TARGET 34

A PATHWAY TO SUSTAINABLE CANE SUPPLY

AN ANALYSIS OF THE POTENTIAL RELATIVE CONTRIBUTION OF CANE GROWER EXTENSION & ADOPTION, SUGARCANE VARIETY ADOPTION, SUGARCANE AREA LOSSES AND HORIZONTAL EXPANSION TO ACHIEVE 34 MILLION TONNES, AND THE COMMERCIAL AND POLICY REFORMS NEEDED TO GET THERE

AUSTRALIAN Sugar Milling COUNCIL

OCTOBER 2021

CORPORATE PROFILE

The Australian Sugar Milling Council (ASMC) is the peak representative body for the sugar manufacturing sector, representing the five companies that collectively produce approximately 90% of Australia's raw sugar at 16 sugar mills across Queensland.

These mills also own and operate large sugarcane farms. Sugar manufacturing generates around $2 billion in revenue annually – the majority of which comes from global raw sugar sales.

The Australian sugar industry – including millers and growers – is responsible for $4 billion in annual economic activity and 23,000 jobs in regional Queensland.

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EXECUTIVE **SUMMARY**

FALLING CANE AREA AND CANE SUPPLY GROWTH AND FLAT CANE YIELDS IS CREATING MILL CAPACITY UNDER-UTILISATION THAT WILL CONTINUE TO PLACE QUEENSLAND SUGAR INDUSTRY OPERATIONS UNDER FINANCIAL STRESS.

In response, industry leaders are developing several complementary initiatives:

- Development of a 20-Year Vision and Roadmap to be completed by Q1 2022 (which this paper will inform);
- Significant changes to the industry-owned R&D services provider Sugar Research Australia's strategy and operational model[1];
- Regular meetings between industry leaders (Industry Leaders Forum); and
- A more sophisticated dialogue with government to improve policy and regulatory settings (the *Revitalisation Agenda*).

Industry leaders have set three objectives to guide the development of the Vision:

1. Increase cane yields and Queensland cane supply from a 10-year average of 30.4 million tonnes (Mt) to a consistent 34Mt per annum (within 10 years);
2. Maintain the net area under sugarcane; and
3. Increase revenues from complementary, diversified, value-add streams.

Increasing Queensland cane production by 3.6 Mt over 10 years is ambitious but necessary. 34Mt represents the combined cane crushing capacity of the State's mills and if achieved consistently would significantly improve economies of scale and mill viability and give mills the confidence to invest, potentially, in value-add diversified projects.

The objective of the mills is to achieve consistently higher cane supply, utilise all current milling capacity as well as create additional value-add, diversified revenue streams from by-products of the sugar milling process.

The ability to generate more revenue from each tonne of cane processed and share a portion of these increased returns with growers under a shared value creation and/or investment approach will be important to keeping growers viable and achieving 34Mt of annual production. It should be noted that diversification strategies are a complement to the 34Mt per annum target, and do not replace this important goal.

To understand the potential pathways to reaching 34Mt, ASMC developed a projection model that:

- Firstly, by productivity zones and by milling regions, calculated the average 8-year yield performance (2013-2019) of cane farms across Queensland to determine yield quartile bands;
- Secondly, applied 2019 Queensland cane yield data to these yield quartile bands; and
- Thirdly, applied a number of assumptions around likely cane variety adoption, extension & adoption (E&A) success and loss of cane land over the next 10 years to estimate the likely relative contribution of these cane supply drivers.

Positively, across 103 Queensland productivity zones across the operations of MSF Sugar Limited (MSF), Tully Sugar Limited (TSL), Wilmar Sugar Australia Limited (Wilmar), Mackay Sugar Limited (MSL) and Isis Central Sugar Mill Co. Ltd (ISCM), it was calculated that in 2019:

- 8% of the cane supplied was from the lowest performing quartile yield band (Quartile 1 or Q1);
- 28% from the Quartile 2 yield band (Q2);
- 26% from the Quartile 3 yield band (Q3); and
- 38% from the Quartile 4 yield band (Q4) (highest performing quartile).

This can be considered a good result as 64% of tonnes (t) produced in Queensland in 2019 was at a yield higher than the median yield (being the point between the Q2 highest range and Q3 lowest range). However, there remains roughly a third (36%) of production in Q1 and Q2 where yield gains through improved E&A and new farm ownership and operation models should be pursued.

The modelling work also found that increasing Queensland production by the 3.6Mt needed (from a baseline of 30.4Mt) is theoretically achievable but difficult. The assumptions adopted in this report increased Queensland cane supply by around 1.6Mt only by year 10 consisting of:

- An increase of 2Mt from improved E&A;
- An additional 0.8Mt from improved variety adoption; and
- A loss of 1.2Mt from reduced cane area.

1 https://sugarresearch.com.au/sra-information/sra-strategy-and-operating-model-review/

Excluding the variable impacts of good weather and sugar and cane prices, it is clear from the analysis that to achieve a consistent 34Mt of Queensland cane supply will require more efficient and aggressive E&A and variety development and adoption approaches and measures to maintain the *net* stock of cane land such as horizontal expansion to close the 2Mt gap.

To achieve more effective E&A outcomes and to assist growers to achieve significantly improved farming practices this paper supports more effective risk-based E&A delivery models and eventually a transition to a more **outcomes based and commercially driven E&A delivery model.**

To assist growers' transition to new ownership and operating models this paper supports:

1. **Development of an industry in-bound investment document** that, inter alia, outlines the benefits and opportunities of cane farming vis-a-vis other uses to domestic and foreign investors. Further, in encouraging foreign investors, ASMC supports more workable foreign investment (FIRB) rules including:

- Benign acquisitions in non-sensitive sectors such as sugar are exempted from all of the proposed national security provisions; and
- The requirement for an 'open and transparent' sale advertising process be removed.

2. **Providing assistance and actively facilitating** growers to work through divestment, succession and leasing and share farming options to achieve farm consolidation; and
3. **Improved government capital loan schemes** and a review to assess whether the Regional Investment Corporation (RIC) and Queensland Rural and Industry Development Authority (QRIDA) funding programs assist with on-farm productivity improvements and positive new ownership and operation approaches. Issues for review would include market knowledge of products, approval times, paperwork burden and security requirements (ratios).

