying futures, expiry date, strike price (price of the underlying futures) and a premium. The obligations of options contracts must be upheld if exercised on or before the expiry date. The premium on options contracts is determined by interest rates, price trends, the length of the contract (also known as the risk period), market volatility and the strike price value.

Example 11: Options Contract

Mid season a grower decides he has a good potential yield and wants to hedge their price risk. They decide to use an options contract to give them the right but not the obligation to purchase a futures contract at a given price.

The price received at harvest using the spot market	
Price Journey	AU$/t
Benchmark price	$230
Local price today	$200
Cost of production	$180
Basis risk loss	($30)
Net profit if sold today	$20

Cost of Option	
Price Journey	AU$/t
Futures Price	$240
Cost of Production	$180
New Net Profit	$59.80

Underlying Futures contract if Option is executed	
Price Journey	AU$/t
Futures Price	$240
Cost of Production	$180
New Net Profit	$59.80

By using a futures contract for their crop, the grower has received a better price for his production. By selling his produce at $240/t he has managed to make an extra $19.80/t.

The ASX Wheat and Barley Futures contracts remain an attractive method to use to hedge price, however, demand for these is relatively low. This is also a global tendency. While the use of Futures and Options is extremely transparent and cost-effective there is a general fear about their use. Feedback from Farmers Reference Group (FRG) suggests that the need to provide deposits and margins for the contracts make it complex for farmers to use as positions need to be monitored daily. Plus, a cash reserve is needed for variation margins should the market move away from the price the contract was set. As the season progresses cash reserves dwindle. Trade and sophisticated traders tend to be the main users. Locally, liquidity is low, albeit growing, which inhibits farmers' use.

We recommend that ASX find a better way for growers to manage deposits and variation margin risk. Adopting the use of Farm Deposits either via the Exchange or via a recognised broker could be an option for the ASX to use in order to resolve this and promote better use of the market. We also conclude that adapting international standards for open position reporting could help as an enabler is the use of the classification of users which is the case on CME.

2.3.3. Riemann Commodity Exchange for Forward Contracts

Riemann Agricultural Services, designs execution software for forward contracts, this is a first in the market and cutting edge. It has an electronic platform that offers an interface for buyers and sellers to trade forwards in the commodity sector. Riemann offers risk management products to the following commodity markets that can be used for hedging and trading:

- Wool - online OTC markets for Forwards and Options which are cash settled against the Australian Wool Exchange nominated Micron Price Guides (MPG) (Mid price of the North & South MPG's).
- Wheat - online OTC Forwards and Options which are physically delivered forward contracts, based on Grain Trade Australia (GTA) Contract No.2 Grain in Bulk Basis Track.
- Cotton - online OTC Forwards which are Physically deliverable forward contracts.
- Cattle (EYCI) - online OTC Forwards and Options which are cash settled against the Meat & Livestock Australia (MLA*), Eastern Young Cattle Indicator (EYCI).

Rieman personnel who were interviewed said the platform was best known for Wool markets and is gaining increased awareness in the Cattle markets.

2.4 Over the Counter (and physical) markets used to mitigate Price Risk

2.4.1. Domestic Forward Contracts

Forward contracts whether direct or negotiated, are non-standardised financial contracts between two parties, in the case of Australian agricultural commodities the grower and the buyer, this isn't always the end-user, it can be a merchant, a value adder or an aggregator. Forward contracts allow the grower and buyer to sell and buy commodities at a predetermined time in the future at a price agreed on by both parties at the end of the contract, this makes forward contracts a form of a derivative instrument.

The two parties involved in the contract negotiation arrive at the exact terms of the contract such as price, end date, number of underlying units and quality. This allows for niche contracts suited towards the growers or sellers' specific needs. Forward contracts only settle once at the expiry date.

Forward contracts allow growers and buyers to hedge their price as once agreed upon the contract is not subject to price fluctuations. This allows the hedgers to reduce the volatility of the underlying commodities price. They are the most popular tool growers use if they have an appropriate market.

This stems from the need of producers and processors to be certain of markets and deliveries of agricultural commodities. The execution of contracts often happens quite early on before the farmer prepares land for sowing/planting. Contract price and terms are subject to a person's arms-length negotiation with the buyer and the seller jointly setting the price, location, specific quality, quantity, harvesting and handling procedures and shipment arrangements (Gillen and Jaeger, 1979).

Since they are not traded through centralised exchanges, they are considered to be OTC (over the counter) instruments. The use of commodity forward contracts resides in the hedging possibilities they offer. It is hard to get out of a forward contract unless one gets the counterparty to overturn the contract (CFTC, 2005).

In relation to grain, forward contracts can be set up to two years in advance, there are three main forward contracts used in Australian grain fixed-grade contracts, multi varietal contracts and multi-grade contracts. Due to the simplicity it makes them the most commonly used hedging tool in Australia. They are also used in the cotton and sugar markets.

Many other industries also mitigate their price risk through forward contracting including cattle, sheep for meat and wool, horticulture, viticulture, poultry and pigs.

Example 12: Forward Contracts

On 3 June 2020, GrainCorp's Forward Price at Temora Silo was $280.00 per tonne for Australian Standard White (ASW1) for December delivery.

Joe Thomas agreed to forward-sell 100 tonnes of ASW delivered to Temora Silo during December. At harvest, Joe delivered 100 tonnes of ASW wheat to Temora Silo, informed the silo manager that the grain had been sold to GrainCorp and quoted the relevant contract number. The driver was issued delivery receipts that were applied to the contract. Payment of $280.00 per tonne was then made as per the contract terms.

If the grain had been warehoused upon initial delivery, Joe could have arranged a title transfer to GrainCorp at any time within the contract delivery period. This method is often more convenient and may help to avoid confusion at harvest.

There are several types of Forward Contracts used in the agricultural industry:

- **Fixed price contract:** Also known as flat price contract is one where farmers commit themselves on delivering a certain quantity of the commodity at an agreed point of time of specified quality. Although the contract can be used to attain pre-harvest financing farmers are paid on delivery. Premiums and discounts may be negotiated for the produce which fails to meet stated quality criteria. When the market price goes up farmers are the one to carry the opportunity risk of losing prospective gains.
- **Price-to-be-fixed contract:** Price-to-be-fixed (PTBF) contracts, also termed executable orders (in sugar trade) or on-call contracts (in cotton trade), are the most common form

of export contracts for commodities in Latin America and quite common in Asian countries. As the buyer/seller (case of importers or en- users) consider their price terms in respect to what's quoted in the futures market, it allows them to fix the contract terms that's suitable and well timed to them.

- **Deferred pricing contract:** Is a contract that ensures that the farmer is in control in respect to pricing, while he delivers the commodity and transfers ownership on the agreed contract date. This contract lets the seller separate pricing decisions from the delivery decision. Risk associated with storage is passed to the buyer at the time of delivery and in case storage is unavailable the same contract could be used as a substitute. The price may equal the elevator's bid price or an adjusted futures price at a time selected by the farmer. Farmers get to benefit when the price rises and retains the risk control when price tends to fall during the contract timeline. This is widely used by small scale farmers especially when they deal with a well-known buyer.
- **Deferred payment contract:** A deferred (or delayed) payment contract stipulates the price to be paid and handovers ownership upon delivery while stalling payment. This contract may also be a bargain for farmers to take tax advantages by deferring income from the sale of a commodity to the next tax year as a tax-saving strategy for the current year
- **Minimum price contract:** Although identical to the fixed price forward contract, this contract guarantees a minimum price with an opportunity to participate in future price gains. Being a farmer, it would eliminate a key risk factor and the enticement to default on the contract is less than that of fixed price contracts. On the other side the buyer (elevator or packer) would hedge the assumed risk by taking opposite positions. The farmer may be required to pay a certain price to exercise this benefit. In most developing countries farmers do not have this kind of access to forward contracts wherein they can manage risk with this component. And even if they are allowed it is probably with high implied rates of interest (buyers may discount the price they offer to manage performance risk on their end) (Varangis and Simmons, 2000).
- **Reference price forward contract:** This is the contract that prices forward contracts based on using reference prices at the time normally the futures prices. The farmers get paid spontaneously the price of day or period when they make the delivery, and this is a procedure that's common in contract farming. It's also the basis for the standard pricing formula among sugar producers who receive a fixed percentage of the sales price in developing countries.

In comparing the contracts from a domestic and international standpoint, they are essentially the same, they are private between the buyer and seller and not transparent.

This is the most active market for producers to utilize to transfer price risk in most sectors. This provides the best possible means for the producer to be able to lock in prices during the season. However, it is not transparent and trying to exit the contracts should the producer fail on his delivery can be expensive. Forward markets are found in most major commodity groups that have liquid global benchmarks from which to price off. They are generally global commodities and especially used in broadacre, livestock, sugar and fibres. There are however significant sectors that have no forward market, namely horticulture and viticulture.

2.4.2 Domestic Commodity Swap Markets

Commodity Swaps in Australia are a financial derivative product that is based on underlying international futures contracts and are marketed in terms that are easier to understand for Australian growers. At the core commodity swaps perform the same purpose of futures contracts, however, a feature is that they do not have the margin and deposit requirements of traditional futures contracts. This can be seen as a positive or a negative.

Commodity Swaps allow growers and buyers to lock in a price for their commodity in advance, the alternative is price fluctuation of the commodity in line with the market. At the settlement date of the swap either the grower will pay the institution who provided the swap contract, or the institution will pay the grower, this all depends on how the market has moved. This is calculated between the settlement price in the contract and the current market price.

The swap providing institution will compensate the grower if the market price at the time of settlement is lower than the contracted price, alternatively the grower will pay the institution if the market price is higher than the contracted price. In most cases, if the grower has to pay the institution the physical market price of the commodity is higher than the contracted price, therefore although the grower has to pay the institution they are compensated through the sale of the commodity at a higher price.

Swaps are more straightforward to use than Futures and Options as they are offered in terms that local growers can understand. For instance, 927 USc/bu, as traded on CBOT, will be converted and offered as $/tonne. Some institutions also give farmers the option of hedging in $US/tonne or $AU/tonne locking down foreign exchange risk. Swaps are offered in 100 tonne lots and swap institutions will normally take a margin per tonne.

Swaps give growers a price to which they add or subtract the basis against the swap price when the commodity is physically delivered and settled. Swaps allow growers to hedge futures and exchange rate risk while leaving the basis open. This system works for both growers and swap providers as the basis generally improve throughout the season.

The final mechanism of the swap is when a grower sells the grain, leaving the basis open means the farmer isn't exposed to delivery risk as they would be when dealing with a forward contract. When a farmer is ready to deliver their commodity, they are able to sell it at the highest spot price on the day, then a transfer of funds either to the swap provider or from the swap provider to the grower will occur.

Example 13: Commodity Swaps

A grower wants to manage price risk when planting their crop. To mitigate adverse movements in the market they take out a commodity swap with their local bank to lock in price certainty.

Scenario One	Scenario Two
At maturity of the swap contract if the fixed price is greater than the reference price then the bank pays the grower.	At maturity of the swap contract if the fixed price is lower than the reference price then the grower pays the bank.
Fixed price AUD Commodity Swap = $200/t	Fixed price AUD Commodity Swap = $200/t
Commodity reference price = $160/t	Commodity reference price =$220/t
Bank Pays farmer = $40/t	Farmer Pays bank = $20/t

However, in the case where the farmer has to pay the bank the higher market price mitigates losses incurred.

Commodity swaps have been used for a while in major commodity groups In Australia. The most popular contracts are for broadacre, fibres and sugar. The reason for this is that a secondary liquid international market exists. As the major components of the swaps are the US Futures Price and AUD, they provide a good opportunity for sophisticated farmers to enable them to lock in separate legs of risk depending on the market conditions.

One of the drawbacks in their use is the way the initial deposits and variation margins deposits are used. These are all "credit" based and require high farm equity ratios to utilize. If a farmer does not produce due to an extreme event, then this becomes problematic as the Farmer needs to make good unrealised losses on the swap. Anecdotally, this is normally bad as drought would see the swap price move dramatically against him.

The use of a more recognisable form of credit other than equity could resolve this issue as the issuer will make a call once the "marked to market" losses get to a critical stage. A margin call is a means whereby the owner of the position can re assess the position. A mechanism similar to the futures market should be utilised to safe guide farm equity.

2.5 Overall - Summary on Price Risk Management Alternatives

As the real profit margins across commodities for many farmers generally decline, an awareness of, and access to prices paid data and price risk tools is becoming increasingly important. These products provide a mechanism for producers to transfer price risk, underpinning access to capital and enhancing enterprise value. If these products were used and available across more industry sectors, there will be a greater chance of achieving farm and industry objectives. However, several sectors remain opaque and therefor vulnerable to both spot-market market failure and a lack of forward price discovery, such as horticulture, viticulture and livestock.

Section Three: International Products used to Mitigate Price Risk

Internationally, the use of Physical, Forward contracts, Futures/Options, Swaps and Parametric Derivatives are similar to what is used in the domestic market. Where there are significant differences, we have provided a further description.

3.1 Forward Contracts used Overseas

As mentioned, using Forward Contracts is the most used method producers use to lock in prices for future delivery and are mainly used when prices are high. The futures market tends to set the price but the physical is negotiated between the buyer and seller. The buyer needs to make good the sale with delivering the physical commodity and is penalised if they cannot. Internationally there are a few different options producers can use to help manage specific issues that are not represented in Australia.

The main types of forward contracts producers are outlined below. (For more of an outline see Forwards Section 2.4.1)

- Fixed price contract
- Price-to-be-fixed contract
- Deferred pricing contract
- Deferred payment contract
- Reference price forward contract

In the US Forward contracts, as in Australia, are the predominant tool used to transfer risk. They are pretty similar in their structure, offering the ability of the producer to lock in a future price. However, unlike Australia, the US has a contract called "Hedge to Arrive" which is gaining use predominantly in the grain markets as it means for a farmer to sell forward knowing that he has an option to cash settle or deliver the contract. This concept could be refined and adopted in the Australian market either using the ASX Wheat Futures contract or existing forward market. Further discussion on the topic is developed in Section 5.

3.2 International Futures and Options Markets Exchanges

3.2.1. International Commodity Exchanges

Futures, Options and many other derivative instruments have successfully been developed for a wide range of agricultural and non-agricultural commodities, and financial assets. Contracts that are traded on derivatives exchanges across the world are transparent, liquid and performance is guaranteed and represent an important market to transfer price risk for producers. Futures traders represent a diverse community from physical market traders who participate in futures trading for hedging purposes and speculators (both, physical and non-physical traders) who take a position on the direction of future movements on the price of the underlying asset.

It is important to understand that these exchanges provide a means through price discoverability to help set benchmark prices for major commodities such as wheat, cotton, livestock and sugar. In Australia, producers and traders use these benchmarks as the basis for deriving local prices.

3.2.2. Chicago Mercantile Exchange

The CME is the world's major market for futures and options and it's where the world comes to manage risk. Being the first exchange to introduce forward contracts, standardization in futures trading, and the clearinghouse mechanism, the exchange has evolved into an important risk-management facilitator for a diverse set of participants trading in a wide range of asset classes. The CME Group provides forwards, futures, and options contracts on products and financial instruments across key asset classes such as agriculture, energy, metals, equity, treasuries and interest rates, exchange rates, real estate, and even the weather.

Currently, the CME Group is the largest futures exchange in the world in terms of number of contracts outstanding (or open interest). One could easily say that every single farmer in fact every investor is impacted by the CME Group.

- **CME Group exchanges - Chicago Mercantile Exchange (CME)**: grains and oilseeds, live cattle, feeder cattle, lean hogs, and a large number of foreign currencies including the Australian dollar.
- **Chicago Board of Trade (CBOT)**: corn, United States and South American soybeans, soybean oil, soybean meal, soft red winter wheat, oats, rough rice and ethanol, and mini-size contracts (1000 bushel) of grains offered.
- **NYMEX:** offers futures and options on various metals, energy, and agricultural commodities (Coffee &Cocoa).

Commodity products traded at CME Group offer a way to manage risks by making it possible for farmers and agribusinesses to lock in profits, enhance business planning and serve their markets more efficiently. These products remain vibrant, reaching new volume levels while establishing benchmark prices for the food industry.

3.2.2. Intercontinental Exchange (ICE)

ICE is a derivative and over the counter (OTC) marketplace offering a wide variety of securities. The ICE network is made up of 13 standardised exchanges and seven clearinghouses located in North

America, Europe and Asia. The premier exchanges of the network are ICE Futures Europe, ICE Futures U.S., ICE Futures Canada and ICE Futures Singapore.

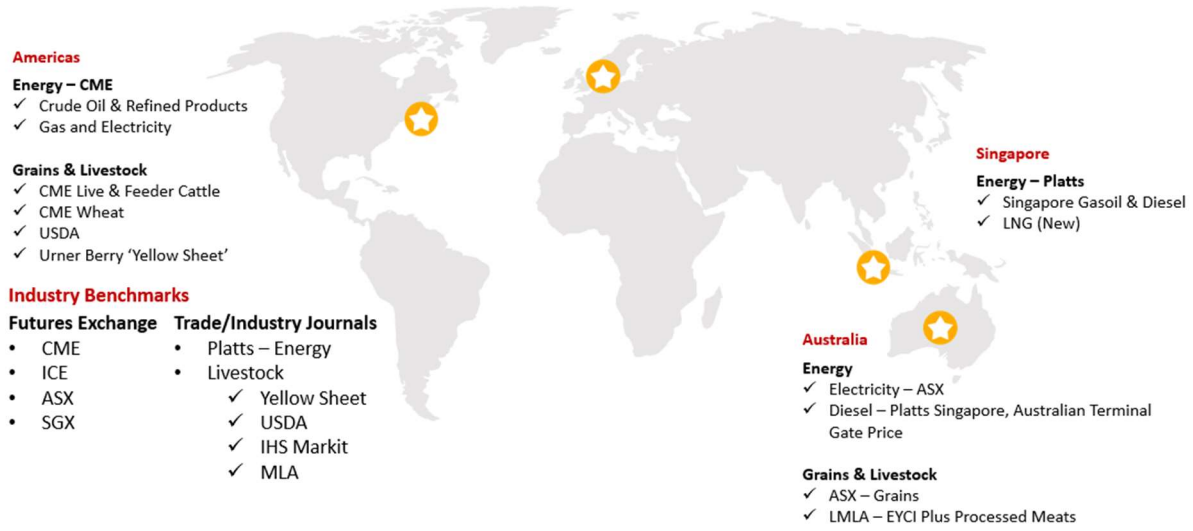
ICE is a global leader in the provision of derivatives products including traditional futures/options contracts and more unconventional instruments such as credit default swaps. Through offering borderless digital market access to speculators and hedgers the world over, it has become a premier venue for international trade. It is a global hub for active speculation and hedging enterprises, with partnerships spanning the futures, options and equities markets.

Since the 2007 purchase of the NYBOT, ICE has been a global leader in the provision of agricultural derivatives. Among the offerings are futures and options contracts based on coffee, cocoa, cotton and sugar.

The Sugar No. 11 contract on ICE is the world benchmark contract for raw sugar trading. The contract prices the physical delivery of raw cane sugar, free-on-board the receiver's vessel to a port within the country of origin of the sugar.

For well over a century, cotton industry representatives have joined traders and investors in the ICE Futures U.S. (formerly "the New York Board of Trade (NYBOT)") futures and options markets to engage in price discovery, price risk transfer and price dissemination for this internationally traded commodity. Each day, people from around the world look to the ICE markets for a benchmark price in cotton.

Example commodity benchmarks and exchanges



Case Study 1: New CME Thailand Long White Rice Futures – transparency and risk transfer - willingness to change

Rice constitutes a dietary staple for millions globally, however rapid population growth and associated demand have given rise to the threat of a global rice production deficit.[1] Such considerations have catalysed greater commercial interest in rice growing regions such as Thailand, estimated by the USDA to be the world's second largest exporter of the commodity.[2] In 2017 Thailand exported 11.63M MT of rice,[3] an annual volume which dramatically fell by in excess of 44% to a forecast of 6.5M MT in 2020.[4] This decline is a phenomenon largely attributed to inclement weather, worsened by process inefficiencies, and the inflation of production costs disincentivising production.[5] Such domestic supply volatility, the emergence of India and Vietnam as competitive rice producers, alongside major shifts in global demand have given rise to greater speculation in the Thai export rice market.