To assist with improving farm profitability this paper supports:

1. **Further work to make regulated water and electricity costs more affordable for growers** including consideration of higher Government imposed efficiency requirements on Government Owned Corporation (GOC) providers and changed pricing models to encourage greater efficiencies and lower costs;
2. Cane planting represents a significant component of grower costs and support should be given to the commercialisation of **seed planting** as a way to reduce costs and encourage more growers to the sector;
3. **Improved policy certainty and policy incentives** to encourage greater investment in first generation opportunities such as cogeneration of electricity and bio-fuels and **strong technical, policy and commercial collaboration and partnerships** to develop the second generation opportunities in areas such as synthetic biology, bio chemicals and bio plastics; and
4. **Replace the pre-contract arbitration and remove the *Grower choice* clauses** in the *Sugar Industry (Real Choice in Marketing) Amendment Act 2015 (Qld) and the Competition and Consumer (Industry Code – Sugar) Regulations 2017* (C'wth) (such that pre-contract arbitration does not allow millers post-investment revenue to be expropriated via an arbiter's decision on cane supply agreements and to remove the rigidity of *Grower choice* to allow more flexibility in pricing cane if cane juice is used for other non-sugar manufacturing purposes).

This paper also supports a **strengthening of the prime agriculture land protections in State Planning Policy and infrastructure development incentives** to assist with horizontal expansion and the commercialisation of geographically distant cane lands.

The purpose of this paper is to:

- Introduce the milling sector's 34MT Queensland cane supply objective to government and communities;
- Outline the industry's structural problems to achieving 34Mt (falling cane acreage and flat yields and cane supply growth in trend terms);
- Estimate the relative importance of E&A, variety adoption, horizontal expansion and land loss to achieving 34MT (under a certain set of informed assumptions); and
- Propose a number of changes to the industry's and government's approach.

The aim ultimately is to stimulate discussion and debate on how the sugar industry can find long-term sustainability based on a consistent 34Mt of annual sugarcane production and a diversification of revenues.

LIST OF TABLES AND CHARTS

1 INTRODUCTION

The Australian sugar industry is a large and vital regional industry. A 2017/18 study revealed that the industry injected $4.05 billion in Gross State Product and supported almost 23,000 jobs in the Queensland economy[2]. Local government regions like Hinchinbrook, Burdekin, Mackay and the Cassowary Coast are highly dependent on a prosperous sugar industry.

The global demand fundamentals for sugar remain strong despite the moderation in end-user consumption patterns in recent times. Driven by strong expected population and income growth in the developing world, global consumption and raw sugar imports are expected to increase by 1.5% and 2.1% per annum respectively out to year 2040[3]. Fortunately for Australia much of this raw sugar demand will be in Asia where the Australian industry enjoys commercial and comparative advantages over its competitors.

However, the financial viability of sugarcane and milling operations is compromised due to sustained periods of low global sugar prices and increasing operational costs. Flat cane yield and falling cane tonne supply growth and area under cane (in trend terms) is also contributing to mill under-utilisation and a lack of economies of scale. Industry leaders are aware of these threats and are currently developing an industry vision and roadmap, and pursuing a number of complementary initiatives[4]. As such, the 'why' (reform is needed) is clear.

The 'what' (reform is needed) is also clear. The industry has three medium term objectives to stay viable and globally competitive:

1. Increase cane and sugar productivity (increased yield and reduced costs). Currently averaging around 30Mt of annual cane production, the Queensland industry has set a target of 34Mt per annum;
2. Increase or at least maintain the amount of cane area; and
3. Increase its complementary, diversified, value-add revenue streams.

The modelling in this paper demonstrates that the goal of 34Mt is theoretically achievable but will require significantly improved:

- R&D and variety development as well as variety adoption;
- More effective E&A and eventually a transition to a more outcomes based and commercial E&A delivery model as the sector consolidates;
- Changes in approach to how cane land can be preserved and replaced in aggregate through improved land, environmental and easement and infrastructure incentives that promote horizontal expansion for example;
- Improved farm viability through lower costs; and
- Generation of value-add diversified revenue flows from improved policy incentives and shared value creation and/or investment approaches.

2 https://asmc.com.au/policy-advocacy/sugar-industry-overview/economic-contribution-sugar/.
3 Internal industry analysis.
4 The three most significant initiatives are regular meetings of leaders from ASMC, CANEGROWERS, SRA and ACFA to build a new vision for the future; an overhaul of the role and functions of SRA; and the development of the Revitalisation Agenda where industry and state and federal government work together to improve the policy and regulatory settings for the industry.

2 THE KEY THREATS

2.1 MILLING CAPACITY UNDER-UTILISATION

Sugar milling companies process the cane supplied by growers to produce raw sugar. Like most manufacturing operations, sugar manufacturers have fixed costs (permanent workforce, maintenance and depreciation of plant and equipment etc.) and variable costs (such as seasonal labour, electricity, cane and sugar transport etc.).

Excluding the costs of procuring the cane, a mill's fixed costs represent around 60-75% of all costs. Mills therefore attempt to maximise the amount of cane through the operations to achieve economies of scale and viability. Maximising the amount of cane through the mills is a key objective regardless of the prevailing sugar price.

How much cane a sugar manufacturer can efficiently crush will vary from site-to-site but typically is a function of the productive capacity of the entire factory and cane supply characteristics. That is, the maturity and quality (and hence the value) of a sugarcane crop, along with the ground conditions for harvesting varies over a typical crushing season thereby creating a shared incentive between growers and sugar manufacturers to optimise the length of time taken to harvest and process the crop. Whilst each Australian sugar manufacturing factory has different productive capacities and different cane supply characteristics, it is possible to estimate the (cane processing) capacity of each sugar manufacturer factory under average conditions.

In 2020, Queensland's then 20 operating sugar manufacturing operations produced 4Mt of sugar from 28.7Mt of crushed cane. Of concern to milling companies is that this 28.7Mt is considerably lower than the collective 34Mt in cane supply and raw sugar production capacity of these mills (84% capacity) (Table 1). This significant under-utilisation drives up per unit costs and is what contributed to the closure of the Maryborough and Bingera mills in 2020. Chart 1 demonstrates that the cane volumes received at all mills in the Queensland milling regions were under-capacity.

TABLE 1: QUEENSLAND SUGAR MILLING: 2020 CANE SUPPLY AND SUGAR PRODUCTION VS AT CAPACITY

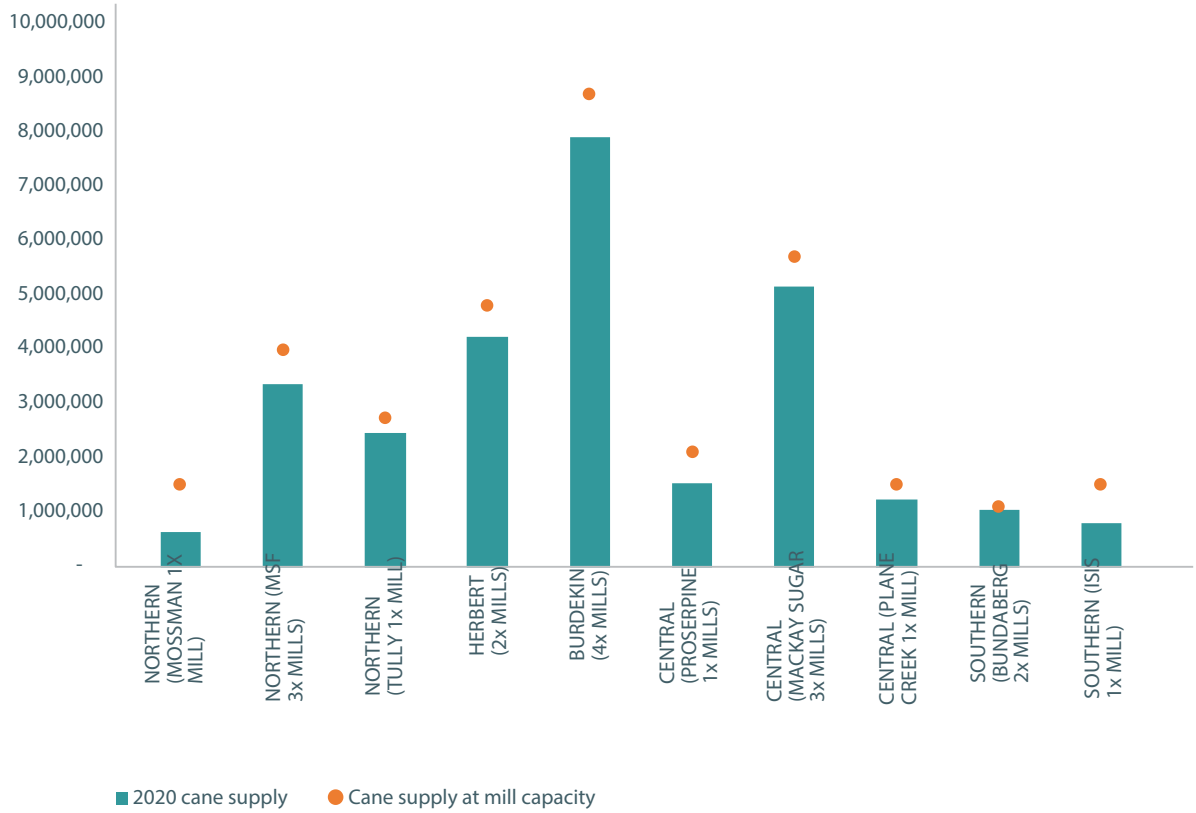
	2020 PERFORMANCE			
	2020 CANE SUPPLY	SUGAR (IPS) PRODUCED (T)	MILL CAPACITY (OF CANE SUPPLY) (T)	MILL CAPACITY (OF CANE SUPPLY) (T)
Northern (Mossman 1x Mill)	647,983	85,060	1,500,000	43%
Northern (MSF 3x Mills)	3,369,728	383,590	4,000,000	84%
Northern (Tully 1x Mill)	2,463,432	301,509	2,750,000	90%
Herbert (2x Mills)	4,250,399	564,653	4,800,000	89%
Burdekin (4x Mills)	7,905,092	1,219,567	8,700,000	91%
Central (Proserpine 1x Mill)	1,535,660	221,827	2,100,000	73%
Central (Mackay Sugar 3x Mills)	5,151,542	697,300	5,700,000	90%
Central (Plane Creek 1x Mill)	1,234,352	184,265	1,500,000	82%
Southern (Bundaberg 1x Mill)*	1,047,595	159,852	1,100,000	95%
Southern (Isis 1x Mill)**	808,815	150,623	1,500,000	54%
Southern (Rocky Point 1x Mill)	281,110	25,411	350,000	80%
TOTAL	**28,695,708**	**3,993,656**	**34,000,000**	**84%**

*Bundaberg Sugar had two operational mills in 2020 and one in 2021.

**Another 633,914 tonnes was supplied to the MSF Maryborough Mill that was subsequently closed.

Source: ASMC member companies

CHART 1: QUEENSLAND SUGAR MANUFACTURING: 2020 CANE SUPPLY VS CANE SUPPLY AT FACTORY CAPACITY



Source: ASMC member companies

2.2 POOR CANE AND SUGAR MANUFACTURING PROFITABILITY

The Australian sugar manufacturing and cane growing sectors are price takers. The raw sugar Futures price (ICE#11) that largely dictates what millers receive is determined by global supply and demand conditions of the traded market while the cane price, based on a historical cane price formula, is largely based on the raw sugar price.

The global raw sugar export market of approximately 58Mt[5] is a distorted market more often than not oversupplied with subsidised production and at prices (ICE#11) below the cost of production, even for low-cost producers like Australia.

With ICE#11 prices averaging AU$437/t for raw sugar (and sugar cane $37.23/t[6]) over the past 10 years and Australian sugar production costs estimated in the range AU$400-650/t for raw sugar (and sugar cane $33-45/t) industry profitability is at times compromised.