In 2012, a report sanctioned by the Asian Development Bank outlining the case for the creation of an ASEAN rice futures market, stipulated that a hedging need for a liquid rice futures contract existed.[6] The report, which identified Thai Rice Exporters Association members as core stakeholders, stated that adequate volatility was a key prerequisite in the creation of the futures, alongside minimal government supply side intervention, as these would ensure demand on a global scale.[7]

Given the aforementioned changes in the Thai rice trade, it is apparent that adequate volatility exists in the contemporary market to generate speculative interest, as well as demand from producers and consumers for the development of financial risk management products. In response to such factors, CME Group announced in October 2020 the listing of the Thailand Long Grain White Rice (Platts) Future.[8] The future, described as "a cash settled futures contract based on an assessment for Thai White Rice 5% broken over the average of the contract month" commences in January 2021 with a contract size of 25 MT.[9] The contract is intended to be complimentary to CME Group's existing "suite of physically derived US Rough Rice futures" by enabling speculators and stakeholders to better manage their price exposure to Thailand.[10] The price employed for the contract is based upon the export price for Platts Thailand Rice FOB Bangkok assessment, classified as 5% broken. Platts uses a Market on Close (MOC) methodology whereby commodity quality, location, delivery date, terms, volume, and bid time are considered live in order to generate a valuation that is time stamped and thus indicative of value at a specific point in time. These values are recorded and used to calculate a daily reported MOC price, which is free from the distortion inherent in simply using the price set by the final transaction at the close of daily trading.[11] To calculate the final settlement price at the end of each month, the arithmetic average of the month's Platt's reported prices is used, rounded to the nearest cent.

Ultimately, the adoption of CME Group's Thai rice futures contract is largely predicated upon growing price volatility, declining supply side assurances, and global economic uncertainty. These

[1] https://www.researchgate.net/publication/225351642_Mapping_the_global_supply_and_demand_structure_of_rice
[2] https://www.world-grain.com/articles/13784-thailand-rice-output-set-to-rise-in-2020-21
[3] https://www.reuters.com/article/thailand-rice-idAFL4N1UZ3WK
[4] https://in.reuters.com/article/us-thailand-rice/thai-rice-exporters-cut-2020-forecast-to-6-5-million-t-lowest-in-20-years-idUSKCN24N0BD
[5] https://www.bangkokpost.com/opinion/opinion/1930988/hard-days-ahead-for-rice
[6] https://www.think-asia.org/bitstream/handle/11540/1386/asean-rice-futures-market.pdf?sequence=1
[7] Ibid.
[8] https://www.cmegroup.com/content/dam/cmegroup/notices/clearing/2020/10/Chadv20-400.pdf
[9] Ibid.
[10] https://www.cmegroup.com/trading/agricultural/grain-and-oilseed/thailand-long-grain-white-rice-futures.html
[11] https://www.spglobal.com/platts/plattscontent/_assets/_files/en/our-methodology/methodology-specifications/platts-assessments-methodology-guide.pdf

factors, and the international exposure inherent in rice exports markets, entails that demand exists on both the buy and sell side. Market liquidity is supported by speculative interest from global commodity traders, as rice futures continue to offer opportunities for strong returns. For local producers, the introduction of the future's contract will encourage more transparent price signaling for the market, and likely encourage an increase in production in defiance of current trends. Simultaneously, it will enable producers to hedge against currency fluctuations in the Thai Baht – a major concern given increasing production costs.

Case study lessons learnt:

- Emerging markets are making progress on transparency and price risk
- Industry was entrenched in a 'boys club' culture but there was a willingness to change
- Leaders in international data and index methodologies (Platts) and futures contract management (CME Group) were engaged
- Strong local banks and regulations to assist with awareness and liquidity
- International customers may now prefer Thai rice given they can manage price risk

Case Study 2: Potential for an Almond Futures Contract – a growing industry

The impetus for the development of almond futures, launched on the Bombay Stock Exchange (BSE) in June 2020, is evident in the rapid domestic growth of almond consumption in India. Demand has been predominantly driven by an increased awareness of, and subsequent desire for, produce perceived as healthy.[12] Such demand, widely attributed to India's emerging middle class, is however price sensitive. In 2019 India imported 131,000 MT of almonds, up from 107,000 MT in 2018; exceeding an average annual growth rate of 9.8% between 2007 and 2018.[13] Simultaneously, annualised spot price volatility from 2016 to 2019 equated to 13.23%, contributing uncertainty to a market which now consumes 48% of global almond exports.[14] Such price volatility has been compounded by exchange volatility in the Indian Rupee (INR),[15] notably against the USD in which Californian almond prices are set.[16]

In light of such factors, the **BSE announced in June 2020 that the world's first derivatives contract for trading in almonds would be made available**,[17] with the first delivery taking place the following month.[18] The contracts, offered in trading units of 1,000 kg, are limited to a maximum order size of 20,000 kg. Sameer Patil, chief business officer of the BSE, stated; "with the launch of almond contracts, we look forward to gain wider participation and add new vibrancy to our commodity derivatives platform. Although, the size of the almond market is small compared to other commodities, BSE has received lot of queries from traders, importers and consumers."[19] The intent is for the broader dissemination of contract prices to constitute a reference point for the physical market.

For the Australian agriculture sector almonds are a valuable commodity, with 2019-2020 exports amounting to AUD$772M and local production constituting 7% of the global almond crop.[20] Consequently, the development of derivative contracts similar to those launched on the BSE provide an opportunity to enhance market transparency, whilst providing producers an effective financial risk management tool. In December 2019, it was identified that production risks associated with drought in California and Australia, combined with broader global economic uncertainty, posed a threat to the competitiveness of the Australian almond industry.[21] The analysis conducted by Rabobank stipulates that long-term local-producer competitiveness is predicated upon water accessibility and the AUDUSD exchange rate.[22]

Subsequently, the provision of futures contracts in the Australian almond market would provide producers an effective mechanism to manage the risks associated with major global supply & demand shifts and exchange rate volatility. Additionally, **80% of Australian almond growers are**

[12] https://apps.fas.usda.gov/newgainapi/api/report/downloadreportbyfilename?filename=Tree%20Nuts%20Annual_New%20Delhi_India_9-17-2018.pdf
[13] https://economictimes.indiatimes.com/markets/commodities/views/now-you-can-hedge-almond-price-risks-using-bse-futures-contract/articleshow/76477785.cms
[14] Ibid.
[15] https://economictimes.indiatimes.com/markets/stocks/news/pain-far-from-over-for-indias-rupee/volatility/slideshow/74607057.cms
[16] https://www.researchgate.net/publication/306423585_Is_USD-INR_Really_an_Excessively_Volatile_Currency_Pair
[17] https://www.thehindubusinessline.com/markets/commodities/bse-launches-almond-futures-contract/article31891583.ece
[18] https://www.thehindu.com/business/markets/bse-delivers-16000-kgs-of-almond-in-shell-in-worlds-only-such-futures-contract/article32157694.ece
[19] https://economictimes.indiatimes.com/markets/commodities/news/bse-launches-almond-futures-contract/articleshow/76512071.cms
[20] https://industry.australianalmonds.com.au/almond-board/almond-insights/
[21] https://www.stockjournal.com.au/story/6546141/aust-almonds-remain-competitive-on-global-stage/
[22] https://www.rabobank.com.au/media-releases/2019/191216-australias-almonds-well-placed-to-compete-with-californian-rivals/

members of the Almondco co-operative,[23] indicative of strong industry collaboration and providing of a unique opportunity to work with a consolidated producer in the design, development, and implementation of futures contracts within the market. Ultimately, the concentration of global almond production between the USA and Australia, ongoing commodity price growth, increasing global and domestic demand, and the significance of exchange rates in determining competitiveness, entail that the creation of an almond futures contract for the Australian market could be viable. Supported by cash settlement terms, liquidity may be maintained by both demand from growers and consumers, in conjunction with speculative investment that may trade spreads between the BSE contract and or physical positions globally. Such a contract would provide Australian growers an effective hedging mechanism, thereby facilitating enhanced financial risk management amongst product adopters.

Takeaway factors for success:

- Adequate infrastructure for the processing and delivery of produce, given physical settlement terms in the contract.
- If a cash settled contract is preferable to the stakeholders, then an active and representative cash market is requires i.e. ~30% of the market is sold (and prices recorded appropriately) at arm's length.
- Cost advantages are primarily evident in the ability to improve forecasting; given that the vast majority of almonds consumed in India are from the US (>75% of imported almonds by weight), fluctuations of the INR against the USD are a substantive issue.
- Clear domestic consumer demand has supported the market for futures, as reports suggest there is little speculative investment – but rather numerous food processing firms who are seeking out the contracts. (This is in contrast to many historic futures markets where speculative investors have provided the necessary liquidity).

[23] https://www.almondco.com.au/about

Case Study 3: Quota B Thai sugarcane pricing mechanism – setting a fair price for farmers by using global benchmarks

Thailand typically exports 4-7M mt of raw and refined sugar globally, positioning the nation as the second largest sugar exporter globally behind Brazil.[24] In spite of "inadequate moisture and poor cane quality, small farm size, lack of mechanization and underutilization of cane mills," Thailand has managed to maintain an internationally competitive sugar sector that now possesses excess milling capacity, and exports 65% of its annual production.[25] Since 1984 the mechanism by which it maintained a burgeoning sugar market was through the implementation of a three tier quota system under the Cane and Sugar Act; this saw 2.5m MT set aside for domestic consumption (Quota A), 800,000 MT set aside for state-sanctioned exports (Quota B), and surplus production allocated to discretionary export by private sugar mills (Quota C).[26]

This system of allocation was enforced by a price floor set for Quota A white sugar, in effect ensuring domestic supply, and guaranteeing local farmers a consistent minimum return. The impact being, by ensuring a high price for sugar sold under quota A, producers were willing to sell Quota B and C export produce at far lower prices on the global market than would otherwise be necessary to generate a sustainable return.[27] The system served to drastically reduce volatility in domestic sugar prices, provide protection to growers and millers, and distort the competitiveness of Thai exports.

The structure of the Thai market is unique too in the way in which it operates. All sugarcane growers are contracted to supply one of 54 mills and must be registered as such, these mills operate under the purview of the Ministry of Industry. In turn, said mills supply processed sugarcane, in the form of refined white sugar to the Thai Cane and Sugar Corporation which manages the accumulation and distribution of Quota A and B. In effect, the government is able to exert indirect control over the entire supply chain. Once A and B have been fulfilled, mills are permitted to export the refined sugar independently under their own brand, or employ the cane for the production of ethanol, molasses, or alternatives. Determining the price paid for sugarcane is done so using a price pooling mechanism, under which the "the system of quotas allows a different valuation for sugars, and serves as a basis for cane payment calculation, for each ton of cane, regardless of its final destination."[28] The mechanism for such calculation is an aggregate of the price paid for sugar under Quota A and B; given the inherent predictability of Quota A sugar prices, it is **Quota B prices that are instrumental in determining the amount received by farmers.**

In 2016, the Thai Government announced its intention to overhaul its sugar policy after Brazilian trade representative raised concerns with the WTO regarding indirect subsidies in the Thai sugar industry. In addition to revoking the quota system and fixed domestic price, it was said that Thailand would also be made to repeal the 70:30 profit sharing arrangement.[29] Under this policy 70% of profits realised from commercial sugar transactions had to paid to farmers, with the remaining 30% allocated to millers. The announcement was criticised as being an exercise merely aimed at appeasing Brazil and the WTO – with industry bodies stating that such changes would take years to meaningfully implement.

[24] https://www.statista.com/statistics/273437/exported-amount-of-sugar-in-leading-countries/#:~:text=Brazil%20has%20the%20highest%20export,million%20metric%20tons%20of%20sugar.
[25] https://sugaralliance.org/wp-content/uploads/2015/08/Meriot-Thai-Subsidy-062015.pdf
[26] https://www.bangkokpost.com/business/1582370/sugar-system-overhaul-at-work
[27] See no.38.
[28] Ibid.
[29] https://www.bangkokpost.com/business/1089401/thailand-to-overhaul-sugar-policy

The process of floating Thailand's domestic sugar price, which has been set at 23.50 baht per kilogram since 2009 has proven complex, with growers and millers alike expressing concern that it may hinder revenue growth as domestic demand continues to decline – with exports offering lower profit margins.[30]

Quota B sugar, this being the 800,000 MT designated for export by the Thai Cane and Sugar Corporation under contemporary allocations, is integral in establishing the basis price paid to millers and farmers. Quota B is sold under **competitive auction conditions** in accordance with ICE#11 futures guidelines for raw sugar.[31] The implication of this structure is that the basis price for all sugar is dependent upon the value of an international sugar futures contract – given that it is this value in conjunction with Quota A that determines grower and miller payments. This pricing mechanisms entails a fair and transparent forward pricing mechanism and is applied to all farmers, mitigating price risk across the supply chain. With Quota A volume relatively constant, Quota B fixed and both combined determining cane prices for farmers, Quota C volume retains the 'equity' or remaining volume and is left to millers to price on ICE#11 and in the physical market that closely observes ICE#11. From a price risk perspective, following a TCSC Quota B tender, the Thai millers have fixed cane (input) costs but a floating sugar income stream to manage.

[30] See no.39.
[31] https://www.theice.com/products/23/Sugar-No-11-Futures

Case Study 4: Horticulture price transparency and risk transfer – Potato and Tomato example

Potato Futures: The European Energy Exchange (EEX) currently offers Europe's premier futures contract for potatoes, employing an index price determined by German, Belgian, French, and Dutch markets. The European Potato Price Index (EPPI), calculated as an unweighted mean of the aforementioned markets for one decitonne of produce, reflects the market price within the European Economic Area. At present, the produce dealt with by the contract is almost exclusively used in the manufacturing of potato crisps, and hence demand for such a contract is largely supported by crisp manufacturers and food processing firms. Additionally, the cash settlement structure of the contract has incentivised adoption of the futures by traders too.

Whilst the EPPI has gained traction in the European market, the broader history of potato futures on global exchanges is that of a commodity derivative that has repeatedly struggled to maintain adequate liquidity, or garner widespread adoption by producers and consumers alike. Previously in Europe, an offering for potato futures contacts was made under the auspices of the London Futures Potato Market (LFPM) on the Baltic Exchange in June 1980. Whilst strong demand initially buoyed liquidity within the market for such contracts, bolstered by speculative interest, by 1990 volumes had substantially declined. In May 2002 the futures was abandoned, citing a lack of volume, and complexities associated with the physical settlement terms of the contract; its scrapping was seen as a blow to producers who lost a transparent pricing indicator and hedging tool. Similarly, potato futures traded on the New York Mercantile Exchange collapsed in 1976, shortly followed by a revised offering on the New York Cotton Exchange folding in 1997. Following these failures, issues surrounding potato futures became apparent, specifically; which species to use, how to guarantee freshness, and cash or physical settlement.

In contrast to these shortcomings, EEX's EPPI future has succeeded in large due to the narrow scope of produce dealt with by the contract. EEX's terms stipulate that potatoes included are for the production of chips, must have a tuber size in excess of 40 mm, and be bintje/agria or comparable cultivar. Given Europe's potato chip market eclipsed AUD$14.8B in 2019, there is evident demand for this highly specified product scope. By contrast, in Australia, the potato chip market reached AUD$909m in the same time period. While it might be challenging for the Australian potato market to sustain adequate liquidity for a futures contract to function properly, it must be noted that the **principle of "narrow scope" should be considered** and applied in the development of other horticulture products.

Takeaway factors for success:

- Broad market access: EEX's potato future functions well as it encompasses four major countries in its pricing data, whilst gaining market access to nearly all nations in the EEC. Inherently, this lends itself to a more liquid exchange and a greater depth and breadth of demand.
- Narrow product scope: The narrow product scope of the EPPI negates the challenges of previous potato futures, and enables producers and consumers alike to enjoy a high degree of certainty as to the quality/specifications of the produce in question.

Tomato Futures: Tomato consumption in India reached 18.165M MT in 2017, reflecting an average annual growth in demand of 8.25% recorded since 1961. Despite such sizeable demand, and widespread local cultivation given that India is a net exporter of tomatoes, the market is plagued by volatility. In July 2020, wholesale spot prices for fresh produce ranged from INR 4/kg up to INR 70/kg; such instance was extreme, but not unusual for in an industry subjected to poor forecasting and opaque pricing. In light of such recurrent fluctuations, and the ensuing disgruntlement amongst growers and traders alike, support has been building for the creation of a tomato futures contract.

India's price volatility is predominantly driven by climactic events, inevitably worsened by the produce's perishable nature, and lack of effective preservation options. Further, a mere 20% of the nation's output is used in processed foods (paste, juice, pickles, etc.), entailing that 80% of tomato produce is intended to be consumed fresh. The combination of such reliance on fresh consumption, the produce's short shelf life, and the frequency of crop damaging weather events, result in a market that is unable to absorb supply shortages, and simultaneously subject to oversupply in prosperous times. Farmers report that it is common to scrap existing tomato crops, or cancel upcoming crops, in times of oversupply in order to plant alternatives. This action inevitably leads to shortage in the longer term when climactic events destroy what small crops have been prepared for the next harvest.

A tomato futures market would serve to mitigate the cyclicality of price volatility by enhancing market efficiency through greater awareness. One industry stakeholder, speaking of the July 2017 shortage, reported that if seed volumes had been monitored, a drop in planting would have been evident months before the shortage. Such information alone could be effectively priced into a futures contract and act as an effective signal to farmers to increase production. Ultimately, it is the fragmented nature of Indian tomato production, widely dispersed across the country, that lends itself to the creation of a futures market. The lack of transparent pricing, a consequence of poor information exchange, is arguably the true culprit for such market volatility. The challenge faced by Indian tomato producers in the adoption of a futures product is that of quality management, and the sourcing of reliable input data.

For Australia's agriculture sector, consideration must be given to how a broader adoption of futures for a greater breadth of commodities may improve farm financial risk management. By providing farmers greater market insight, specifically current and future production levels, more efficient **resource allocation decisions** may be reached. However, India's consideration of tomato futures is largely predicated on strong domestic demand, and a high likelihood of widespread adoption due to the severe consequences of both shortages and gluts evident in the market. Consequently, the selection of whether specific agricultural commodities are appropriate for futures contracts in Australia is largely dependent upon the degree of current price volatility, the scale of domestic production, and the likelihood of both producer, consumer and investor uptake.

Takeaway factors for success:

- Demand for futures often occurs in markets where fluctuations have substantial economic consequences. Whether this be due to large price fluctuations on small quantities (i.e. domestic consumption of tomatoes in India), or minor price fluctuations on large quantities (i.e. commercial consumption of potatoes in Europe).

Section Four: Australian Farmers use of Price Risk Management Alternatives

Australian agricultural policy is, relative to other developed countries, based on a high expectation of self-reliance by farmers. As part of that "Australian Government policy focuses on creating an environment of **self-reliance and encourages farmers to adopt better risk management practices**" (ABARES 2012). As noted earlier in the report, and supported by survey reports later, the use of formal risk management tools is limited. This may however be a sectoral rather than national problem, with Kang, from his 2006 FAO paper into price risk management options, concluding that "price risk management is very critical to the success of agriculture, and yet there is a lack of tools used to manage risk as well as a lack of understanding of the tools themselves". As shown below, Australian producers generally see themselves as risk-averse, however, the use of risk transfer mechanisms remain low across all sectors.

The strategies used to manage price and marketing risks for farm products have been described in many recent publications, for example, Duncan et al. (1991), Cooke (1997), Williams and Schroder (1999), Meuwissen (2001), Wilson and Wagner (2002), and Adam et al. (2006). **For Australia, we found that price transfer alternatives, if they exist, are generally used where there is a liquid secondary market, such as a futures contract or a recognized product that industry endorses such as a commodity pool. Also, we have noticed that use is greater where the sector is capital intensive and has been regulated, then deregulated - such, as with wheat, cotton and sugar.**

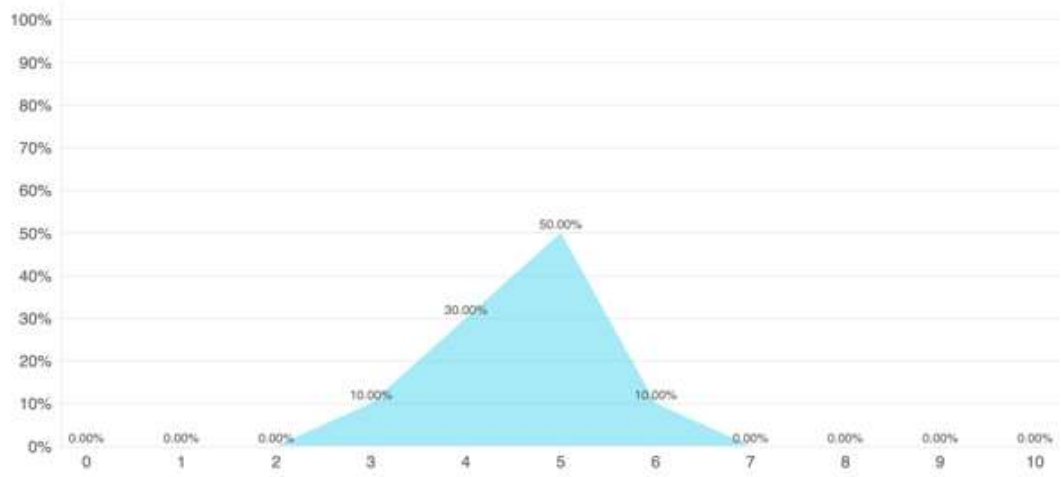
In order to gain a better insight into the use of Price Risk management alternatives we conducted a survey of 94 producers. Of those, 56% were broadacre farmers, 20% in livestock, 9% in horticulture, and 3% in viticulture. 34% were aged between 40-49, 23% between 50-59, 13% between 30-39, and 21% between 60-69. Of the total, 65% had been farming for more than 20 years with 13% between 5-10years and 13% between 10-20yrs. 74% of the farm sizes were between 1000ha-10000ha with income ranging from $1mio to $5mio.

Attitudes to Risk Aversion

Bond and Wonder suggest that risk aversion is the most prevalent risk attitude in the agricultural sector (Bond & Wonder 1980), whilst Simmons and Rambaldi indicate that prices and climate have had a significant influence on producer decision making them risk averse (Simmons, P., & Rambaldi, A. 2000). Similar experiences were found in Williams and Malcolm's work in the Cotton Industry. (Williams & Malcolm 2012). Somewhat in contrast to this, we found from the survey that the majority of farmers involved in livestock or broadacre do not mind taking a risk on production. Yet, the take up of risk transfer mechanisms remains low as 86% of survey responses say they have tried financial products, yet the elasticity of demand is very sticky. The uptake of price risk management tools may be dependent on the conditions that prevail at the time.

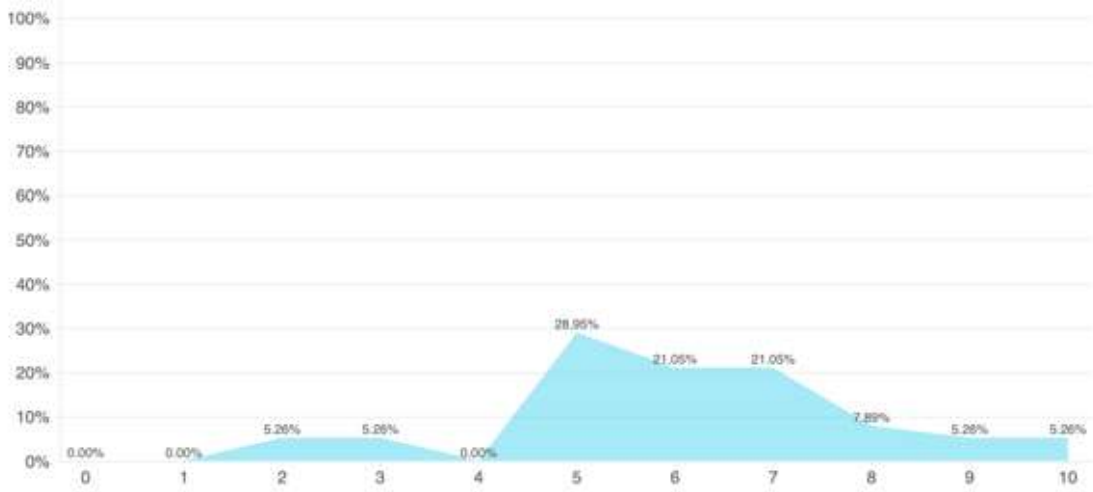
Below are charts from the project survey for Broadacre and Pastoralists (q.12 and q.191) showing that farmers are not highly risk averse (Figure 1) and understand that farming can be a gamble. Hence the management of price risk is more important.

Figure 1: Distribution of risk aversion self-assessments for livestock producers



(a score of 10 and you are extremely risk averse)
Source: CelsiusPro Project Survey 2020

Figure 2: Distribution of risk aversion self-assessments for broadacre farmers



(a score of 10 and you are extremely risk averse)
Source: CelsiusPro Project Survey 2020

Perhaps farmers understand that risk is a part of the business program, or perhaps the idea is reinforced by farming and family narratives. Producers from the Farmers Reference Group (FRG), seem to understand the risks (Figure 2), but these risks become more prevalent as either the seasons progresses, or particular events occur. In both cases it was agreed by the FRG that the need for price risk management products become more acute.

4.1 Price Risk Markets for Producers

As we have identified the main tools that farmers can use to manage price risk and therefore income are through spot and forward sales, the use of ETD and OTC derivatives, commodity pools and weather derivatives. There are only a few markets where producers have a range of tools to use to help mitigate price risk. As can be seen by the (Table1) below there are limited options for Horticulture, Viticulture, and Dairy. Livestock, Broadacre and the Fibres markets seem to be catered for albeit the markets are underutilized. As such the industry as a whole remains at risk to adverse conditions such as drought.

Table 1: Summary of current on-farm risk management products

Current Summary of On-Farm Risk Management Products											
Sector (By overal $ Value top 5)		Physical				Exchange Traded - Derivatives				OTC - Derivatives	
		On Farm Storage	Cash Sales	Forward/ Contract Sales	Commodity Pool	Futures (Domestic)	Options (Domestic)	Futures (Int'l)	Options (Int'l)	Recognised Swaps	Weather Index Certifcates
Animal Products	**Cattle**	✗	✓	✓	✗	✗	✗	✓	✓	✓	✓
	Sheep (Lamb)	✗	✓	✓	✗	✗	✗	✗	✗	✗	✓
	Pork	✗	✓	✓	✗	✗	✗	✓	✓	✗	✓
	Poultry	✗	✓	✗	✗	✗	✗	✗	✗	✗	✓
Broadacre Crops	**Wheat**	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Barley	✓	✓	✓	✓	✓	✓	✗	✗	✓	✓
	Canola	✓	✓	✓	✓	✗	✗	✓	✓	✓	✓
	Oats	✓	✓	✓	✗	✗	✗	✓	✓	✓	✓
	Sorghum	✓	✓	✓	✗	✗	✗	✗	✗	✗	✓
	Chickpeas	✓	✓	✓	✗	✗	✗	✗	✗	✗	✓
	Cottonseed	✓	✓	✓	✗	✗	✗	✗	✗	✗	✓
	Lupins	✓	✓	✗	✗	✗	✗	✗	✗	✗	✓
	Lentils	✓	✓	✗	✗	✗	✗	✗	✗	✗	✓
	Peas	✓	✓	✗	✗	✗	✗	✗	✗	✗	✓
	Broadbean	✓	✓	✗	✗	✗	✗	✗	✗	✗	✓
	Sunflower	✓	✓	✓	✗	✗	✗	✗	✗	✗	✓
Diary	**Milk**	✗	✓	✗	✗	✗	✗	✗	✗	✗	✓
Horticulture	Vegetables	✗	✓	✗	✗	✗	✗	✗	✗	✗	✓
	Fruit	✗	✓	✗	✗	✗	✗	✗	✗	✗	✓
	Nuts	✗	✓	✓	✗	✗	✗	✗	✗	✗	✓
Fiber	**Wool**	✓	✓	✓	✓	✗	✗	✗	✗	✗	✓
	Cotton	✓	✓	✓	✓	✗	✗	✓	✓	✓	✓
Viticulture	Table	✗	✓	✗	✗	✗	✗	✗	✗	✗	✓
	Wine	✗	✓	✗	✗	✗	✗	✗	✗	✗	✓
Sugar Cane		✗	✓	✓	✓	✗	✗	✓	✓	✗	✓
Bananas		✗	✓	✗	✗	✗	✗	✗	✗	✗	✓

Our survey looked at identifying the markets that farmers use and then considered why they remain underutilized.

The farmers' use of products to manage price risk varies across the agricultural market with a major focus on Livestock and Broadacre. 69% of respondents indicated that they have used a financial product to manage farm-related risks. In order to gauge the use of the products and to gain a better understanding into the market's viability, we first asked questions about ranking production inputs that make up a successful and sustainable farming enterprise (Table 2 & Table 3). The reason for this question was to ascertain that they first had a focus on the use of price risk management tools. In both the Livestock and Broadacre sectors of the market a well-defined farm risk management strategy ranks highly, which suggests a need for a product.

Table 2: Ranking Important inputs for Livestock production

Livestock		
Choice	Score	Rank
Healthy Livestock	6.6	1
Stable input and sale prices	5.3	2
Accurate Weather Forecasts	5	3
A clear on farm risk management plan	4.4	4
Appropriate Insurance	4.2	5
More flexibility in funding and credit arrangements	4.1	6
Government support	3.2	7
Off farm Business analysis skills	3.2	8

Source: CelsiusPro Project Survey 2020

Table 3: Ranking important inputs for Broadacre

Broadacre		
Choice	Score	Rank
Adhering to Agronomic practices	6.81	1
A clear on farm risk management plan	6.16	2
Stable input and sales prices	5.19	3
Appropriate insurances	4.41	4
Accurate weather forecasts	4.38	5
Off farm Business analysis skills	4	6
More flexibility in funding and credit arrangements	3.27	7
Government support	1.78	8

Source: CelsiusPro Project Survey 2020

Second, we asked respondents about the products they used (Table 4) in their price risk management plan.

Table 4: Financial Risk Products used

Product Usage (%)		
Product	Yes	No
Forwards	6.6	1
ASX Grain Futures	5.3	2
International Futures	5	3
Commodity Swaps	4.4	4
Weather/Index Derivatives	4.2	5
Grain Pools	4.1	6

As the respondents mainly had a Livestock and Grain focus, price risk management options centred on Forward Contracts and Grain Pools. The use of Futures/Options and Commodity Swaps and Weather/Index Derivatives were mixed. So, then the next question was to ask the reasons why these products are not utilized more.

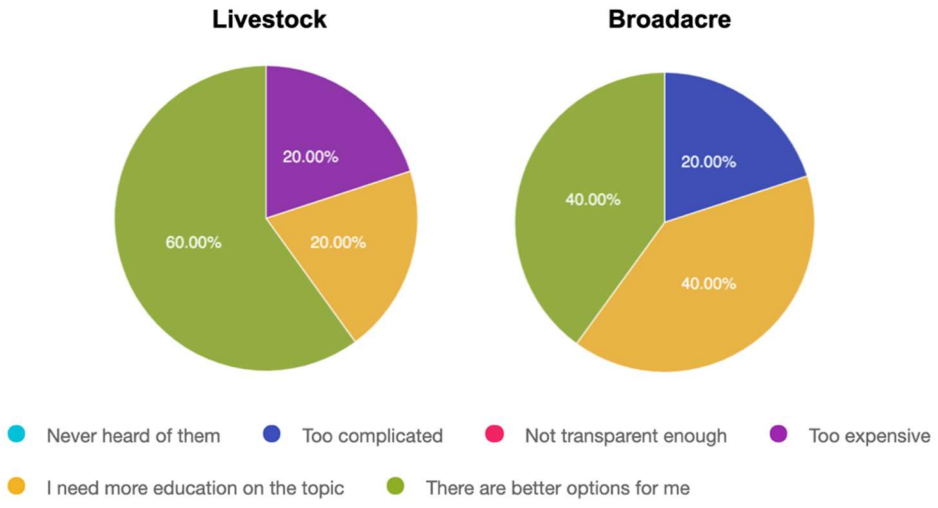
4.2 The Use of Price Risk Management Tools

4.2.1 The use of Forwards Contracts by Farmers

As discussed, the use of forward contracts are the most prevalent form of price risk management used by farmers (Figure 3). For the livestock and broadacre respondents, the predominant answer was that 'there are better options for me', followed by the need for more education.

Figure 3: Reasons why Farmers in the industry have not used the Forward Contracts

Q: Why have you never used Forward Contracts?



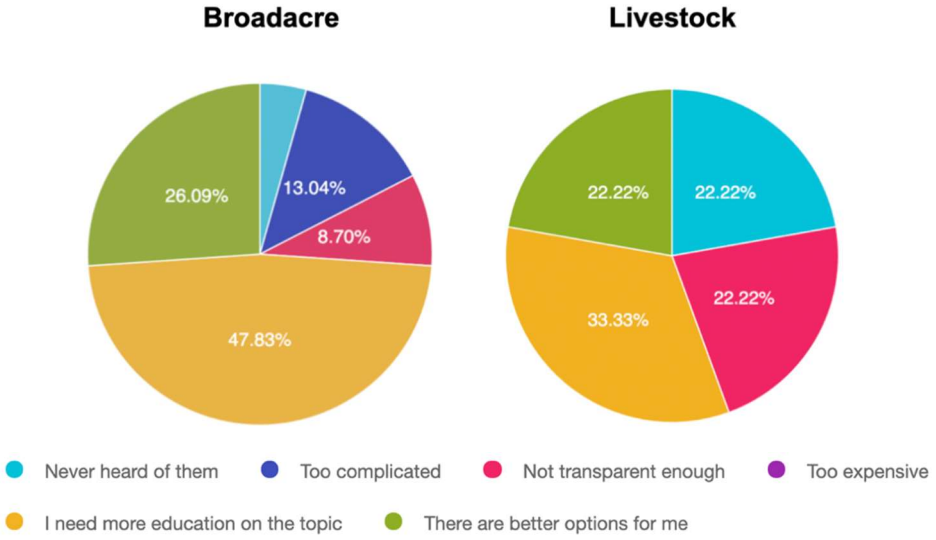
Source: CelsiusPro Project Survey 2020

4.2.2 The use of International/ US Futures and Options by Farmers

A large proportion of Broadacre and Livestock respondents to the Project survey indicated lack of awareness on using International futures to hedge price risk. When asked about their use in the FRG most, indicated that unless they fully understand the international markets would not use them. If they warranted use, they needed more education (Figure 4). Our view is that this market can be used to gauge the general trend of prices for commodities and used as a benchmark for domestic price and not be utilised unless the user has a thorough understanding of the vagaries of the market.

Figure 4: Reasons why Farmers in the industry have not used US options/Futures

Q: Why have you never used US Options/Futures?

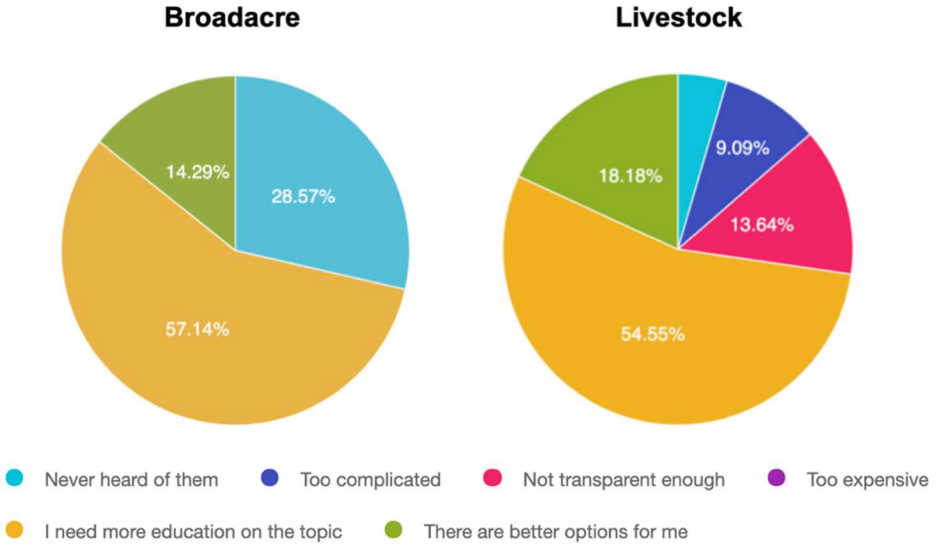


Source: CelsiusPro Project Survey 2020

4.2.3 The use of Commodity Swaps by Farmers

Figure 5: Reasons why Farmers in the industry have not used Commodity Swaps

Q: Why have you never used Commodity Swaps?



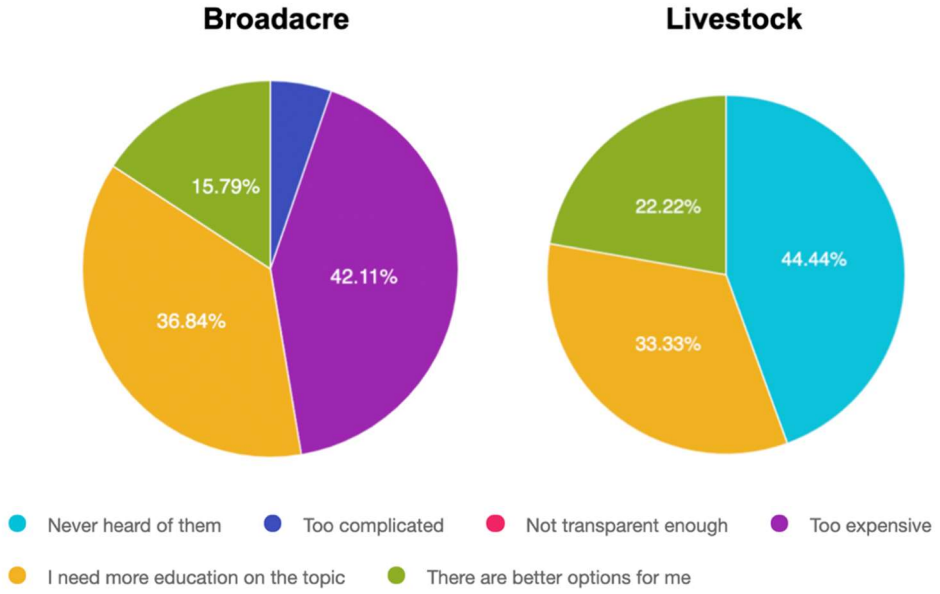
Source: CelsiusPro Project Survey 2020

Whichever route is taken, learning marketing skills using futures, options, and commodity swaps will greatly enhance the ability to manage price risk in volatile markets. Some farmers without knowledge of alternatives may elect not to use other risk management strategies and remain completely exposed to price risk. That is possibly a challenging concern to all and clearly evident by the potential use of Commodity swaps (Figure 5).

4.2.4 The use of Weather Derivatives by Farmers

Figure 6: Reasons why Farmers in the industry have not used Weather Derivatives

Q: Why have you never used Weather Derivatives?



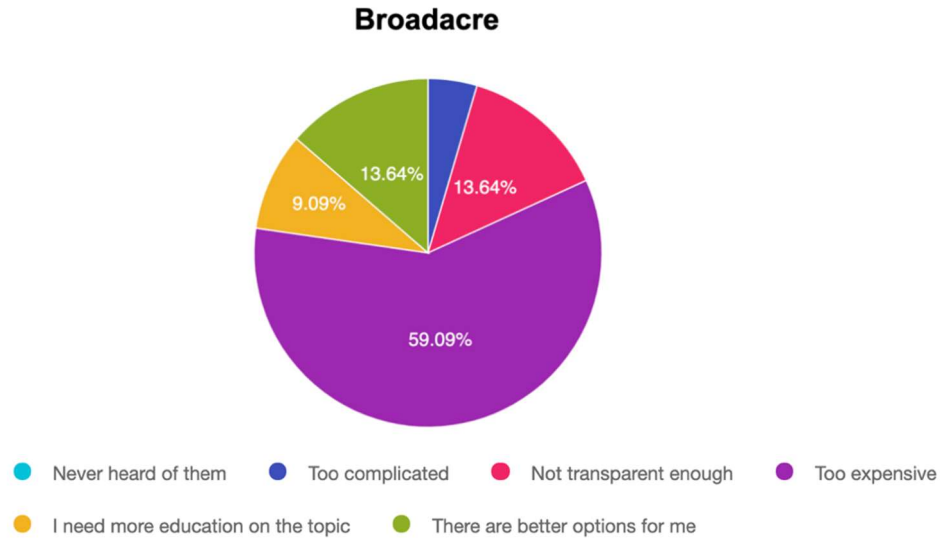
Source: CelsiusPro Project Survey 2020

We notice that many producers want to learn how to use price risk management alternatives, however, the few who have tried using them, cite pricing as an issue (Broadacre) and most in Livestock have no knowledge of the alternatives at all (Figure 6).