5 International Sugar Organisation, 2020 Yearbook.
6 At a 13.5 CCS (average) and AU raw sugar price of $437/t.

3 THE ROOT CAUSES OF SUGAR MANUFACTURING UNDER-UTILISATION AND POOR PROFITABILITY

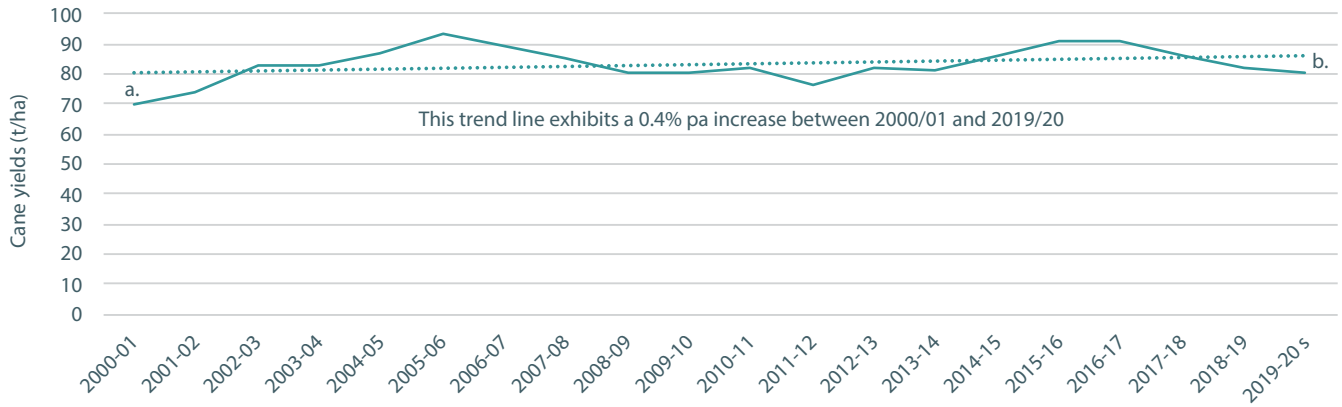
3.1 FLAT CANE YIELDS AND FALLING CANE SUPPLY TONNES AND CANE AREA

In trend terms and over the past 20 years, the Australian sugar industry has experienced flat cane yield growth and falling cane supply and area under cane:

- 0.4% per annum increase in cane yields (a 0.3t/ha gain per annum) between 2000/01 and 2019/20 in trend terms – being points a. and b. at Chart 2;
- -0.6% per annum decline in cane supply (tonnes) (or 200,000 less tonnes per annum) between 2000/01 and 2019/20 in trend terms – being points a. and b. at Chart 3 and more specifically, flat or falling cane supply growth in 11 of 14 sugar manufacturing regions over the past 10 years (Chart 4); and
- -0.8% per annum decline in the area under cane (or 3,300 less acres per annum) between 2000/01 and 2019/20 in trend terms – being points a. and b. at Chart 5.

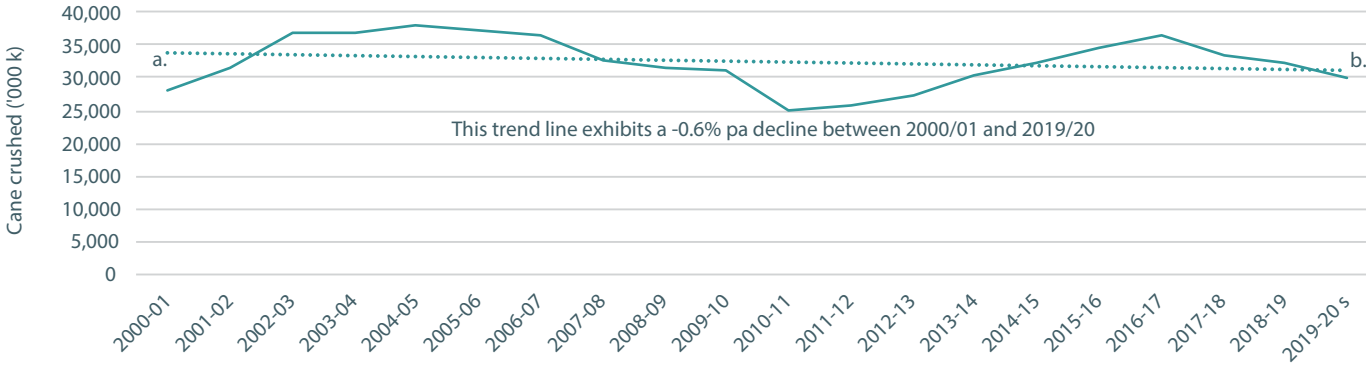
Whilst the drivers vary from region to region, ASMC member companies report that falling or flat volume performance in those 11 regions are on account of poor variety selection, grower demographic, poor profitability, relative cost of regulated inputs such as water and electricity, and substitution to other competing land uses.

CHART 2: AUSTRALIAN CANE YIELDS (T/HA): 2000/01 AND 2019/20 (ACTUAL AND LINEAR TREND)