4.2.5 The use of Multi Peril Crop Insurance by farmers

Figure 7: Reasons why Farmers in the industry have not used MPCI

Q: Why have you never used Multi Peril Crop Insurance?



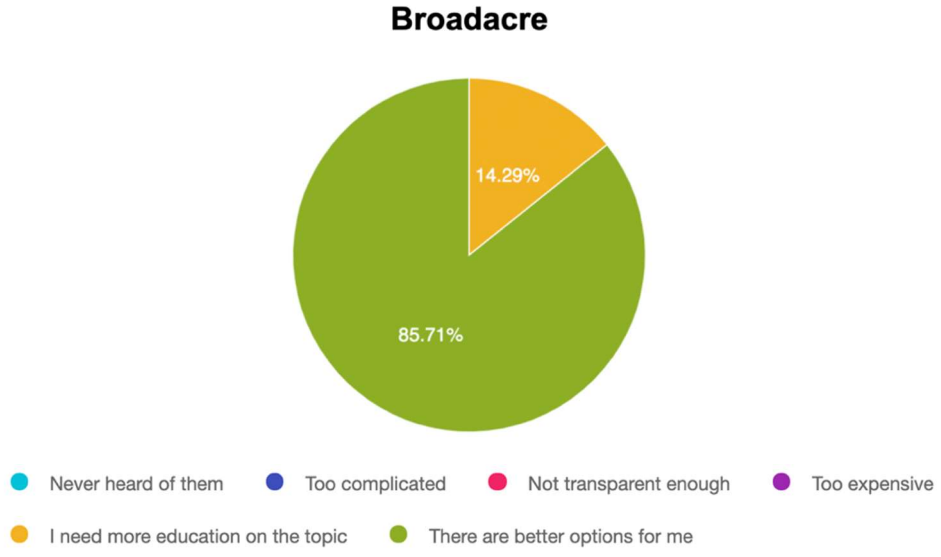
Source: CelsiusPro Project Survey 2020

The majority of growers in the survey indicated the product to be too expensive and for some transparency was an issue. (Figure 7).

4.2.6 The use of Grain Pools by Farmers

Figure 8: Reasons what farmers in the industry have not used Grain Pools

Q: Why have you never used Grain Pools?



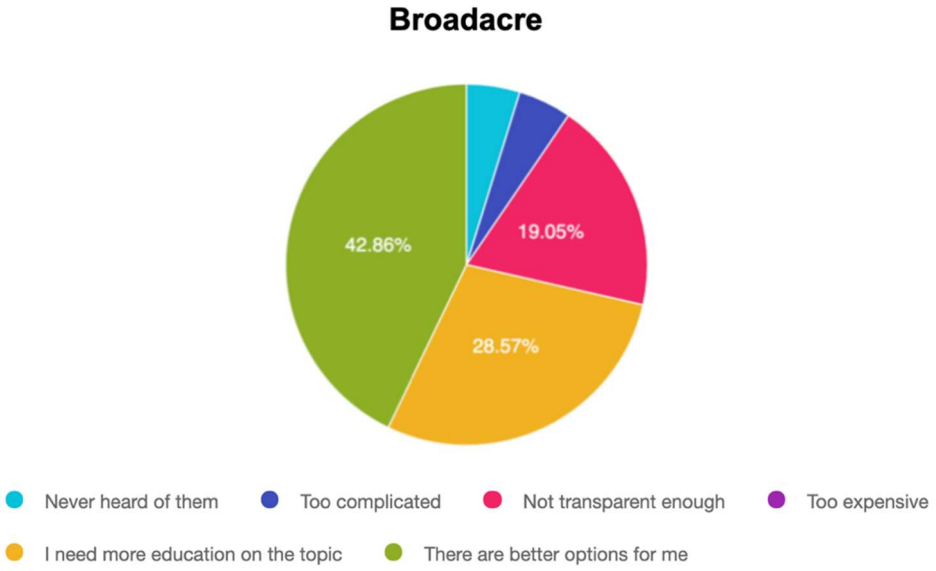
Source: CelsiusPro Project Survey 2020

After utilizing Grain pool markets many producers feel that they had better options for "marketing" their grain (Figure 8). However, the use of Commodity Pools in the Cotton and Sugar markets present another picture where growers utilize this structure more vigorously.

4.2.7 The use of ASX Futures and Options by Farmers

Figure 9: Reasons why Farmers in the industry have not used ASX Grain Futures

Q: Why have you never used ASX Grain Futures?



Source: CelsiusPro Project Survey 2020

The ability and willingness of farmers to use grain futures together with alternative "on farm" strategies to manage price risk is not a priority. As indicated by the project survey they continue thinking that they have better options to use (Figure 9). Using grain futures does require learning new skills and this is a recommendation.

4.2.8 Summary

From the survey results, three issues are apparent. First, there is the lack of awareness of some types of market products. The second is the need for more education about products, highlighting uses and usability. Third, some products were too expensive relative to the willingness-to-pay of producers. It could be argued on this point that the more aware the market is of the product the more it will be used and therefore more entrants into the market could lower the cost. Overarching all of this, however, is the critical starting-point to market transparency and risk transfer – prices paid data.

Further, our survey results suggest that where farmers have not used risk transfer products in the past, the main reasons are the lack of awareness, education and training. **(See Section 5.1 for an extension of this issue)**

4.3 Industries pro-active in the use and education of Price Risk management alternatives.

Both the Cotton and Sugar industries in Australia are well regarded for stakeholder use of risk management products. The Cotton industry use is mainly due to the capital-intensive nature of the industry and thus returns need to be secured. Whilst the Sugar industry is an example of growers groups taking the responsibility to provide a strong charter on practices and policies to manage price risk.

Case Study 4: Cotton Industry

Growing Cotton is a capital-intensive industry and in areas where it is irrigated, returns are pretty much guaranteed. As such growers look to secure returns when the price is right. In some instances, they will lock in prices that are several years out. The reason they can do this is that a liquid price transfer market exists, and the commodity is pretty standard globally. A survey conducted in 2006 by Ada, Malcomb and Williams (2006) found that "the uptake and effectiveness of price risk management in the Australian cotton industry is prolific however is constrained by the extent of producer experience, confidence and understanding of price risk management principles and processes".

The survey did however show that more than 95% of participants surveyed in Australia had at one stage attempted the use of price risk management tools and 60% said that it had a positive outcome on their farm business. Tools included forward sales, futures and options, on farm storage, commodity pools and swaps. Education, experience, farm leverage, farm size, off-farm incomes, expected income changes from hedging and beliefs that hedging could stabilize income (Shapiro and Brorsen, 1988), were the critical factors in determining their use.

Case Study 5: Sugar Industry

The market for sugar is liquid with little variance in the quality of the commodity. This makes for a good market where producers can lock in prices many years out. Sugar, like cotton, extensively uses price risk mitigation tools. The market consists of growers and marketing agents. The use of Forwards, Commodity Swaps and Sugar Pools is prolific. The Sugar pools are widely understood and used as they look to smooth out price risk. They are popular, managed well and transparent. The Futures contract is liquid and traded globally on the International Commodities Exchange(ICE).

There are limited supply contracts. The Sugar Industry is a good example whenever the main grower representative group "CaneGrowers" has developed a healthy "Growers Market Information Service", it has been going for 3 years and its mainly responsible for grower education on price risk management tools. CaneGrowers have developed a strong "Charter" around Practise and Pricing that is similar to Grain Trade Australia however more focused on price risk management concepts.

Section Five: Assessment of Existing or New Products that could be Adopted and or Developed in Australia.

5.1 Assessing the Physical Commodity market

As set out in Section 3, there are four main strategies for the physical commodity market. These are the cash market, on-farm storage, off-farm storage and pooling.

The cash market is the most popular form of sales for most commodities. They are also seen as the benchmark for other secondary markets. They are particularly active in the post-harvest period, but this can also be the low-price period as farmers sell to offset the accumulated costs of production.

As noted, on farm storage is also increasingly popular for storable commodities. Market premiums can be captured through cleaning, blending and drying grain to add value. In years of drought, crop failure or natural catastrophe growers who store commodities in on farm storage bins will continue to have cash flow. This normally coincides with higher spot market rates, however, due to the international pricing nature of Australian agri commodities the basis price may still be low due to international regions producing at high or median levels (Kingwell, 2017).

Off Farm and Bulk Storage options are mainly used in the grain and wool industries. Initial expenditure is far less when compared to on-farm storage, although transport, storage and logistic costs need to be factored in when considering the use of such instruments as a marketing and price risk management tool. Another negative for bulk handlers is harvest logistics as many bulk handlers are at capacity during harvest as many growers choose this method of price management. We have also seen growers use Bulk Storage as a means to gain financial leverage for projects (Premiums for insurance for current season crops).

A recommendation would be to enable the use of the commodity stored in a bulk storage facility to be used as collateral to secure the use of other risk transfer products. For example, grain stored could be collateralised by a financier for ASX for use as an initial deposit and variation margin for Futures trading or could be used as security against an insurance premium funding solution.

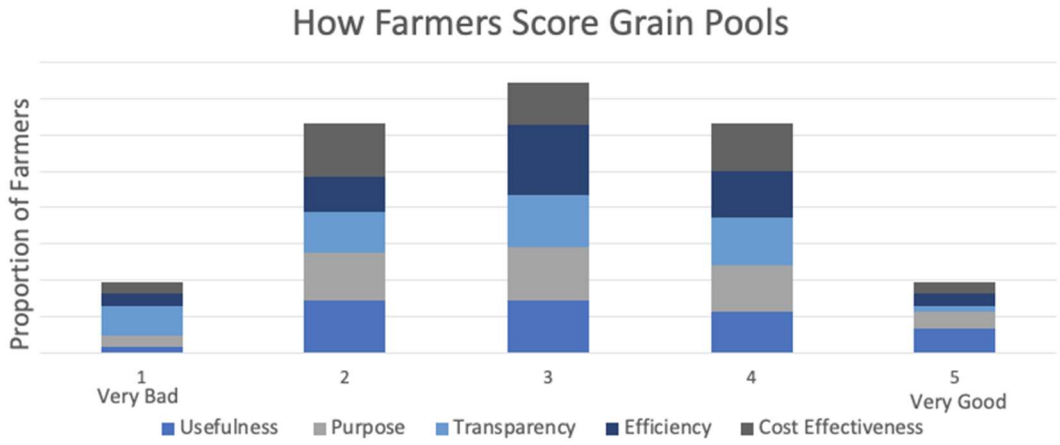
5.1.1 Commodity Pools

Commodity pools are mainly used by the grains, sugar and cotton sectors. Survey respondents rated this approach as relatively useful across a number of aspects (Figure 10).

Figure 10: Use of Grain pools to manage price risk

Q: How do you score the use of Grain Pools to help manage price risk?

Percentage of Farmers Scores					
Indicator	1(low score)	2	3	4	5 (high score)
Usefulness	3%	29%	29%	23%	13%
Purpose	6%	26%	29%	26%	10%
Transparency	16%	23%	29%	26%	3%
Efficiency	6%	19%	39%	26%	6%
Cost Effectiveness	7%	30%	23%	27%	7%



The columns indicate the cumulative score a product has. Here the majority of farmers have scored its usefulness, purpose, transparency, efficiency and Cost effectiveness between 2-4, indicating it is an average tool across each of the facets.

Source: CelsiusPro Project Survey 2020

The benefits of commodity pools are due to their long market window ensuring that price risk is mitigated, relative to market movements. In some instances, for the duration the commodity is in a pool the adviser can sell certain quantities when desired to provide cash flow. Servicing and maintenance costs are also less, compared to on farm storage. Advice is provided by the manager of the Pool about future markets to allow the grower to plan future seasons. Marketing of the commodity is also taken care of by the pool manager.

With the increased quantities of the commodity available comes the inherent ability to leverage the market, furthermore with increased volume also comes the benefits of economies of scale, including pre-payments back to producers.

Comparing different pools requires the seller to take into account the risk management strategy, accuracy of estimates, cash flow and tax implications, supply chain costs, management fees and payment systems and costs.

However, depending on the storage pool provider and operation, one of the downsides can be high storage and logistics fees and longer wait times for payment, but this can be negated by the forgone cost of on farm storage. For instance, due to the large size of grain pools price risk cannot be fully hedged so estimated returns may fluctuate until the pool closes. Pre-harvest contract pools involve

production risk for growers. Also, some pool managers take not only a management fee but also a percentage of gains over a benchmark.

For grain, sugar or cotton producers where pools are common, and they do not need the cash flow it represents a good marketing strategy. Commodity Pools do offer an easy way to gain from any potential upside in the market, as long as the manager positions for price upside participation.

5.2 Assessing Domestic and International Exchange Traded products.

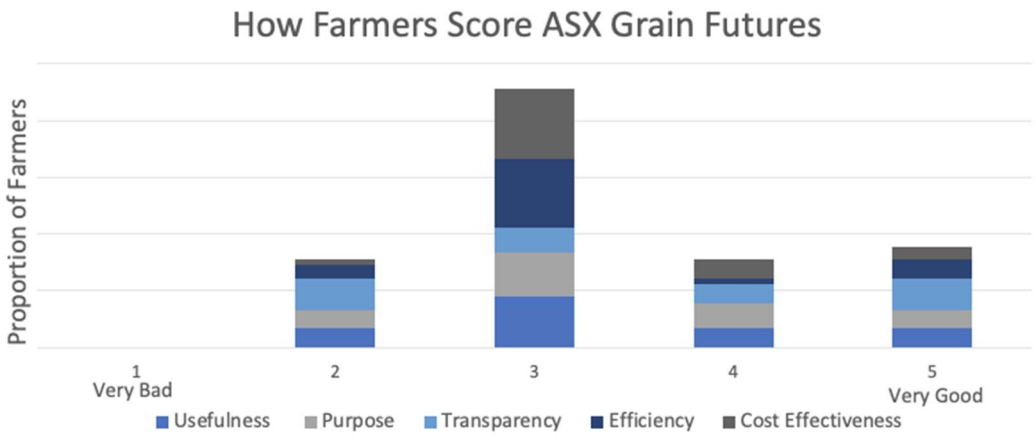
5.2.1 Australian Securities Exchange - ASX Futures.

ASX Grain Futures allows the pricing of futures in Australian terms. The benefits of futures markets and futures contracts is the easy entry and exit into liquid markets, this allows growers and buyers to shift a large portion of their price risk on to someone else and hedge their sales and purchases. Futures contracts also allow financial leverage as farmers are allowed to trade and manage high market value assets at a fraction of the total value of the underlying asset. Futures markets are transparent as the price and its constituents are publicly available, as they are traded on an exchange (Figure 11). Futures Contracts also deliver no counterparty risk as clearing houses and margining systems guarantees the financial integrity of the contract.

Figure 11: Use of ASX Futures to manage Price Risk

Q: How do you score the use of ASX Grain Futures to manage price risk?

Percentage of Farmers Scores					
Indicator	1(low score)	2	3	4	5 (high score)
Usefulness	0%	17%	44%	17%	17%
Purpose	0%	17%	39%	22%	17%
Transparency	0%	28%	22%	17%	28%
Efficiency	0%	11%	61%	6%	17%
Cost Effectiveness	0%	6%	61%	17%	11%



The columns indicate the cumulative score a product has. Here the majority of farmers have scored its Usefulness, Purpose, Transparency, Efficiency and Cost Effectiveness at 3, indicating it is also a considerably average tool across each of the facets.

Source: CelsiusPro Project Survey 2020

The risks of futures contracts are that growers can be exposed to basis risk. Plus, if there is any upward movement in the market growers must pay maintenance (variation) margin on their contracts, also known as margin calls. Due to the standardised nature of futures contracts they cannot be adapted to individual growers' needs. Price fluctuations in the market mean constant monitoring and management is needed. The biggest risk is that if the market moves against the grower, large losses can be incurred.

Where a price risk solution exists, such as a liquid Futures and Options market ie ASX Contracts for wheat and barley via the ASX it seems to be underutilised. However, the use of Futures and Options is extremely transparent and cost-effective.

Our FRG noted that there was a general fear about their use in the wider agricultural community.

Recommendation to ASX Futures contracts

The ASX Futures market offers futures and option contracts that are transparent forward-looking price risk management tools for Wheat and Barley. However, it is underutilized when compared to the overall market. Users of this market are mainly restricted to trade and professionals who understand the use of deposits and variation margins to secure positions. Volumes are low when compared to physical traded commodities. We found via our survey and Farmers Reference Group that uptake and use is low for the farmer community. The typical farming enterprise shies away from these contracts due to the management/maintenance of the position i.e. use of variation margins and the basis risk which is an exchange requirement. Growers tend to expense most of their growing budgets and have limited cash reserves towards the end of the growing season. Having to come up with cash to meet a margin call at those critical times is detrimental to holding the position and the season. Most would look just to close the position as may be seen as an additional expense.

In order to encourage more participants to use this market and to enable other contracts to be developed we recommend the following:

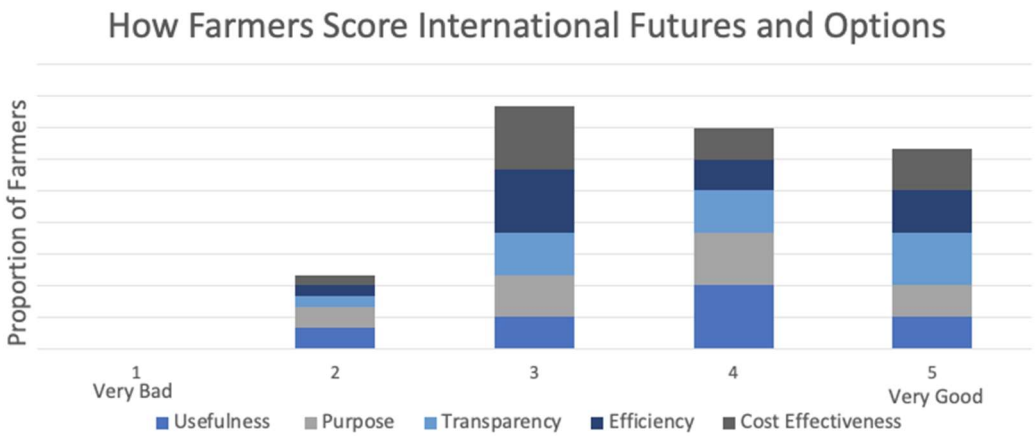
- **Education** – As a short term priority, ASX have indicated a willingness to partner with grower brokers, banks (OTC) and clearing brokers on education to increase uptake;
- **Cash and administration** – of futures positions (margin calls) is likely to be difficult for most farmers, so delivery channels and product innovation needs to occur e.g. accessing farm management deposits, greater use of OTC's with clean lines and greater use of options;
- **Inventory finance development** – encourage development of access to non-land asset security such as grain and livestock that will support cash or collateral requirements for servicing margin calls e.g. Repo style products supported by warehouse receipts and development of on-farm financing. In addition, wider awareness of the use of the Personal Property Security Registry (PPSR) to open channels to capital.
- **Liquidity** – in terms of futures, turnover will encourage more participants, options market makers and larger positions. Some participants, e.g. banks, are concerned unwinding their position may move the market too much;
- **Price Data Recording** - Similar to all other futures contracts, data recording of physical sales to create a benchmark is an important feedback loop for futures. ASX may also be able to have a cash settled mechanism if better reference prices where available; this may involve structuring auctions to deliver additional data.

5.2.3 International Futures and Options Markets

Figure 12: Use of International Futures and Options to manage price Risk

Q: How do you score the use of Futures and Options to manage price risk?

Percentage of Farmers Scores					
Indicator	1(low score)	2	3	4	5 (high score)
Usefulness	0%	13%	20%	40%	20%
Purpose	0%	13%	27%	33%	20%
Transparency	0%	7%	27%	27%	33%
Efficiency	0%	7%	40%	20%	27%
Cost Effectiveness	0%	7%	40%	20%	27%



The columns indicate the cumulative score a product has. Here the majority of farmers have scored its Usefulness, Purpose, Transparency, Efficiency and Cost Effectiveness at 3-5, indicating that farmers consider this to be a good tool across each of the facets.
Source: CelsiusPro Project Survey 2020

Both CME and ICE exchanges maintain a transparent, free-market setting for the trading of futures and options, which helps the underlying industry find a fair market price (price discovery) for the product and allows the transfer of price risk associated with cash price volatility. Increase the liquidity of markets by unifying them and guaranteeing transparency. Participants on exchanges can procure commodities from 'unseen' sellers making the price discovery mechanism vibrant. They use a variety of controls throughout the life of each trade, and those protections help to ensure customers have confidence in the market so they can manage their risk (Figure 12). They use performance bonds, appropriate margin methodologies and additional risk management tools to protect markets. These ensure that customers have the ability to execute the orders they place. They facilitate arbitrage and minimise fluctuations keeping price controls. Orders are processed in the order they are received and are matched based on defined algorithms. Exchanges send out market data to all customers at one time. All customers get the same information, though the speed at which they consume the market data is up to them. To ensure the correctness and efficacy of the trading process, the exchanges also resolve disputes/disagreements through arbitration.

However, the potential for conflict of interest among brokers, who also act as off-market traders is an issue plus the potential for market manipulation exists when contracts are thinly traded. The size and financial muscle of the dominant firms, together with their diversification across a number of commodities has allowed these firms to weather the increasingly volatile environment of international commodity markets while deterring producers. Most market players may be unable to open accounts with brokers in western market

s and set up credit line arrangements (to pay margin calls); or the price correlation between local prices and global contract prices may be too low to make effective risk management possible in few commodities. Domestically, only those that have an acute understanding of their operations use them.

5.3 Assessing the Physical and Over the Counter markets used to mitigate Price Risk

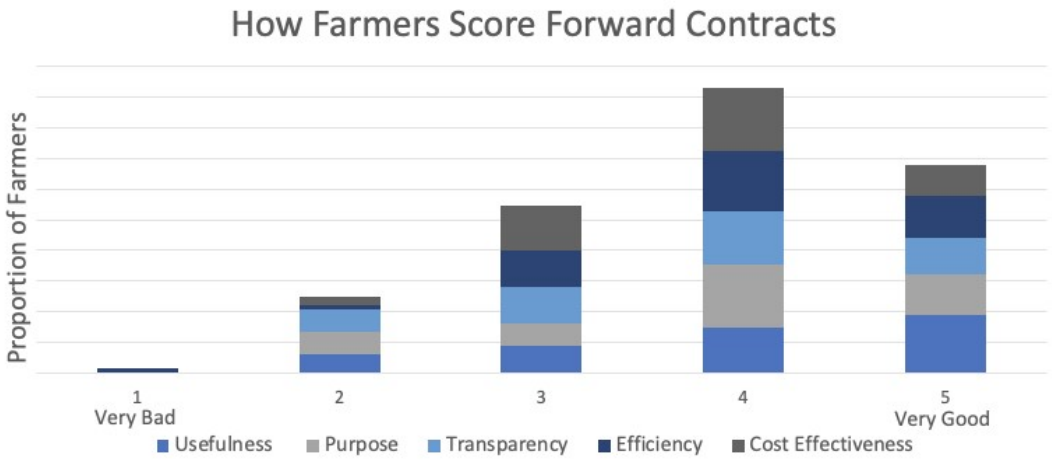
5.3.1 Domestic and International Forward Contracts

The benefits of Forward contracts are they are simple to use and easy to understand. Growers don't need to present any capital outlay. Growers are protected against price falls and it allows the price to be secured. All costs are known at the time of contracting making these products very transparent.

Figure 13: Use of Forward Contracts to Manage price risk

Q: How do you score the use of Forward Contracts to manage price risk?

Percentage of Farmers Scores					
Indicator	1(low score)	2	3	4	5 (high score)
Usefulness	0%	12%	18%	29%	38%
Purpose	0%	15%	15%	41%	26%
Transparency	0%	15%	24%	35%	24%
Efficiency	3%	3%	24%	39%	27%
Cost Effectiveness	0%	6%	29%	41%	21%



The columns indicate the cumulative score a product has. Here the majority of farmers have scored its Usefulness, Purpose, Transparency, Efficiency and Cost Effectiveness at 4-5, indicating that most farmers think it's a very good tool across each of the facets.

Source: CelsiusPro Project Survey 2020

Basis risk tends to be small because contracts are customized to meet the precise needs of the users. Basis risk exists when the standard (quality, price movements etc.) of goods traded are different and therefore the need to hedge risk.

Initial capital is not required for market participation. Collateral (margin calls) is not required. Contract terms are negotiable (Figure13), wherein they could be longer than those of standardized contracts.

The risks when taking out a forward contract are that it does not allow growers to take advantage of price rises. Once locked into the contract both parties must follow their contractual obligations, this means the grower must deliver their commodity stated in the contract for the predetermined price. Due to the illiquid nature of forward contracts they are inflexible and can be difficult to exit should either party need. The calculation of washout costs can often not be transparent. Growers and buyers are exposed to counterparty risk as buyers may default and growers may fail to deliver. Many forward contracts contain a weak basis price, particularly when taken out early in the season. Often due to the weak basis price the farmer is left exposed to price increases. Once locked into a forward contract, farmers can often not compensate for the risk of delivery.

The contract cannot be overturned or transferred to another person. Prices tend to be less transparent because they are negotiated between two parties. Transactions are not monitored so that counterparty risks remain. Loss of flexibility and opportunity for farmers to take advantage of premium prices. Could involve a substantial cost for the farmer and contractual terms may be unfavourable for the less powerful party.

Other options are for the contract to be extended or contract rollover into the next season, however, the buyer is under no obligation to offer these.

Hedge to Arrive Contracts using Futures and Physical Sales

A hedge-to-arrive contract lets the producers lock in a futures price with the elevator, leaving the basis to be set at a later time. The elevator will establish a hedge in futures on behalf of the producer in exchange for the delivery of the cash commodity at a set time. This contract is worthwhile if futures prices are relatively high and market conditions lead you to believe that they will weaken and/or think there is room for improvement in basis levels. It's one of many contract options that allow producers to actively manage price risk. The contract will be complete when the producer sets the basis, which will determine the cash price. The basis can be set at any time but must be set prior to delivery.

We see good potential in the adoption of this contract in Australia.

Example 14: Hedge to Arrive Contract

It is May the producer wishes to contract corn for harvest delivery.

Current forward pricing bid for harvest delivery is:	*$2.15*
Current futures price for December corn is:	*$2.75*
Basis is:	*$0.60*
Normal basis is:	*$0.40*

Producer has the choice of cash contracting on a basis that he now knows is 20 cents wider than normal or he could contract his corn with the elevator using a December HTA at $2.75. If he opts to contract his corn using a December HTA contract, he could possibly pick up an additional 20 cents per bushel if the basis narrowed before harvest. Keep in mind the basis could also widen. That is a risk you take but with a basis that is 20 cents wider than average already (for corn), chances of it widening further are minimal. Typically, producer would want to establish the basis by late August as basis usually widens coming into harvest for corn and soybeans.

Example 15: Hedge to Arrive Contract two

Contract corn using a December HTA in May *$2.75*
By mid-summer, basis narrows to: *$0.40*
Established cash price after fixing basis at –40 is: *$2.35*

By using a HTA contract in the above scenario, the producer netted 20 cents per bushel more than he would have cash contracted in May at $2.15.

HTA contract is just like selling futures, but the brokerage fee is replaced by an elevator fee.

Futures price (when sold) + expected basis – HTA fees = Expected price

The fees charged for an HTA contract vary extensively; often reliant on how far out the producer wants to price the grain.

The benefits of using HTA are that the producer locks in the futures but allows the producer to also take advantage of possible improved basis levels at a later date. It removes the risk of restricted delivery opportunities since used prior to delivery. Could be used to lock in a high futures price without using a commodity broker or futures commission merchant. Allows a producer to speculate on strengthening or improved basis levels.

The use does necessitate the need for a good understanding of basis and the factors that influence it. Used alone, it does not totally eliminate cash price risk. Producer being the maker of decisions on his own will have minimal control of upside or downside risk in case markets change. If the grain is delivered prior to a pricing basis, there may be service charges.

A good HTA contract requires mandatory delivery, though absent of an overriding event, such as crop failure, of a stated quantity and grade of grain at a specified location and reference price by an indicated date within the crop-year during which the crop is harvested. Contract should cater to the transfer of a quantity that is judiciously related to the producer's annual production, not committed elsewhere, and generally available for merchandising and at a location whereby delivery can be made by the producer under customary merchandising practices. Specify a delivery date and futures contract month reference price that concurs with the crop-year during which the grain will be harvested. Basis risk is usually comparatively small but can be substantial in times of extreme weather problems, inadequate storage space, transportation problems, and demand shocks. Spread risk (differences in various futures price delivery months) is not involved with these contracts.

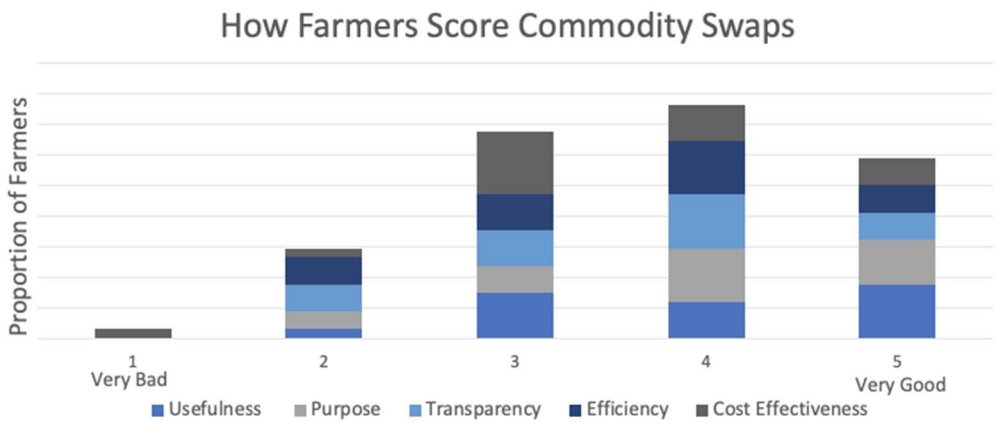
5.3.2 Domestic and International Commodity Swap Markets

The benefits of commodity swaps are there are no initial maintenance margins like when dealing with futures, the profit or loss from the swap is defined when the swap contract matures. In a swap contract, there is also no requirement to deliver the commodity so little delivery risk is involved as the swap is cash-settled (Figure 14).

Figure 14: Use of Commodity Swaps to manage price risk

Q: How do you score the use of Commodity Swaps to manage price risk?

Percentage of Farmers Scores					
Indicator	1(low score)	2	3	4	5 (high score)
Usefulness	0%	6%	29%	24%	35%
Purpose	0%	12%	18%	35%	29%
Transparency	0%	18%	24%	35%	18%
Efficiency	0%	18%	24%	35%	18%
Cost Effectiveness	6%	6%	41%	24%	18%



The columns indicate the cumulative score a product has. Here the majority of farmers have scored its Usefulness, Purpose, Transparency, Efficiency and Cost Effectiveness at 3-5, indicating farmers score this tool well across each of the facets.

Source: CelsiusPro Project Survey 2020

The risks of undertaking a swap contract are that the costs are not transparent, this is due to the swap providers' costs being concealed in the swap price. This could be done in several ways, normally with the grower receiving a lower futures price or a higher exchange rate then what could be achieved if the grower were to use futures directly. However, this is part of the swap providers operating costs, it is compensating them for taking on some of the price risk and for them the meet margin calls on behalf of the grower. In a normal swap contract, the operator's margin can be set either at the establishment of a contract or when it matures and is normally not a fixed amount.

Due to the nature of Swap Contracts protecting growers against price movements of an underlying physically delivered tangible commodity. If for whatever reason there is no physical commodity able to be delivered, means the grower will have to buy the underlying position back. If the price of the commodity is very high compared to the swap price large losses can be incurred.

Commodity swaps have been used for a while in major commodity groups in Australia. The most popular contracts are for broadacre, fibres and sugar. The reason for this is that a secondary liquid international market exists. As the major components of the swaps are the US Futures Price and AUD they provide a good opportunity for sophisticated farmers to enable them to lock in separate legs of risk depending on the market conditions.

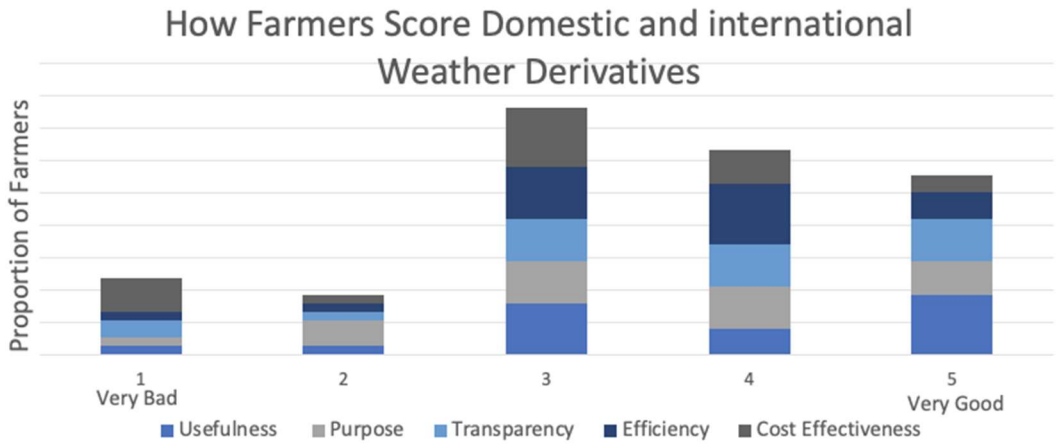
One of the drawbacks in their use is the way the initial deposits and variation margins deposits are used. These are all "credit" based and require high farm equity ratios to utilize. If a farmer does not produce due to an extreme event then this becomes problematic as the farmer needs to make good unrealised losses on the swap. Anecdotally, this is normally bad as the drought would see the swap price move dramatically against him. The use of a recognisable form of credit (Farm Deposits) other than equity could resolve this issue as the issuer will make a call once the "marked to market" losses get to a critical stage. A margin call is a means whereby the owner of the position can re-assess the position. A mechanism similar to the futures market should be utilised to safe guide farm equity. Costs are minimal however all are traded on credit issued by a bank, up to a point which is usually when farm equity is reduced substantially by negative price movements in the position.

5.3.3 Domestic and International Weather Derivatives

Figure 15: Use of Weather Derivatives to manage price risk

Q: How do you score the use of Weather Certificates to manage price risk?

Percentage of Farmers Scores					
Indicator	1(low score)	2	3	4	5 (high score)
Usefulness	5%	5%	32%	16%	37%
Purpose	5%	16%	26%	26%	21%
Transparency	11%	5%	26%	26%	26%
Efficiency	5%	5%	32%	37%	16%
Cost Effectiveness	21%	5%	37%	21%	11%



The columns indicate the cumulative score a product has. Here the majority of farmers have scored its Usefulness, Purpose, Transparency, Efficiency and Cost Effectiveness at 3, indicating it is also a considerably average tool across each of the facets.

Source: CelsiusPro Project Survey 2020

The benefits of weather derivatives are that they can be booked anytime throughout the year outside of the underwriters' forecast window. They are a set and forget product. The weather data throughout the certificate duration is automatically recorded and presented to the certificate holder, allowing full transparency (Figure15). At the end of the risk period, the climate data is assessed and payout into the certificate holders bank account is complete within 20 days. No on farm assessment needs to be done with weather certificates, therefore no demonstration of loss needs to be established. Weather derivatives effectively transfer risk from those who are involuntarily exposed to unwanted weather risk to those who voluntarily trade in risk management. Weather derivatives also reduce problems previously exposed to traditional indemnity insurance providers such as information asymmetry, like adverse selection and moral hazard. Weather certificates allow for quick cash flow in the event of adverse weather.

This technology has great potential to expand as it is easy to implement, the future looks bright for the weather derivative industry in the future for Australian risk management tools due to the transparency and live feed for the cover. Weather data is also becoming more accessible and accurate, along with agricultural experts moving into this field leading to better fit for need applications of weather derivatives.

One of the issues currently facing the weather derivatives market in Australia is the lack of uptake due to either lack of exposure or education on how the products work and price.

Further, farmers who undertake a weather derivative and then do not produce their commodity are exposed to the price of the premium. Basis risk can also be an associated risk, meaning what is happening on the farm is not what occurs within the certificate and as such farm and third-party data analysis must always be carried out during the underwriting process of a weather certificate. Weather derivative providers can be exposed to geographic concentration risk when dealing with a lot of clients within a small geographic area, if all the clients in one area get a payout the product (weather certificate) will become expensive.

Weather Certificates or Parametric Index options are relatively new offerings that producers can use to mitigate the effects of the weather on their crops. They can also be used by other market participants to help hedge risks. You do not have to farm to use them.

The application to other sectors remains a key point as the weather makes it inclusive.

Understanding how premiums are calculated remains an issue when compared to other products and local issuers who understand the domestic weather market need to be found.

Premium values need to be explained as they are not like traditional indemnity-based options.

5.3.4 Enterprise Supply Side Replacement contracts

Enterprise Supply Side Replacement contracts are not directly related to price risk management. However, the major component of the contract is a weather derivative, hence its inclusion. In the event of adverse weather such as a drought occurring the provider of the input supplies the farmer the input at no cost.

Enterprise Supply Replacement Contracts are relatively new albeit simple for farmers and input supplies to use. There is an agreement by the supplier to replace the input either by value, credit or actual input if there is an event during the season that renders the input non-productive. This for example could be due to a dry season or an excess rain period where the input is rendered useless. The use of these contracts to transfer risk is limited in the Australian experiences. However, momentum is gaining as Input suppliers see this is a product differentiator, it leads to brand loyalty and producers see that the supplier is prepared to share some of the risk.

As agricultural supplies and farmers exist in a symbiotic relationship it makes sense for the two to work together. This is a relatively new offering from those input supplies who are looking for loyalty and momentum is slowly gaining in their use.

Section Six: Identify and assess barriers to uptake of existing and new products

6.1 Supply Side Barriers

Supply of financial products to hedge price risk are based on the ability of the risk transfer market to understand what the risk is, how to price it, then monitor it and settle it. If this does not occur then it represents a barrier for uptake.

In the national survey, drought was the single most peril that farmers faced. 44% of broadacre farmers indicated that they are most affected by drought and 22% of beef producers say the same. 93% of those surveyed say that they don't have a cover for drought yet it ranks as the main risk they face. Institutions need to innovate in order to capture this risk. There is no current indemnity style risk transfer product that addresses drought.

A deeper dive into agricultural sectors via the project survey found that broadacre farmers ranked drought, followed by frost and heat as the major risks, and for livestock it was drought. Yet, institutions have found it difficult to supply products to address this risk.

Of the existing price risk management products in the market we have identified supply barriers in Forward contracts, ASX Futures and Parametric non indemnity products.

6.1.1 Forwards Contracts

Forward contacts are the most widely used product to set prices for the sale of a commodity. Broadacre farmers rank them as a highly efficient tool and fit for purpose (project survey q17). Cotton and sugar producers also see them as an important means to lockaway prices when they are high. This is an efficient market when the product is generic and is liquid.

However, after discussing with our FRG and research from interviews with farmers and questions asked in the project survey we see there are three main issues with the market that represent a supply barrier.

i. Limited education and no extension work on their use.

ii. In some sectors, it is costly and difficult to find a willing counterparty i.e. horticulture, viticulture and livestock.

iii. The market for forwards is illiquid due to their idiosyncratic nature so they are not easily sold to other parties if desired.

iv. One party usually has an incentive to break the agreement. Generally, it is accepted that this is the farmer as he cannot fulfill the contract.

6.1.2 Exchange Traded Futures and Option Contracts

Futures and Options contracts are highly ranked moderately in terms of transparency (Project Survey q20). Contracts are globally used to hedge price risk. In the US there are 13 traded agricultural commodities. The CFTC reports monthly on who holds the contracts whether they are non-commercial, commercial, and index traders. However, the supply of Futures contracts in Australia are limited to wheat and barley, with the most active being wheat and mostly traded by professionals who understand the nuances of the market. Farmers generally do not use them.

Our FRG spent considerable time on the reasons why farmers do not use them.

The main barriers to the supply are:

i. Lack of education on how to use them properly.

ii. Lack of products to the trade.

iii. The use of initial deposits to control positions.

iv. The requirement for variation margin during the life of the position.

For the domestic futures markets to make a difference in managing price risk for farmers the exchange needs to engage more potential users and enhance operational use.

6.2 Demand Side Barriers

Demand for financial products to hedge price risk are based on user needs. If there is demand for a product the financial markets will and should provide a solution.

Farmers understand the risk they have, it is well documented throughout the report. Of the existing price risk products in the market we have identified barriers that affect the demand for all of the price risk management products.