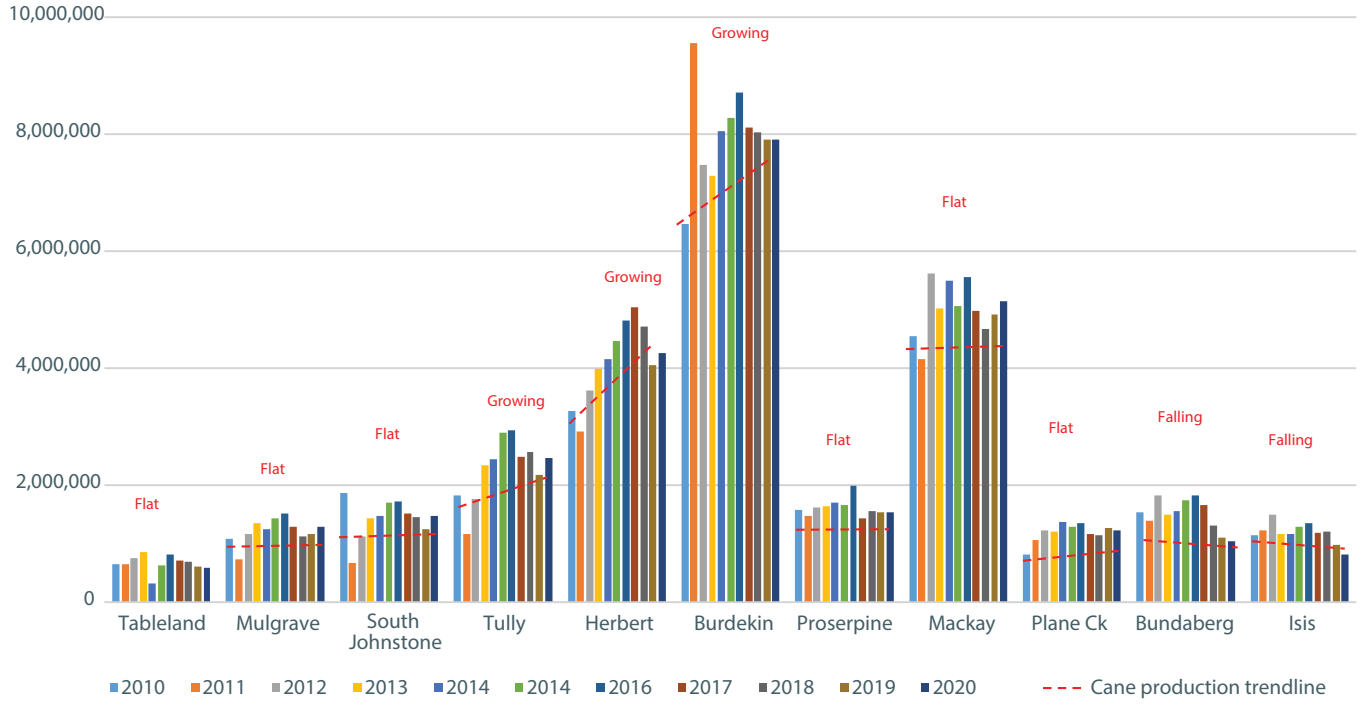
Source: ABARES Agricultural commodity statistics

CHART 3: AUSTRALIAN CANE CRUSHED (T): 2000/01 AND 2019/20 (ACTUAL AND LINEAR TREND)



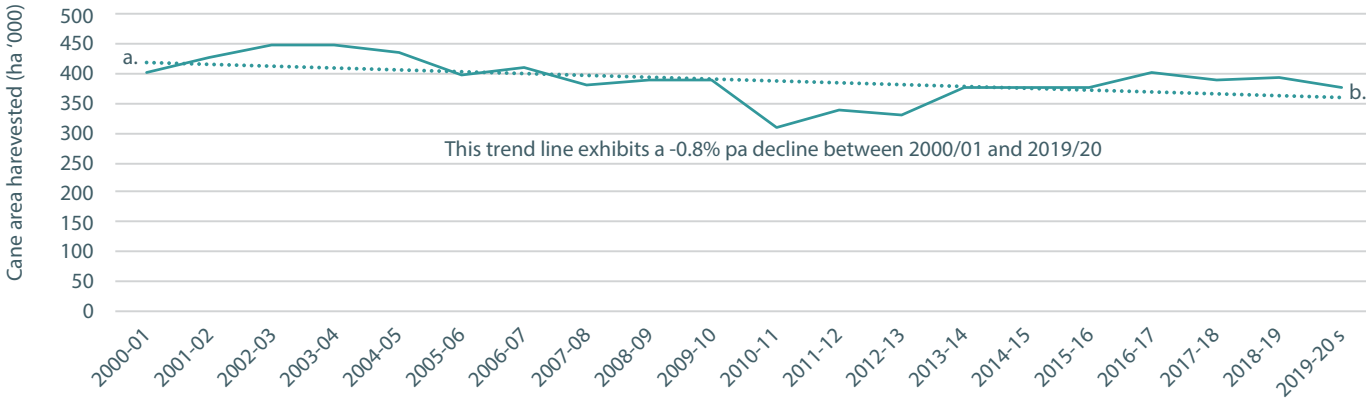
Source: ABARES Agricultural commodity statistics

CHART 4: QUEENSLAND CANE PRODUCTION BY SUGAR MANUFACTURING REGION: 2009 TO 2019 AND TREND GROWTH



Source: ASMC Member survey data.

CHART 5: AUSTRALIAN CANE AREA HARVESTED (HA '000): 2000/01 AND 2019/20 (ACTUAL AND LINEAR TREND)



Source: ABARES Agricultural commodity statistics

4 THE BROAD OPTIONS TO ACHIEVE A CONSISTENT 34MT

4.1 IMPROVED VARIETY ADOPTION

A significant proportion of Sugar Research Australia's (SRA) $30 million annual budget is devoted to developing new cane varieties through breeding and selection processes. SRA states that it has 'released 250 varieties in the past' and 'these varieties are developed to improve, amongst other things, yield, disease resistance and improved milling and sugar quality'[7].

The last significant 'super' variety released in Australia was Q124 in the early 1990's. Unfortunately by the late 1990's this variety became susceptible to orange rust disease and was eventually removed from circulation. The situation today is that cane yields are not maximised because growers continue to grow a variety of old and new varieties and do not universally access clean seed. Whilst no hard data exists[8], and it is difficult to isolate the yield benefits from genetic gains, up to 0.5% per annum production growth is considered possible if growers adopted the most suitable known variety to their conditions and regularly accessed clean seed.

Beyond the breeding and selection processes, SRA has a number of complementary initiatives including the publication of variety guides and selection tools such as *QCane Select* which outline the field results of various varieties, numerous regional variety committees which manage new variety releases, and a variety exchange program where sugarcane germplasm is imported and exported between countries where sugarcane is grown commercially.

Whilst often considered by growers as the most important factor given ease of implementation, R&D wins in variety breeding and selection have proven difficult in the Australian sugar industry and it is clear that a mix of strategies are required, including extension and adoption (section 4.2) and approaches that at least maintain the net amount of land under sugarcane (section 4.3).

4.2 MORE EFFECTIVE EXTENSION AND ADOPTION

E&A services in the Australian sugar industry refers to the provision of third-party advice to canegrowers. Although various models exist, these services are mainly provided by local industry-owned productivity service organisations. These productivity service organisations are funded jointly – with the sugar manufacturers and growers contributing (depending on the region) around 5 to 10 cents or more each per tonne of cane produced (that is, at 30Mt of cane supply, equates to $3m to $6m).