6.2.1 Education

Education on price risk products for the farmer is generally poor. The majority of farmers surveyed (project survey, q18, q21 q24, q27and q30) on why they would not use recognised products indicated that they needed more education.

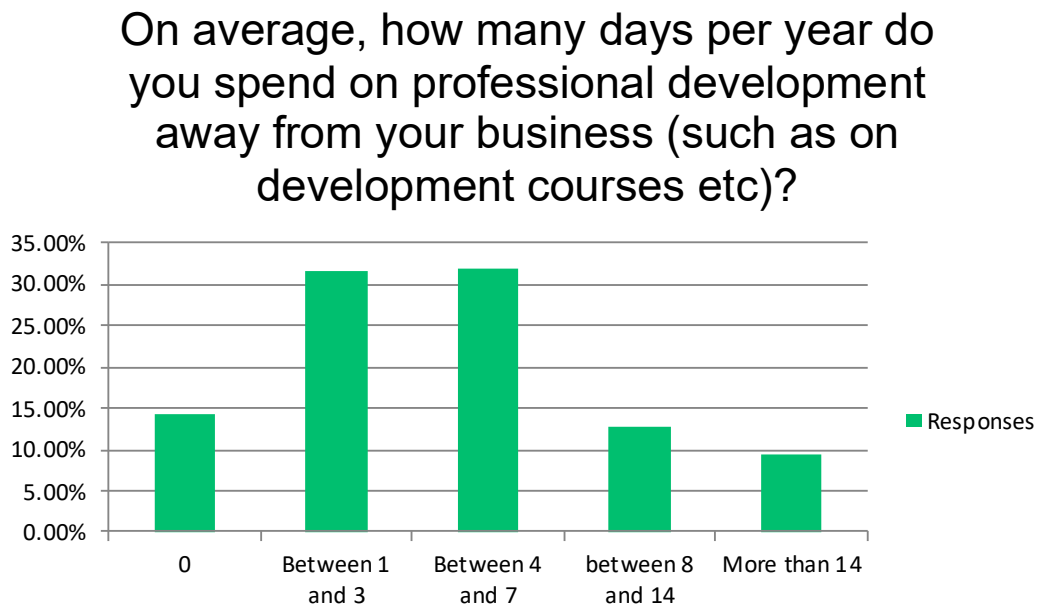
- 40% said they needed more education on Forward contracts
- 28% said they needed more education on ASX Grain Futures
- 47% said they needed more education on International Futures
- 54% said they needed more education on Commodity Swaps
- 36% said they needed more education on Weather Certificates

It is important to recognize that there is no single risk management tool that will meet the diverse needs of farmers exposed to price volatility, particularly given the complexity of local market and

policy environments. Solutions need to be tailored, drawing on a mix of different tools and responses. Educating and training farmers on how to use price risk management products as a risk-reducing investment can give them more realistic expectations about the issues involved and greater familiarity with the nature of the product which will assist in reducing income volatility.

Farmers are willing to learn. When surveyed on the days per year they would spend on professional development ie at courses (Figure 16) 31% said that they would spend between 1-3 days and 32% said they would spend 4-7 days (national survey q55), which indicates a window to connect farmers with price risk management options.

Figure 16: Chart showing days per year farmers would spend on professional development



Source: National Survey 2020 q.54

FRG discussions indicated that limited focus by industry stakeholders about price risk products occurred. This discussion was further reiterated when an audit on Research Development Corporations (RDC) strategic planning and focus reports failed to recognize price risk as an important topic. A deeper dive into University and other educational institution courses about Price Risk Management revealed a similar theme.

Audit of RDC Strategic Plans for Price Risk Management Options

RDC's are industry influences so it makes sense to understand their involvement in the promotion and education of members on price risk management options. In order to do this, we looked at the Strategic Plans for GRDC, CRDC and MLA to investigate their endorsement and or education to members around tools that could be used to manage price risk.

- **Grains Research and Development Corporation (GRDC):** Their Strategic plan 2018-223 points to "extensions to create enduring profitability for Australian grain growers. https://rdeplan.grdc.com.au/ Analysing the content of the program via the key investment targets we found a limited extension on education on managing price risks. Where there is a focus to maintain and improve price, there is nothing specific about price risk management options. Further by reading into "Grower Communication and

Extension" work for GRDC members the development of extensions that include education on price risk management options should be relatively effective and inexpensive to complete.

- **Cotton Research and Development Corporation (CRDC):** As noted above the Cotton industry is one of the most advanced when it comes to the use of price risk management options due to the generic nature of the product and market. CRDC conducted an extensive SWAT analysis of their industry, and through a consultation process came up with 16 trends that are most likely to influence their industry. There is very little notation on issues that address price risk management. Further on analysing CRDC's "RD and E Plan for 2018-23", we once again found that there was no mention of issues/education or extension work for growers relating to the management of prices for the commodity.
- **Meat and Livestock Association (MLA):** In the MLA Strategic Plan for 2025, MLA fostered 6 key priorities but little mention of transparency or price risk management alternatives was discussed. Although, we do understand that the MLA is currently investigating a program to members on climate adaptability and cattle benchmarks & price risk management. With respect to price risk management, it is unclear if further resources will be allocated despite industry support and decline in price data (for cattle). Interestingly, a series of Resilience Webinars has been scheduled for November 2020, although no mention of price data metrics or forward price discovery is in the promotional information.
- **Rice:** When looking at the Rice Program RD&E Plan - 2016/17 to 2021/22. Which is another program funded by statutory levies paid by industry participants and then matched by the Australian Government funding up to 50% of the RD&E program we find the focus is purely on production issues with no relevant information on price risk management. Although climate change is mentioned, no focus on any climate adaptability programs is mentioned. A more in-depth look into the 11 priorities fails to look at price risk management. Interestingly, Thailand is to launch a rice futures contract in January 2021.
- **Australian Wool Innovation**: For Australian Wool Innovation, once again there is little mention or extension work in the 2021-22 Strategic plan on climate adaptability and education on price management there is at least some interest in education (from p. 10) but not much on business management and no mention of risk management.

Further Universities and other educational institutions had limited focus on the topic. In researching how the Australian education system teaches and addresses farm risk management, we found that there is little to no units that cover this area to the extent that it should be. Despite there being subjects in Agribusiness courses that skim the surface of risk management tools, there seems to be no option that discusses and teaches an in-depth analysis of such tools.

Out of 578 courses that pertain to agriculture in Australia, 26 of these courses are in agribusiness (The Good Universities Guide 2020); In these business degrees, there is typically only 1 subject that addresses Farm Risk Management. There are no postgraduate certificates or degrees which directly teach these areas.

These findings accord with the work of Cockfield et al. (2019) looking at business management decision-making in the dairy industry. The researchers found that attention to risk management was very limited but that there were more fundamental issues in relation to attention to business

management in general, though this was changing. The researchers, based on in-depth interviews and using some frameworks from the cognitive sciences, drew some conclusions about developing business management programs that may be important in developing risk management knowledge and skill.

These were:

- While the farmer interviewees acknowledged the importance of farm business management, many also acknowledged that they did not give it the priority that was needed, with operational matters taking precedence.
- Untutored self-assessments of skills and knowledge should be treated with caution.
- Formal financial analysis of and for decision-making is very rare. Most farmers, for most decisions, rely on some form of intuitive decision-making.
- There is an overwhelming focus on cash flow as the important business indicator and this is the critical consideration in most investment decisions (not return on investment or assets).
- Further to that, there is very little sustained use of decision-support tools or technical assessment tools.
- Business skills, and for that matter other management skills, programs cannot be run as one-off, 'conversion' interventions. That is, one round of explaining a certain approach is highly unlikely to have much industry impact.
- Management development programs must be delivered by people who have credibility within the industry. Such credibility is not fixed and can be developed over time.

This research used concepts from the cognitive sciences and social psychology to inform the survey work. Prominent in this was Daniel Kahneman's (2011) work on cognition in decision-making. He summarised his own and others' work to show how people are generally poor at: evaluating or even understanding probabilities, which we assume would also carry into decisions about risk management; self-assessing skills and knowledge; and the accurate recollection of events and one's own attitude to earlier events (we are wise in hindsight). Most importantly, Kahneman concludes that people overwhelmingly rely on intuitive decision-making (fast thinking), with structured decision-making (slow thinking) being rare and extremely effortful. What often looks like structured thinking is actually post facto justification for the intuitive decision. This fast thinking is practical and generally very effective but can be limited when considering new or highly uncertain situations (Kahneman 2011).

The context of decision-making is also important. Farmers, as with other predominantly owner-managed businesses, are managing marketing, operational activities (production) and financial management. This load can be spread across multiple business partners but often the operational demands predominate. Compounding that, farmers clearly have task preferences, which rarely include business management as a high priority (Cockfield et al. 2019, Cockfield & Doran Browne 2018). Hence, farmers operate in an environment of high demand for decisions, in which business management is not necessarily a priority, receiving only occasional attention. Similarly, operational demands and work preferences also combine to inhibit participation in self-development activities, especially if these do not involve operational foci and tangible on-farm experiences (Cockfield et al. 2019, Cockfield & Doran Browne 2018).

The focus on production issues is then reflected in the allocation of time, funds and expertise within research, development and extensions agencies (RDCs and state government departments of agriculture). The origin of Australian extension services lie in concerns about production so this focus is understandable. In the era of open and highly dynamic markets and increasing climatic variability, business decision-making has become more important. In addition, it is implicit, and sometimes explicit, in much agricultural RD&E, that: a. the benefits of adaptation strategies will be largely self-evident to 'rational' decision-makers; b. benefits are clear; and c.once learnt, adaptation thinking and strategies are embedded. These assumptions are highly questionable.

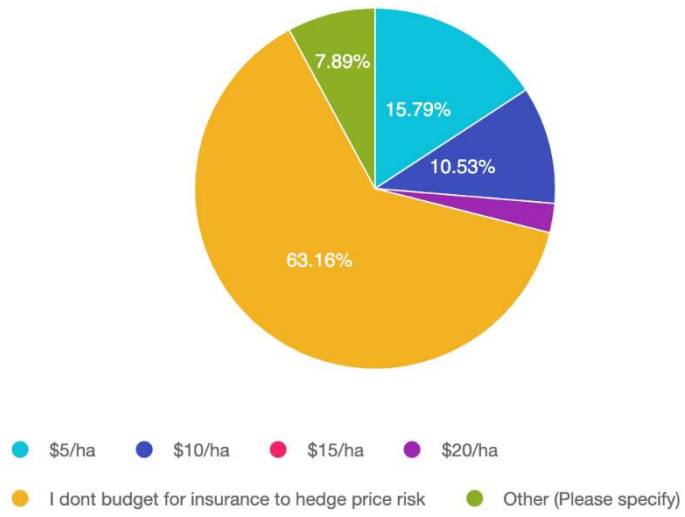
Intuitive decision-making, and its relative effectiveness amongst farmers have long been recognised (McCown et al 2012; Nuthall, 2012; Nuthall & Old, 2018). The efficiency of intuitive decision making process may, however, be augmented by recognising and addressing the limitations of intuition (Nuthall & Old, 2018) and selectively using decision-support tools (DSTs) (Nuthall, 2012), developing managerial skills and ability (Nuthall & Old, 2018), and using relevant data (Antle, et al., 2017; Antle, Jones, & Rosenzweig, 2017; Cabrera, 2018). Hence, extension and education have a role in developing management skills. However, given that what is learnt can be soon forgotten or, more frequently, recalled and interpreted differently over time, industry programs might benefit from being located in long-term strategies that consider life-long learning, or perhaps more accurately, life-long learning and reminding.

It is clear that this lack of focus of price risk management in the agricultural community is making Australian future farmers and communities less equipped and hence more vulnerable to economic downturns and increased climate variability. The more farmers are educated about a product the more demand for that product there will be.

6.2.2 Affordable products

Figure 17: Budget for premiums to be spent on Risk Management Options

Q: In your seasonal planning guide do you have a budget for insurance for hedging price risk? (select the closest value per hectare)



Source: CelsiusPro Project Survey 2020

The farmer when making decisions to buy risk transfer products looks at:

- The perception of value for the cover.
- Budgetary constraints at the time.
- That the cover is fit for purpose.

As drought is the primary risk farmers have they were surveyed as to what they would be willing to pay for $100 worth of cover per ha (national survey q72).

- 18% said less than $1.
- 38% said between $2 to $5.
- 28% said between $6 to $10.
- 15% said more than $11.

A deeper dive into affordability via the CelsiusPro survey reveals that 29% of broadacre farmers are willing to pay between $5-10, 23% prepared to pay between $10-$15 /ha and 18% between $15-$20 /ha.

The willingness to pay the going rate for financial products offered needs to be realistic from both the demand and supply side of the equation in order for the uptake of the product. At the moment the perception is that there is a mismatch. If this was resolved the uptake on demand would be better.

6.2.3 Product Awareness

Awareness about risk transfer products that can be used is paramount to the success of de-risking the industry. The demand of any product is reliant on farmers knowing about them and using them. Awareness on price risk management products is generally poor, yet 17% of farmers surveyed ranked them as being the most important risk facing them and 48% ranked them as the second most important (national survey q.74). Yet when asked if they had used or heard of forwards, futures/options commodity swaps, weather derivatives the results pointed to a general lack of awareness.

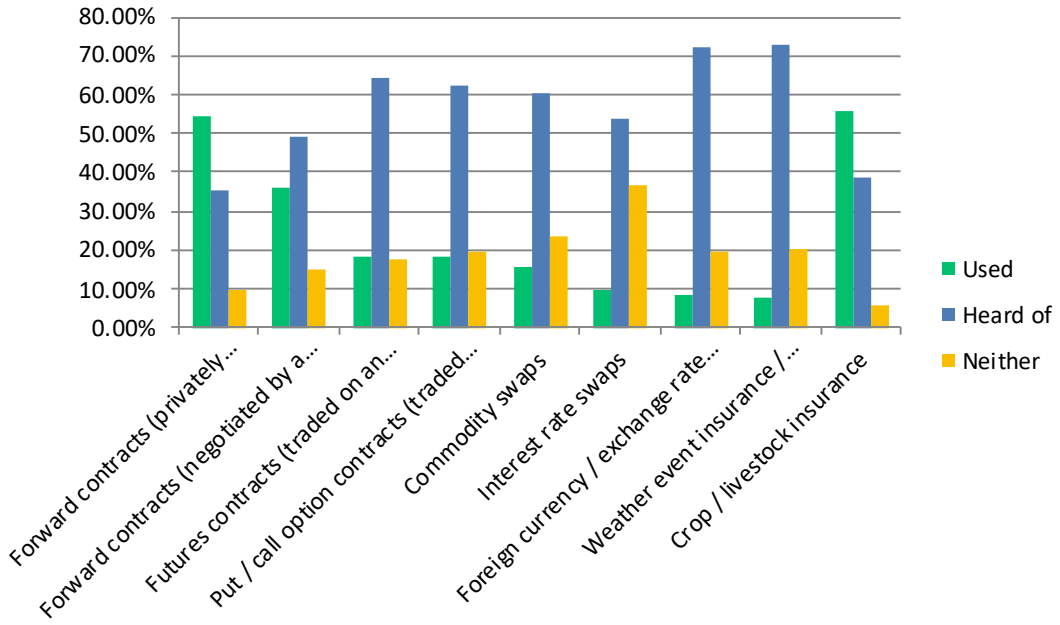
For instance, Forwards Contracts are the most used management tool to hedge price risk products for farmers. Of those surveyed for (Figure 18) privately negotiated contracts 54% had used them leaving a deficit of 46% of those surveyed not utilising the tool, even though price risk ranked highly.

A more drastic picture emerges on the use of the other price risk products, only 18% had used futures, 16% used commodity swaps and 7% had used weather event cover. However, interestingly, 64% had heard of futures, 60% of swaps, and 72% of weather event cover. Concluding that awareness on other price risk management products is high yet conversion is low (national survey q.75).

This was further reiterated by FRG and interviews with farmers.

Below are the survey results showing use and awareness by product.

Figure 18: Use and Awareness of Price Risk Products



Source: National Survey 2020 q.75

6.2.4 Appropriateness of product

The appropriateness of the product is extremely important for the demand. In our FRG we noted that the use of price risk management tools were underutilised. This has to do with the appropriateness of the product. As drought has been identified as the major risk faced by farmers the need for appropriate products is paramount to helping shifting risk.

When asked, farmers ranked via relevance what influenced their decisions not to buy insurance 38% ranked suitability as very relevant (Figure 19). This suggests that institutions need to evolve in order to deliver products that are suitable.

Section Seven: Identify, Assess and Make Recommendations to Address Barriers

7.1 Addressing Supply Side concerns

Supply side constraints hamper the ability for the products to grow in the market. Reference from the FRG and national survey indicate that if suitable insurance/price risk management options were available, products were less complicated, and premiums were better priced that the uptake of price risked mechanism would grow (national survey q.65).

7.1.1 Forward Contracts

The main barriers to the development and use of Forward contracts are:

- It is costly and difficult to find a willing counterparty i.e. horticulture, viticulture and livestock.
- The market for forwards is illiquid due to their idiosyncratic nature so they are not easily sold to other parties if desired.
- One party usually has an incentive to break the agreement. Generally, it is accepted that this is the farmer as he cannot fulfill the contract.

We feel that industry stakeholders in those sectors that do not have recognised forward markets, investigate ways to encourage their development.
Where a recognised forward market exists, a fusion between regulated futures and forward contracts would help to resolve supply side issues and encourage more farmers into using the market. The development of a similar style of contract to the "Hedge to Arrive" contract currently offered in the US would help to resolve some of the above issues. It enables the seller to lock in a forward price via a futures contract and on expiry either have the contract cash settled or delivered to the warehouse of the seller's choice. Currently you can deliver Futures contracts however the delivery points discourage this.

In addressing these problems, we feel that transparency around pricing and the ability to easily trade the position and then have an option to cash settle the contract will resolve most of the barriers.

Further exchanges that offer the technology to enable transparent forward markets such as Riemann offer markets are also looking to resolve transparency issues in the forward markets. They present a market online for price discovery. It is working in the Wool market and Rieman is recognized as an enabler for forward contracts by streaming live prices you can deal on. Farmers, traders can hedge forward contracts, buy and sell and have them settled at appropriate warehouses. Although this is mainly used for wool it is seeking to establish the same markets for livestock, wheat and cattle.

We can recommend the development and extension of Forward contracts into other industries mainly horticulture and viticulture. We recommend the industries work with the regulated futures markets to deliver contracts similar to "Hedge to Arrive" contracts.

7.1.2 Exchange Traded Futures and Option Contracts

The ASX offers a futures contract that is a transparent, forward-looking price risk management option for Wheat and Barley. However, users of this market are restricted to trade and professionals who understand the vagaries of the market. Volumes are low albeit growing when compared to physical traded commodities. We found via our Farmers Reference Group that the typical farming enterprise shies away from the contract due to the management/maintenance of the position.

As identified the main barriers to uptake of Futures and Options price risk management options from the supply side by farmers are:

i. Lack of education on how to use them properly.

ii. Lack of products to trade and reporting of positions.

iii. The use of initial deposits to control positions.

iv. The requirement for variation margin during the life of the position.

v. Understanding who is participating in the market.

Education is a key driver to use and uptake. The ASX needs to be involved in communicating the use of its products to all markets that need them. The farmers need to be educated. After an interview with the ASX we believe that this has been recognised and is currently in the process of being addressed.

During the interview we discussed the need for more products. The ASX has three main contracts (wheat, barley and canola) , it has had several product launches over the years and uptake has been low and the contracts have been disbanded. We feel the reasons have been the inability of the products to address the needs and to be able to connect to the users.

Also, feedback from our FRG and the survey suggests that the need to improve operational standards needs to be done in order to attract more participants. The current use of providing deposits and margins for the contracts make it complex for the farmer as futures positions need to be monitored daily. Plus, a cash reserve is needed for variation margins should the market move away the price the contract was set. As the season progresses cash reserves generally dwindle, and farmers see more importance to provide capital to the deposits and margins rather than keeping a cash reserve. As a result, the "Trade" and sophisticated traders tend to be the main users. Locally, liquidity is low which inhibits farmers' use.

Plus, we feel that adapting international standards for open position reporting could help as an enabler delivering more transparency to the market.

By modifying the use of deposits and variation margins allowing growers use of Farm Deposits as collateral for initial contract deposits and maintenance margins either by the exchange or via Broker collateral agreements.

Modify the existing contract by adding an ability to deliver the contract to a delivery point of choice. This is done in the US and contracts are called Hedge to Arrive Contracts (HTA). The basis risk is locked in once the delivery point is chosen. The contract if left to expire is cash settled.