Common topics of advice include fallow management, variety selection, crop establishment, nutrient management, weed management, disease management, pest management, irrigation and/or drainage management and harvesting.

SRA's role in E&A in the future will see a greater emphasis placed on 'translation' – where the focus becomes communication to E&A third party providers of SRA's research findings and a feedback loop back to SRA to inform SRA's research priorities.

4.3 MAINTAIN THE NET AREA OF SUGARCANE LAND

The Australian sugar industry's cane area footprint is in decline. Industry data shows that over the past 20 years the amount of sugarcane acreage in Queensland has decreased by an average of -0.8% per annum (i.e. 420,000 hectares [ha] to 355,000ha in trend terms - refer to Chart 5 and points a. and b.).

Over this time, some cane land has been lost to timber (through the tax-incentivised managed investment schemes support *for plantation forestry in the period 2006 to 2010* for example), bananas, cattle, tree crops (predominantly macadamias and avocados), solar farms and urban encroachment. The loss of cane land in the Southern region (Bundaberg to Maryborough) has been particularly acute leading to the permanent closure of two sugar operations following the completion of the 2020 crushing season.

Finding offsetting new cane land is difficult but possible. As sugarcane must be processed within 10 to 20 hours of harvesting before it starts to deteriorate both in terms of quality and value, it has traditionally been grown in close proximity to a sugar manufacturing factory (ideally not more than 30km from the factory). As such, increasing potential sugarcane area requires currently geographically distant land beyond 30km or close, marginal land to be converted to economic land. In large part, this will require investment in water supply and cost-effective transport infrastructure. More work is required to understand the economic and technical feasibility of bringing geographically distant land into cane production (see section 6.4.2 for a preliminary estimate of Queensland horizontal expansion opportunities).

7 https://sugarresearch.com.au/growers-and-millers/varieties/
8 Feedback from SRA 1/2/2021

5 A PATH TO A CONSISTENT 34MT

5.1 10 YEAR ESTIMATES - METHODOLOGY AND ASSUMPTIONS

To assess the feasibility of reaching 34Mt, ASMC developed a projection model that forecast the cane productive capacity of each sugar manufacturing region (being 16 sugar manufacturing operations within ASMC membership) under variable variety adoption, E&A and land loss assumptions. Developed in conjunction with key representatives within ASMC member companies, the assumptions that were adopted in this report are outlined at Table 2.

TABLE 2: FORECASTING 10 YEAR QUEENSLAND CANE SUPPLY (ASSUMPTIONS PROVIDED BY ASMC MEMBER REPRESENTATIVES)

ASSUMPTIONS	NORTHERN (MSF 3X MILLS)	NORTHERN (TULLY 1X MILL)	HERBERT (2X MILLS)	BURDEKIN (4X MILLS)	CENTRAL (PROSERPINE 1X MILLS)	CENTRAL (MACKAY SUGAR 3X MILLS)	CENTRAL (PLANE CREEK 1X MILL)	SOUTHERN (ISIS 1X MILL)
Period (years)	10	10	10	10	10	10	10	10
VARIETY SELECTION								
% of Q1 area subject to gains	100%	100%	100%	100%	100%	80%	100%	100%
% of Q2 area subject to gains	100%	100%	100%	100%	100%	100%	100%	100%
% of Q3 area subject to gains	100%	100%	100%	100%	100%	100%	100%	100%
% of Q4 area subject to gains	100%	100%	100%	100%	100%	100%	100%	100%
% increase in yield per annum from Q1 (years 1-7)	0.5%	0.2%	0.0%	0.0%	0.0%	0.2%	0.0%	0.5%
% increase in yield per annum from Q2 (years 1-7)	0.5%	0.2%	0.3%	0.3%	0.3%	0.2%	0.3%	0.5%
% increase in yield per annum from Q3 (years 1-7)	0.5%	0.2%	0.1%	0.1%	0.1%	0.2%	0.1%	0.5%
% increase in yield per annum from Q4 (years 1-7)	0.5%	0.2%	0.1%	0.1%	0.1%	0.2%	0.1%	0.5%
Additional % increase in yield in year 7 (across all quartiles)	1.0%	1%	0%	0%	0%	0.3%	0%	1.0%
Additional % increase in yield in year 8 (across all quartiles)	1.5%	1.5%	0.3%	0.3%	0.3%	0.3%	0.3%	1.5%
Additional % increase in yield in year 9 (across all quartiles)	2.0%	2%	0%	0%	0%	0.3%	0%	2.0%
EXTENSION & ADOPTION								
% of land in Q1 that achieves Q2 (median) yield performance	0.0%	0%	0%	0%	0%	10%	0%	0%
% of land in Q1 that achieves Q3 (median) yield performance	25%	20%	37.5%	37.5%	37.5%	30%	37.5%	0%
% of land in Q1 that achieves Q4 (median) yield performance	25%	20%	37.5%	37.5%	37.5%	35%	37.5%	0%
% of land in Q2 that achieves Q3 (median) yield performance	25%	25%	25%	25%	25%	20%	25%	25%
% of land in Q2 that achieves Q4 (median) yield performance	0%	0%	0%	0%	0%	30%	0%	0%
% of land in Q3 that achieves Q4 (median) yield performance	10%	20%	10%	10%	10%	10%	10%	25%
LAND LOSSES								
% of land in Q1 lost to other non-cane purposes	25%	25%	25%	25%	25%	25%	25%	100%
% of land in Q2 lost to other non-cane purposes	0%	0%	0%	0%	0%	10%	0%	0%
% of land in Q3 lost to other non-cane purposes	0%	0%	0%	0%	0%	5%	0%	0%
% of land in Q4 lost to other non-cane purposes	0%	0%	0%	0%	0%	5%	0%	0%

Source: ASMC member companies

Considerable effort was undertaken to understand the yield performance of each productivity zone in a sugar manufacturing region with yield quartile bands calculated using 8-years of yield performance (2013-2019) to calculate yield quartile bands. Productivity zones were utilised as these areas share common topographical characteristics (soil, run-off, rainfall etc.) thereby allowing a more meaningful comparison of grower performance. A detailed note on how the yield quartiles were calculated is provided in **Appendix A**. Knowing how much land and tonnes of production are within each yield performance quartile band within a sugar manufacturing region assists in understanding the magnitude of the E&A effort required and likely cane production benefits. Furthermore, this approach helps to determine how much (underperforming) land is likely to be lost in the future or transitioned within the sector. A detailed note on how these 'uplifts' were calculated is provided in **Appendix B**.

5.2 10 YEAR ESTIMATES – FINDINGS

For each of the 16 operations within ASMC member companies, the model was used to forecast the productive capacity of each operations area with the assumptions outlined at Table 2. The results are presented in Table 3. In summary by the 10th 'outlook' year, and applying the assumptions provided by the ASMC member company representatives, the industry could potentially achieve an increase of 1.6Mt consisting of:

- An increase of 2Mt from E&A;
- An additional 0.8Mt from R&D and variety adoption; and
- A loss of 1.2Mt from land losses[9].

TABLE 3: 10 YEAR FORECAST FINDINGS (ASSUMPTIONS PROVIDED BY ASMC MEMBER REPRESENTATIVES)

	POTENTIAL UPLIFT IN CANE TONNES			
	EXTENSION AND ADOPTION GAINS (A)	VARIETY SELECTION GAINS (B)	(LESS) LAND LOSSES (C)	NET UPLIFT TONNES INCREASE (D) = (A)+(B)-(C)
Northern (MSF 3x Mills)	187,642	263,494	-122,820	328,316
Northern (Tully 1x Mill)	94,494	128,429	-81,269	141,654
Herbert (2x Mills)	291,900	52,477	-134,649	209,728
Burdekin (4x Mills)	586,447	102,319	-228,361	460,406
Central (Proserpine 1x Mill)	133,810	19,825	-61,030	92,605
Central (Mackay Sugar 3x Mills)	545,993	118,253	-458,479	205,767
Central (Plane Creek 1x Mill)	80,885	29,285	-37,515	72,655
Southern (Isis 1x Mill)	32,530	76,402	-80,105	28,827
Northern (Mossman 1x Mill)				
Southern (Bundaberg 1x Mill)		Not assessed		
Southern (Rocky Point 1x Mill)				
TOTAL / AVERAGE	**1,953,701**	**790,484**	**-1,204,228**	**1,539,958**

Source: ASMC internal analysis

Furthermore, the results of the quartile analysis are provided at Table 4. In summary, and across 103 productivity zones, it was calculated that in 2019:

- 8% of the cane supplied was from the lowest performing quartile (Quartile 1 or Q1);
- 28% from Quartile 2 (Q2);
- 26% from Quartile 3 (Q3); and
- 38% from Quartile 4 (Q4) (highest performing quartile).

This can be considered a good result as 64% of tonnes produced in Queensland was at a yield higher than the median yield (being the point between the Q2 highest range and Q3 lowest range).

9 Note, beyond the preliminary estimates provided in section 6.4.2, the potential increases in sugarcane land area from bringing geographically distant land (i.e horizontal expansion) into production was not formally assessed as part of this analysis but remains an area for future investigation. It is assumed in this paper that the majority of any supply gap will need to come from horizontal expansion.

TABLE 4: PERCENTAGE OF 2019 PRODUCTION WITHIN EACH YIELD PERFORMANCE QUARTILE

	# OF PRODUCTIVITY ZONES	2019 LAND CANE HARVESTED (HA)	TOTA CANE TONNES SUPPLIED (2019)	% OF 2019 CANE PROODUCTION IN EACH YIELD QUARILE			
				Q1	Q2	Q3	Q4
Northern (MSF 3x Mills)	37	41,975	3,117,300	16%	20%	30%	35%
Northern (Tully 1x Mill)	8	28,335	2,113,772	15%	24%	30%	31%
Herbert (2x Mills)	7	56,361	4,055,299	13%	22%	27%	37%
Burdekin (4x Mills)	8	67,824	7,909,756	12%	23%	29%	36%
Central (Proserpine 1x Mill)	10	21,036	1,546,803	16%	25%	29%	30%
Central (Mackay Sugar 3x Mills)	17	64,862	4,917,597	15%	23%	27%	34%
Central (Plane Creek 1x Mill)	4	17,841	1,272,644	14%	29%	28%	30%
Southern (Isis 1x Mill)	12	12,838	970,253	8%	27%	26%	38%
Northern (Mossman 1x Mill)							
Southern (Bundaberg 1x Mill)			Not assessed				
Southern (Rocky Point 1x Mill)							
TOTAL / AVERAGE	**103**	**311,072**	**25,903,423**	**8%**	**28%**	**26%**	**38%**

Source: ASMC member data and ASMC internal analysis

The increases in cane yields that area achieved between 2019 as the baseline and the 10-year are outlined at Table 5.