The ease of increased delivery points to growers and use of Farm Deposits as collateral represents a start that could be adopted to other product lines. This would enable growers initially in Wheat and Barley to be able hedge price risk with using Futures more easily but without the worry of maintenance margins.

We have been in discussions with ASX concerning such a program and this is being looked into.

7.2 Addressing Demand Side Concerns

7.2.1 Education

In our research we identified this as a major issue to increase the demand for price risk management options. The lack of education around price risk management products was extremely poor. Generally, it is left up to the farmer to manage his own education, when surveyed 30% are happy to spend between 1-7days a year on professional development. The key is understanding who is to do the educating. If it is the national interest, then the responsibility falls on all stakeholders.

In our Farmers Reference Group, we proposed a question about who was responsible for the role of educating the industry on risk transfer products. An interesting discussion evolved around the federally funded Managing Farm Risk Program (MFRP) and NSW Government Funded Farms Business Skills Professional Development Program (FBSPD). Both initiated educational funding packages to help educate growers about preparing for drought either through the use of improved farming techniques or types of insurances.

- The Federal Government had the Managing Farm Risk Program (MFRP) of $20.2 million over 4 years. An initiative which recently expired May 2019.
- The NSW Government has the Farms Business Skills Professional Development Program (FBSDP) which offered $45 million over 5 years which expires in September.

The MFRP was later disbanded after it lost a significant amount of funding. Comments from the Farmers Reference Group suggested that MFRP was actually achieving goals and that more engagement from advocacy groups would have provided better dispersion of the project. Note that there is no mention of the FBSDP on RDCs web sites.

Apart from farmers doing their own education around price risk management products, we identified that Research Development Corporations (RDCs) and Universities could assist in helping to address the shortfall in educating farmers.

In regard to risk management, existing programs could be developed to include risk transfer products that would engage growers through a trusted path to look at the array of risk transfer

products on the market and apply the most suitable ones for their production. These programs should be developed by training experts but draw on a number of complementary learning strategies (written material, webinars, seminars, conference presentations and workshops)

We recommend using current extensions work by RDCs as a means to disseminate appropriate information and training on risk transfer products. We suggest that where the government matches grower levies for industry groups for research, that a stipulation is made or policy constructed that a percentage of these funds are spent on educating their members on financial risk transfer products or spent on inviting experts on the subject matter, preferably those that are licensed under an AFSL regime, to speak at regular grower presentations they hold.

We recommend that Universities and Educational resources who receive specific agricultural based government grants that already interact with growers or students be directed under a policy so that a proportion of time or study units/modules be mandated to be spent on awareness, education and training on risk transfer products in appropriate courses.

This is a core recommendation that is cost effective and can be implemented moderately easily given current dynamics on how RDC's and Universities function and interact with their patrons.

7.2.2 Affordability

The willingness to pay for premiums and wide bid / offer spreads is a concern and therefor barrier to uptake, particularly in this margin sectors. The first step is education to increase uptake and therefor liquidity which will 1. Narrow the bid / offer and 2. Allow for more options style products that typically result in a lower negative cash settlement in the event of a rising market.

Section Eight: Assess the Commercial Impact of an Increased Take Up of Price Risk Management Alternatives

To assess the commercial benefits that price risk management products could bring to the Australian agricultural sector we (i) reviewed current scientific literature, (ii) results derived from the two national surveys and (iii) developed specific case studies.

As such, this sections focus will be broken up into four areas:

i. A general discussion, based on literature review, the use of financial risk transfer products and assessment of the economic benefit they bring.

ii. Results of the two national surveys and qualitative statements from the Farmers Reference Group (FRG) regarding perceived benefits of the financial risk management products

iii. Benefits of Weather/ Index Derivatives in the Sugar Industry.

iv. Benefits of Weather/Index Derivatives in Broadacre farming.

8.1 Benefits of price risk transfer products: Literature review

In general, the primary commercial benefit to the Australian agricultural sector of risk transfer products is its improved ability to recover following major catastrophic events, including price depressions, with significantly less reliance on government handouts. More importantly, the smoothing of financial volatility in farming will also allow better long-term investment and planning decisions. Funding of farming activities such as through bank lending will also be less onerous and ultimately more successful through farms having a more consistent income basis.

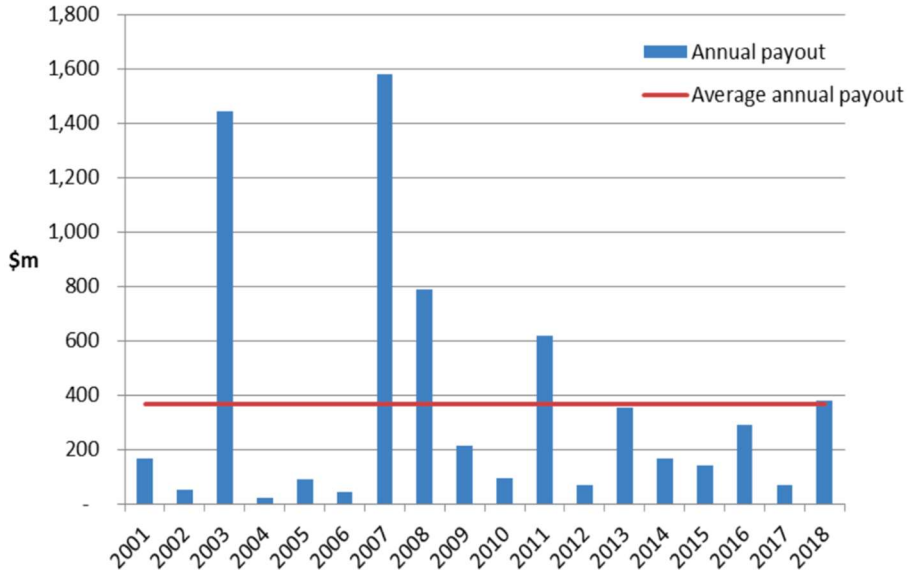
Academic literature, particularly focussing at the macro level, suggests that insurance may contribute to economic growth by allowing for more effective risk management. Lester (2014), Arena (2008) and Barrett et al. (2008), after analysing 2,500 natural catastrophes that occurred between 1960 and 2011 in over 203 countries, found evidence that the insurance sector contributed to economic growth. Based on Arena (2008), the contribution of non-life insurance to the GDP growth in developing countries is about 0.53% of the GDP.

Vedenov and Barnett (2004) analysed the financial benefit of weather derivatives as primary insurance instruments for six crop reporting districts that are among the largest producers of corn, cotton, and soybeans in the United States. Specific weather derivatives were constructed for each crop district combination based on analysis of several econometric models. The performance of the designed weather derivatives is then analysed both in- and out-of-sample. The primary findings

suggest that the optimal structure of weather derivatives varies widely across crops and regions, as does the risk-reducing performance of the optimally designed weather derivatives. Further, optimal weather derivatives required rather complicated combinations of weather variables to achieve reasonable fits between weather and yield.

Hugh (2020) used ex-post analysis and simulations to conclude that the use of risk transfer mechanisms will slightly benefit the user. According to Hugh (2020), the effect of weather on farm outcomes is complicated and that the lack of reliable farm data is a barrier. However, using 20 years of simulated yield data over 20 years shows a yield index that captures the events well but due to the regularity of payouts the benefits are muted to some extent due to the volatility. It concluded that the use of yield index insurance would slightly benefit the user. The results of simulations from Hugh (2020) are shown below (Figure 21). The index satisfactorily captures the events, however, given the multiple payouts the premiums would be prohibitive and not provide a substantial benefit unless accompanied with appropriate triggers.

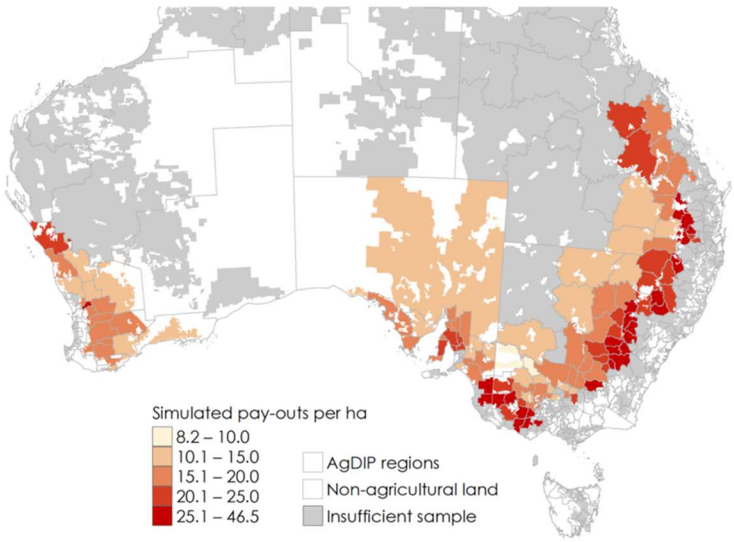
Figure 19: Simulated total crop insurance payouts



Source: Hugh 2020

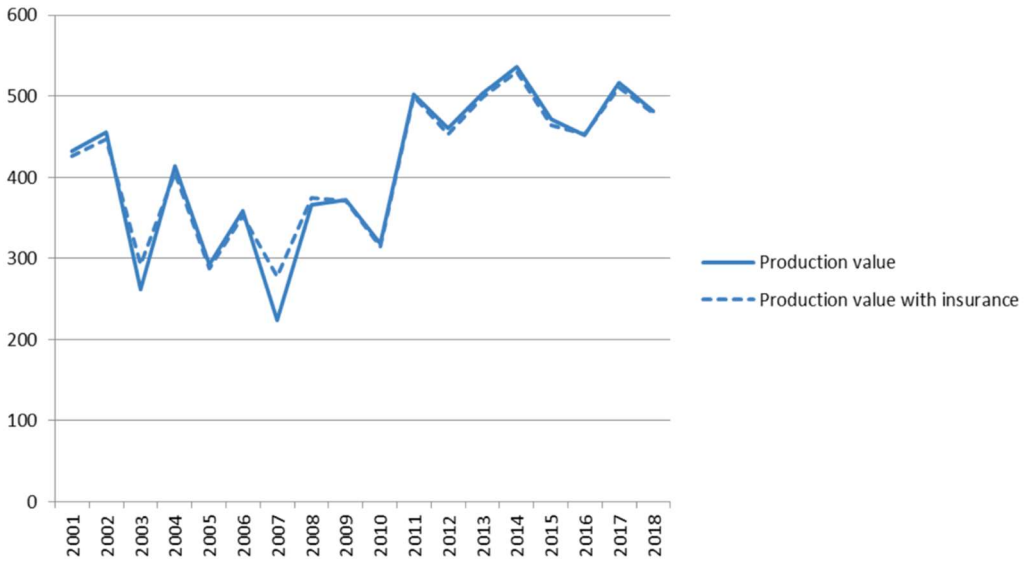
Similarly, (Figure 22) shows simulated pay-out per ha at different wheat crop growing [SM1] regions of Australia. The simulations indicate the benefit between $8 – $46 per ha could be realised with insurance products. (Figure 23 and Figure 24) show simulated farm level production and income benefits with and without insurance.

Figure 20: Average Simulated payout per ha



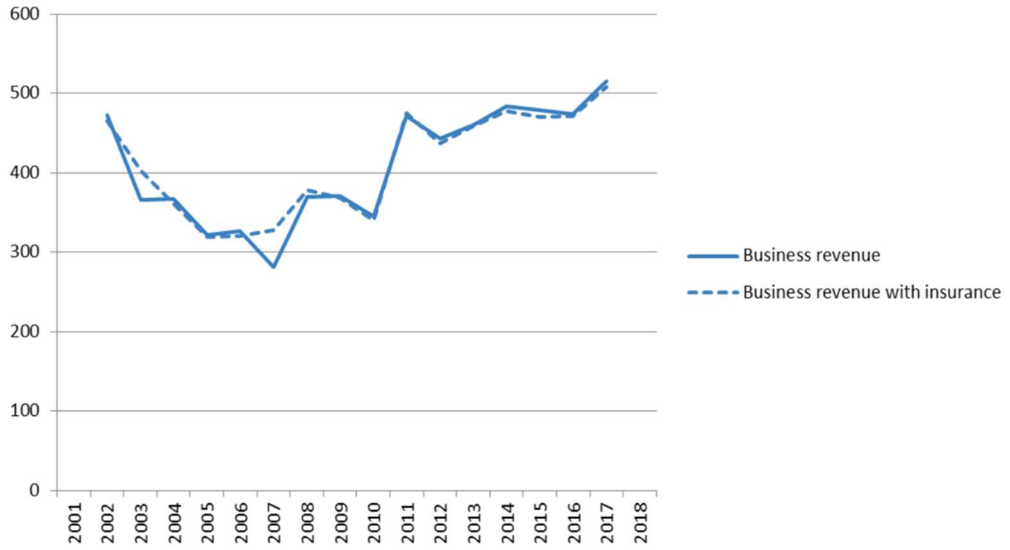
Source: Hugh 2020

Figure 21: Simulated Farm Production with/without Insurance



Source: Hugh 2020

Figure 22: Simulated Farm Revenue with/without Insurance



Source: Hugh 2020

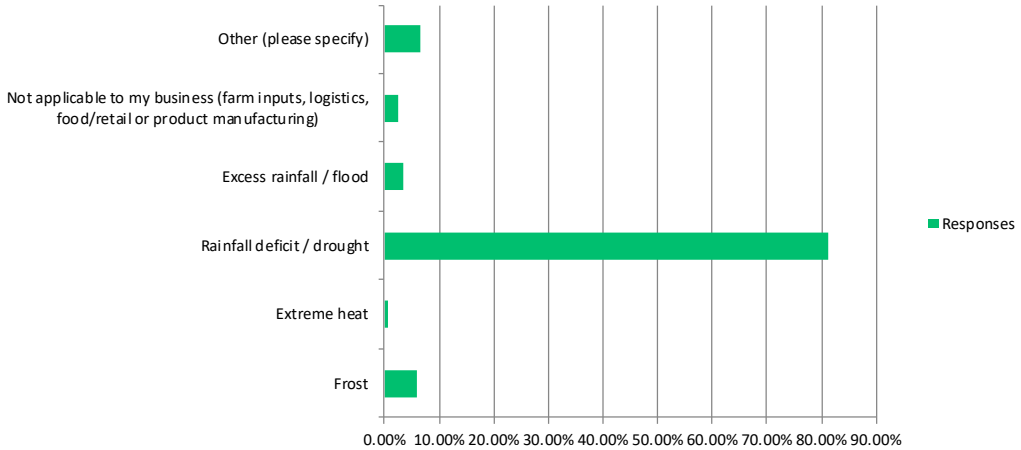
In summary whether analysing past climate events or the future there exists a positive link towards the use of strategies that can help transfer price and production risk.

8.2 Benefits and impact of price risk management options

The industry as a whole would benefit from an uptake in risk transfer products. For example, the national survey has recognised 'drought' as the single most peril that causes volatility in income then adopting price risk management options can only be seen as beneficial (Figure 25). Not just for the farmer but through the entire value chain. In addition, adopting financial strategies at a farmer level reduces the need for government support in an adverse event.

Figure 23: Weather Perils for Farmers

Q: Based on the understanding that most businesses face multiple perils, what is the main weather peril your business faces?

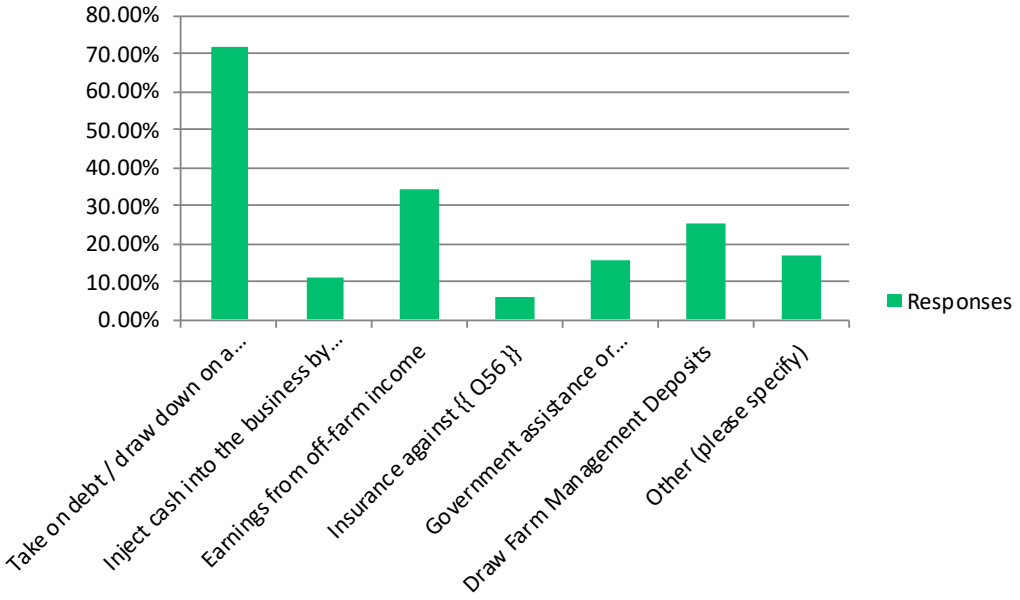


Source: National Survey 2020 q.56

When faced with drought, about 70% of the respondents of the national survey indicated they take on debt or draw down loan facilities (Figure 26). These are clearly sub-optimal strategies, which can significantly erode farm equity and the ability of the farmer to be able to enjoy optimum benefits when conditions normalise.

Figure 24: The primary financial mechanisms responders are employing to manage drought

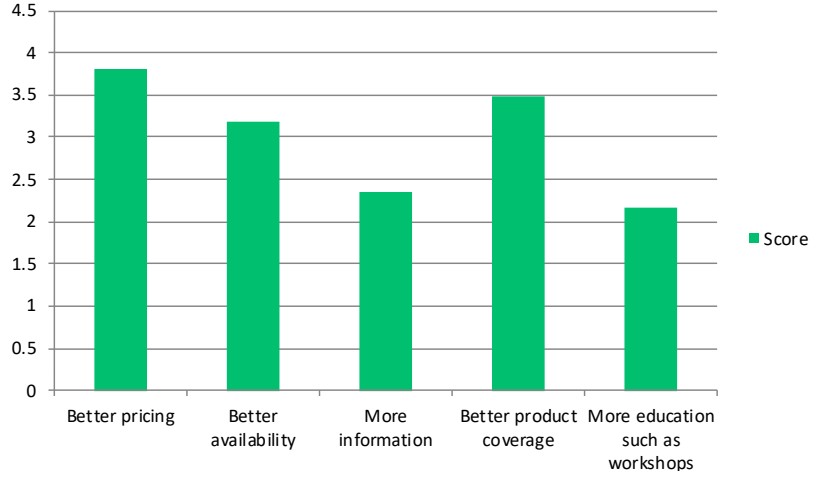
Q: What are the primary financial mechanisms you use to manage losses in the worst 10% of years for {{Q56}}?



Source: National Survey 2020 q.59

Figure 25: Improvement of Financial risk management products

Q: How can the financial risk management products you use be improved? Please rank (1 being the most important and 5 the least important)



Source: National Survey 2020 q83

A list of statement indicating the benefits of the financial risk management products, based on the surveys and the Farmers Reference Group, are provided below, including:

- Ability to lock in forward prices in particularly grain prices without issues relating to transparency and cost to wash out contracts.
- At a defined economic cost, more affordable and may offer significant value for money
- With clear understanding of the products, this will contribute to risk management
- Reducing exposure to risk through these financial tools may be worth considering
- Production risk outweighs the output price, which this survey is categorised as a financial risk management product. It could be worthwhile bundling production and price risks together.
- These products will allow certainty in commodity price received
- If I could lock in my selling price when I purchase my steers then this could be great.
- Production and price risk dominates our risks. In using 'risk management products', and simply exchange one risk for another risk, and pay a price for doing so. I budget out the distribution of expected costs and returns in making this decision.

8.3 Impact of using Weather/ Index Derivatives in the Sugar Industry

Sugar and Weather Index Options

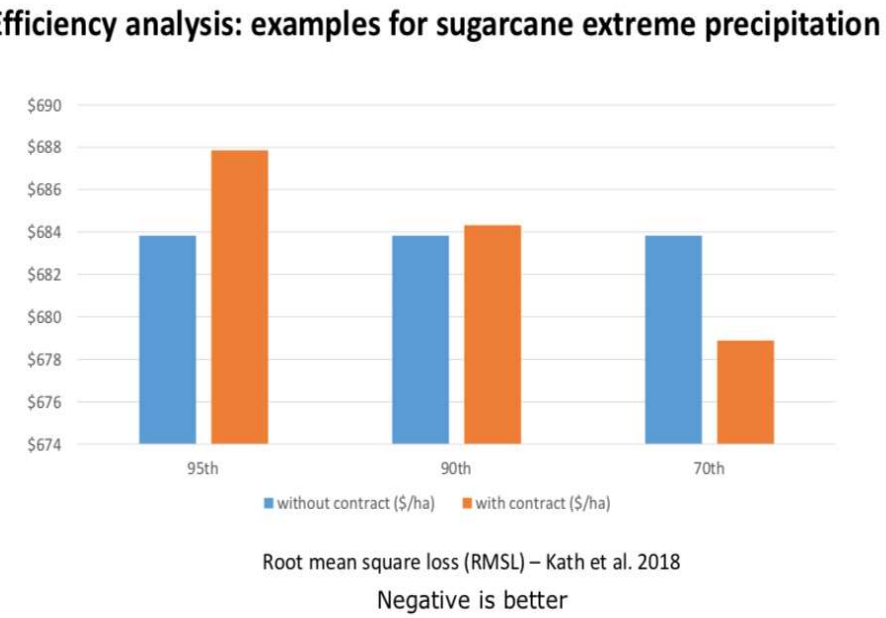
The Australian sugar industry delivers raw and refined sugar from sugarcane. Around 95 per cent of sugar produced in Australia is grown in Queensland and about five per cent in northern New South Wales, along 2,100 km of coastline between Mossman in far north Queensland and Grafton in northern New South Wales. Major portion of production is exported. Exposure to global markets today is bigger than ever and new risks emerging as a result of climate change render the income of farmers more fragile.

To gauge the benefits of using index style derivatives against adverse rainfall weather in the sugar Industry Kath et al. (2018) conducted a study that found that it was beneficial for the sugar industry to adopt parametric index solutions.

Kath et al. (2018) demonstrated the possible financial advantages to sugar farmers in Tully, Northern Australia when parametric index options were employed as a tool to manage risk against excessive rainfall. 80 years of historical climate and yield were used to develop an excessive rainfall index. Using generalised additive regression models (allowing nonlinear effects) and quantile regression which allows low yield events to be assessed, were used to develop the index. Relationships between excessive rainfall index and sugar cane yield losses were converted to option fair premiums (i.e. premiums that cover expected losses). Built on Conditional Tail Expectation (CTE), Certainty Equivalence of Revenue (CER) and Mean Root Square Loss (MRSL), the study used efficiency analysis to measure financial benefits to growers if they bought excessive rainfall index options. Growers were better off by 269.85AUD/ha on average during the years with excessive rainfall (i.e. years with

rainfall over the 95th percentile) with the uptake of index insurance (based on assumption of a fair premium) in this study. The decent prognostic performance of the regression model and its agreement with on ground farmer surveys and other studies on sugar cane suggested this model could be used in assessing revenue losses and calculating fair premiums to assess the efficacy of excessive rainfall index options for sugar cane growers. As can be seen below (Figure28) efficiencies are gained with the use of the Index styled product.

Figure 26: Possible benefit of different percentile levels of cover of index insurance of sugar cane growers



Source: Kath et al.2018

Results from the study also suggest index options may be feasible for sugar cane producers, and potentially other crop types, in parts of the world where extreme rainfall poses a threat to production.

8.4 Impact of using Weather/Index Derivatives in Broadacre farming

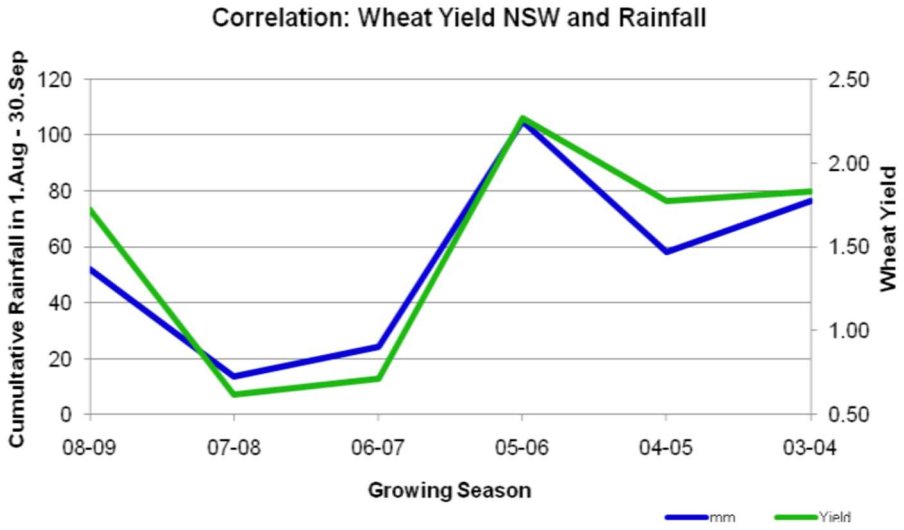
As there is little available data to assess the commercial impact of an increased take up of price risk management options, CelsiusPro conducted a study in 2010 that looked at the Wheat Yields in NSW, their dependence on Weather and a weather derivatives program to see if such a program was viable. This study is useful as it looks at an eleven year period of production and covers the 2006-7 droughts which is analogous to 2017-18 seasons where we saw similar percentage drops in production.

This case study looked at the dependency of the wheat yield to cumulative rainfall during spring. It shows how the financial risk of low yields due to low precipitation can be mitigated with weather derivatives.

In 2008-09 the Australian Bureau of Agricultural and Resource Economics reported an average production of 6,209kt for the past eleven years with the high of 8,602kt in 2008/09 and lows of 2'477kt in 2007/08 and 2'569kt in 2006/07. This translated to an average yield (t/ha) of 2.51 and lows of 0.62 and 0.71. Assuming the average price of AUD 290 per ton, NSW produced on average wheat for AUD 1'800bn but in a dry year only AUD 0.718bn. This earnings volatility is not only negatively affecting farmers but the Australian economy as a whole [SM1] .

For NSW, the period from the beginning of August to the end of October is when the crop grows the most. The results from the quantitative analysis confirm that the precipitation during this period is essential for the crop yield. The correlation of the wheat yield (t/ha) in NSW (Figure 29) to the cumulative rainfall from August to September showed a high correlation of 0.95 or 95% of the last six years showed wheat's high dependency on rain.

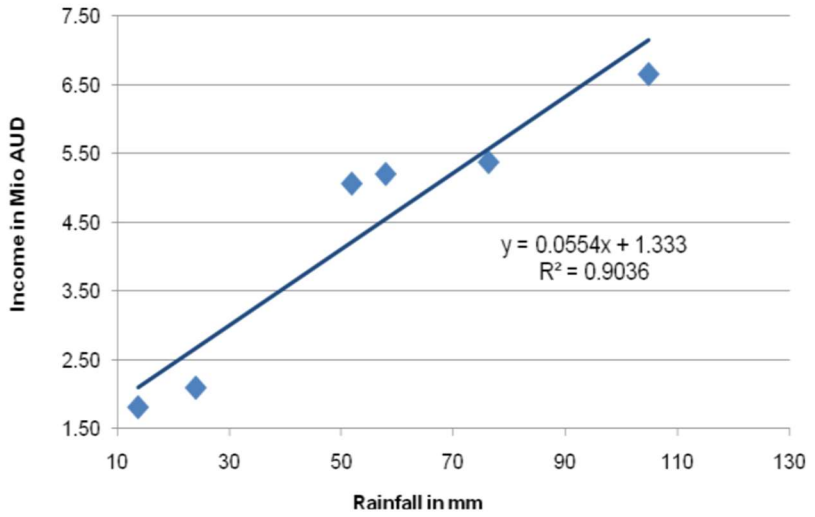
Figure 27: Correlation between Wheat Yield and Rainfall



Source: CelsiusPro 2013

On conversion of Yield to AUD per mm Rain. The regression analysis (Figure 30) showed how much yield changes per mm rainfall (0.0188).

Figure 28: Regression analysis Wheat income and Rainfall

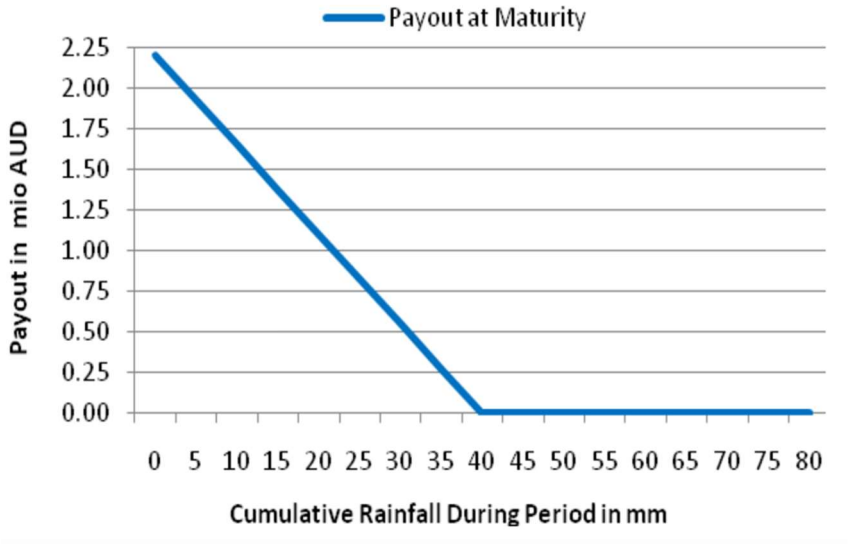


Source: CelsiusPro 2013

This value was converted to AUD by:
*Yield (ton/ha) * Area (ha) = tons (t)*
*Average price per ton (AUD) * ton = Earnings*

So, for an area of 10'000ha at a price of AUD 290 per ton the earnings variation per mm was AUD 54'520. Using this value as a payout per mm with a Strike of 40mm dramatically improved the risk profile of a wheat grower if they adopted a price risk management program using a weather derivative to hedge yield fluctuation (Figure31).

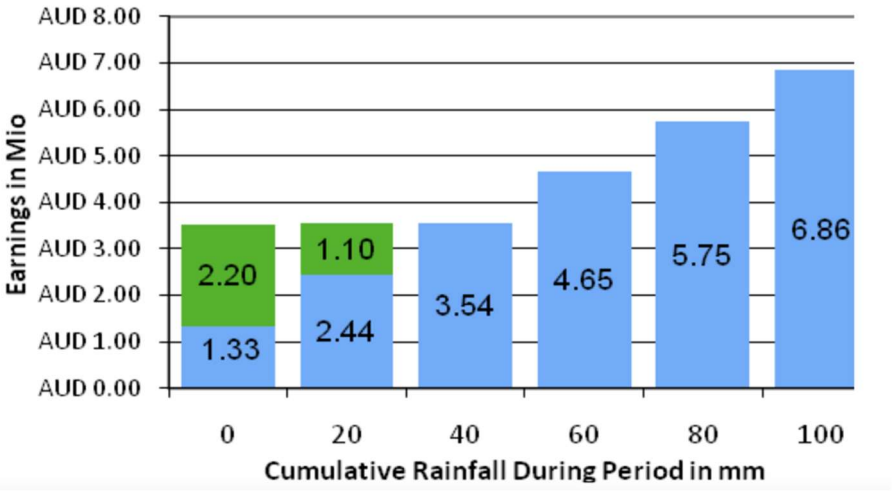
Figure 29: Payout Profile of a Dry Season Certificate



Source: CelsiusPro 2013

If adopting the learnings of the past study to the most recent drought in NSW and the industry would be far better off (Figure 32).

Figure 30: Earnings Profile with Protection



Source: CelsiusPro 2013

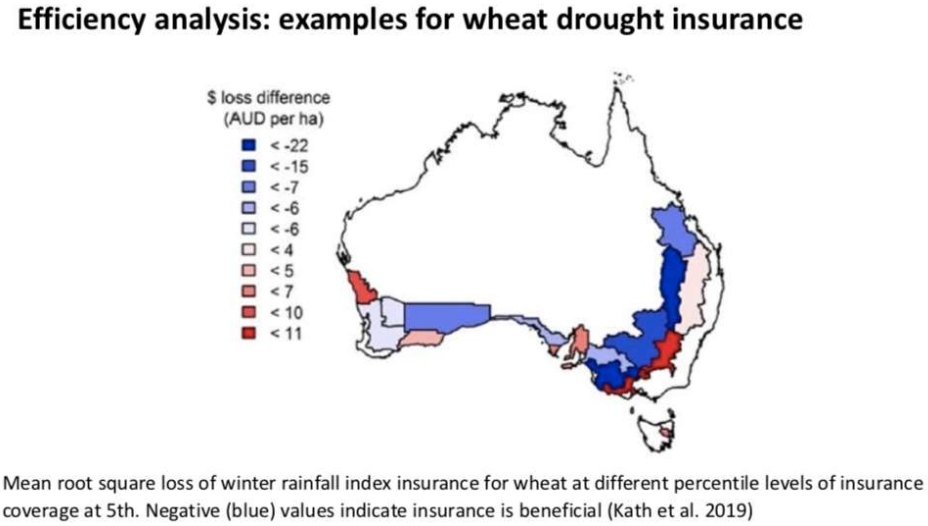
The loss of earnings due to the most recent drought would have been offset by the weather derivative.

8.5 Case study 3: Impact of using Weather/ Index Derivatives in wheat farming

Kath et al (2019) assessed the use of parametric products and the production of wheat. They concluded that there would be benefits of using an index style of cover to help growers manage the risk of rainfall deficiencies.

The regions in blue below point to the benefit (represented as a reduction in losses) of having an index style of cover (Figure 33).

Figure 31: Potential benefit of winter rainfall index insurance for wheat. Blue values indicate that insurance is beneficial (i.e. it helps to reduce losses by the amount shown in the legend).



Mean root square loss of winter rainfall index insurance for wheat at different percentile levels of insurance coverage at 5th. Negative (blue) values indicate insurance is beneficial (Kath et al. 2019)

Source: Kath et al.2019

Given an increased impact of climate change in the future, more extreme weather conditions such as extreme droughts and extreme heat would be likely to further increase volatility of wheat production in Australia. As such, an encouraged risk transfer market for index style of covers should only be explored.

8.6 Summary

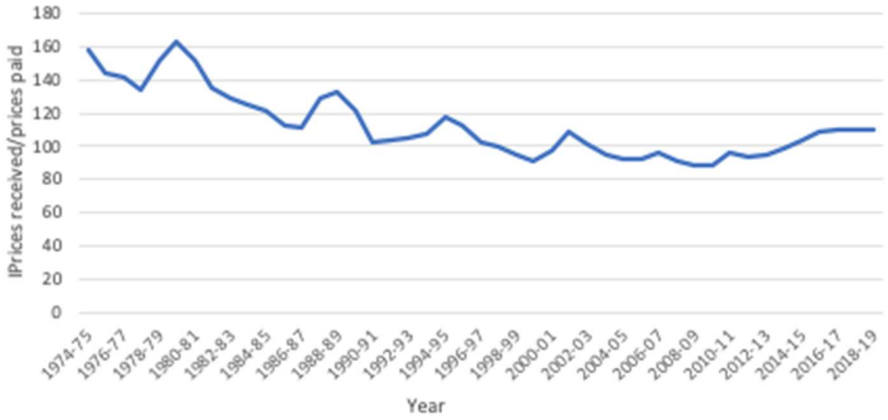
In assessing the commercial impact of an increased take up of price risk management alternatives we can conclude that there is a positive influence on the agricultural sector if the use of price risk management alternatives were to increase. The key enabler in the use of these products rests with awareness as through awareness and bid/offer prices will become more competitive.

Section Nine: Policy Impacts of the Enhancement and Increased Uptake of Existing and New Options

9.1 Market and Policy context

Agricultural commodity prices are generally both volatile and subject to strong and persistent downward pressures. Short-term volatility stems from inelasticity of demand, combined with significant fluctuations in supply, largely due to climatic factors. On top of that there are long-term downward pressures on net returns to farmers, as suggested by the ABARES estimates of terms of trade (Figure 34) for Australian farmers.

Figure 32: Farmers terms of trade (index of prices received/index of prices paid)



Source: ABARES 2020

These pressures have, in aggregate, been described as the treadmill effect (Levins and Cochrane 1996). In summary, individual farmers have little individual market power being numerous and in competition with each other. Therefore, they are largely price-takers. Nor do they have great control over input costs, which tend to increase in real terms, leading to a cost-price squeeze. There are two responses to this, excluding short-term belt-tightening: increase scale of operation, so that increased volume offsets lower margins in terms of net revenue; and implement technical and managerial innovations that reduce per unit costs. The additional problem with that, is that perpetual innovation (being on the treadmill) enables farmers to keep producing at lower, or at least non-increasing real prices, thereby further keeping prices down.

That treadmill effect and the responses to it then mean that even small fluctuations in prices (and yields) can have a big effect on farm business profits and so mechanisms that insulate against such

fluctuations are of potentially great importance. So it is important for them to look towards price risk management options as this has a direct effect on income.

Governments in developed countries have used a range of policy instruments to try and reduce price and production risks for farmers. These include:

- Production-based payments, such as the US Direct and Counter-Cyclical Program, which effectively tops up returns under certain circumstances of price decreases. The EU Common Agricultural Policy also used output-linked payment schemes for farmers.
- Supply constraints (to potentially increase prices) such as: through tariffs, quotas, stockpiling (Australian Wool Price Reserve Scheme) and incentives to take land out of production (US Conservation Reserve Program);
- Mandated 'demand' such as for school milk programs (Australia) and biofuel content (US and Brazil).
- Statutory pooling of commodities so as to increase aggregate market power and therefore producer returns, with the former Australian Wheat Board being a good example. In the US, agricultural cooperatives enjoy special regulatory and financial arrangements (see report from Project 3) that have helped them develop market power.

There is also a myriad of instruments that have been used to indirectly offset supposed low and variable price effects. These include:

- Input subsidies or rebates, such as for fertiliser, fuel and insurance premiums.
- Non-commodity payments such as those in the US and EU based on historical output or for contributions to environmental benefits and landscape amenity.

Some of these instruments or institutional arrangements are meant to offset production risks and production volatility, including production insurances and pooling to spread farm income. More latterly, there has been a greater focus on farm household income, with conservation programs also meant to diversify income sources, which helps with both price and production risks. In Australia, the Farm Household Allowance is a safety net program that counteracts some price and especially production risks, as these affect household income. This program is discussed more fully in other sub-projects.

In general, production-linked support options became increasingly constrained from the mid-1980s, with the increasing role of the World Trade Organisation (previously the GATT) in international trade policy. This period of policy change is discussed and explained in an Appendix to Sub-project 3. The key points from that review, relevant to this project, are:

- Trade rules significantly constrained the use of production-based assistance, with a greater reliance on the indirect support instruments.
- Australian governments, along with those of New Zealand, have been relatively diligent in applying the principles of market liberalism, meaning that the processes of deregulation and the expectations of self-reliance amongst farmers have been some of the most stringent in the developed world. Australian farmers currently receive the

second-lowest level of effective support in the OECD countries (see sub-Project 3 Appendix i).

- Australia (and New Zealand) have comparatively 'neutral' regulatory approaches to agriculture. That is, there is little in the way of industry specific protection or (competition) exemptions. Exceptions include Farm Management Deposits and some other taxation measures, but generally farm businesses are subject to general regulatory regimes.
- While Australian farmers do have some support programs, these do not involve on-going commitments to transfers to farmers or significant market effects.

We therefore proceeded on the basis that any risk management options would be unlikely to receive on-going government support so they would need to have a strong market basis. Second, we assume that markets for risk management products would be largely subject to universal (not industry specific) regulatory frameworks. Nonetheless, there could well be indirect support for the adoption of relevant instruments and strategies and that any cases of impediments to the operation of risk management product markets could be considered for regulatory reforms or adaptations.

Section Ten: Acknowledgments

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To the Farmers that were involved in our Reference Group, we would like to thank you for your valuable time in contributing to the project and helping to "ground truth" some of the findings of the Project. Kind support has also been provided by ASX, Chicago Mercantile Exchange, Platts and Commonwealth Bank of Australia.

Further, we would like to thank colleagues from other Subgroups for their valuable contributions.

We acknowledge the Traditional Custodians of the land on which we work and live, and recognise their continuing connection to land, water and community. We pay respect to Elders past, present and emerging.

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