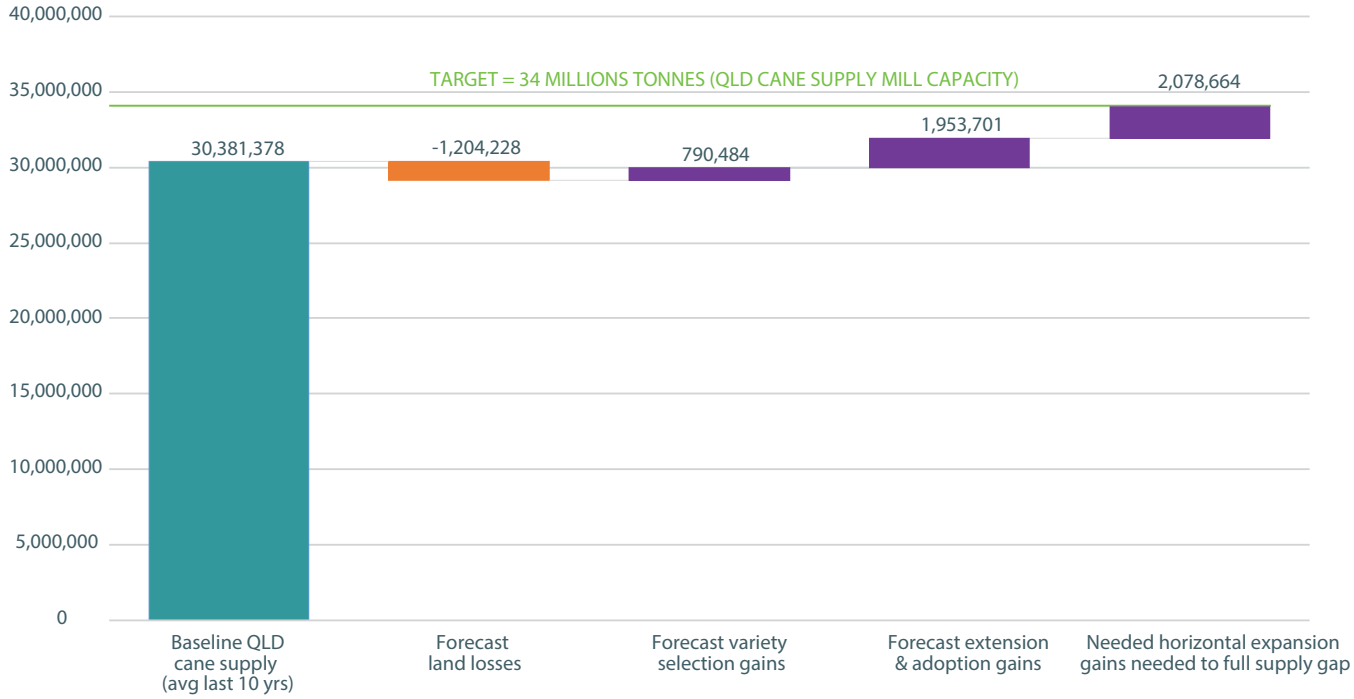
TABLE 5: INCREASES IN CANE YIELD (ASSUMPTIONS PROVIDED BY ASMC MEMBER REPRESENTATIVES)

	2019 CANE YIELDS (T/HA)	10 YEAR FORECAST CANE YIELDS (T/HA)
Northern (MSF 3x Mills)	74	86
Northern (Tully 1x Mill)	75	84
Herbert (2x Mills)	72	79
Burdekin (4x Mills)	117	129
Central (Proserpine 1x Mill)	74	82
Central (Mackay Sugar 3x Mills)	77	85
Central (Plane Creek 1x Mill)	71	79
Southern (Isis 1x Mill)	76	88
Northern (Mossman 1x Mill)		
Southern (Bundaberg 1x Mill)	Not assessed	
Southern (Rocky Point 1x Mill)		

Source: ASMC internal analysis

Positively, the 'uplift' assumptions outlined at Table 2, and the additional 1.6Mt of annual cane production would (assuming a baseline of 30.4Mt – being the average production over the last 10 years) bring production to 32Mt. This however remains 2Mt short of the target of 34 Mt which brings horizontal expansion into the mix (Chart 6).

CHART 6: A PATH TO A CONSISTENT 34MT (AFTER 10 YEARS) (ASSUMPTIONS OF ASMC MEMBER REPRESENTATIVES ADOPTED)



Source: ASMC internal analysis from ASMC member data

To achieve 34Mt more aggressive advances in E&A and variety adoption will be required than that assumed in this projection and stronger efforts made to maintain the current cane footprint and/or bring geographically distant land into production (horizontal expansion). Significant advances in variety development will also be required (SRA reforms are focussed on this outcome). Using this forecast modelling approach, further engagement between stakeholders at each sugar manufacturing region is encouraged to determine alternative pathways to achieve sugar manufacturing utilisation and the collective 34Mt of Queensland cane supply.

6 WHAT CHANGES ARE REQUIRED TO ACHIEVE A CONSISTENT 34MT?

The focus of this paper is how 34Mt of cane production can be achieved annually, and specifically, how to increase cane and sugar yields and maintain cane area or offset reductions in area. The suggestions below are beyond the SRA strategy and operating reforms that are already proposed. Furthermore, the changes below by no means represent the full suite of changes likely to be required but are provided as views for consideration.

6.1. MORE EFFECTIVE E&A

6.1.1 IMPROVED RISK-BASED APPROACH AND A TRANSITION TO A MORE OUTCOMES BASED E&A APPROACH

ASMC member company representatives believe that considerable increases in cane production can occur from uplifting Q2 growers to either Q3 or Q4 yield performance levels and Q3 to Q4 performance levels through improved farming practices of incumbent growers. This implies a strong need for more efficient and effective E&A services based, ideally, on stronger risk assessments that better target the areas of farming most in need of improvement.

Although various models exist, E&A services are mainly provided by local industry-owned productivity service organisations. These productivity service organisations are funded jointly – with the sugar manufacturers and growers contributing (depending on the region) 5 to 10 cents (and sometimes more) each per tonne of cane produced.

This paper supports a stronger risk-based approach to the delivery of E&A currently and as the cane growing sector consolidates, current E&A services should become more market orientated and competitive. Ideally also these providers would receive regular scientific and technical updates from research bodies and would have an opportunity to influence the priorities of these research bodies.

6.2. NEW FARM OWNERSHIP AND OPERATING MODELS

ASMC member company representatives also believe that considerable increases in cane production can occur from uplifting Q1 growers to either Q3 or Q4 yield performance levels. This implies a need to encourage and actively facilitate new ownership and operation models in the sector.

6.2.1 DEVELOPMENT OF AN INVESTMENT PROMOTION DOCUMENT TO ATTRACT NEW CAPITAL

Despite the moderation in global demand for sugar in recent times due to COVID and changes in diet, the demand fundamentals remain strong with sugar consumption globally expected to increase 1.3% per annum (on average) out to year 2040 – or 181 million tonnes in 2020 to 234 million tonnes by 2040[10].

Australia remains well placed to meet this increasing demand with a number of strong operational advantages – namely a highly skilled workforce, innovative and efficient production, highly efficient rail infrastructure and bulk storage facilities and excellent R&D capability.

Sugarcane itself remains an extremely resilient crop and highly suited to Queensland's climatic and soil conditions and promises stable returns.

Furthermore, Australia has an excellent reputation as a reliable and sustainable supplier of raw sugar – qualities that the global market is likely to be more responsive to in the years to come.

The Australian sugar industry has seen a moderate increase in capital and ownership changes in recent years and investment opportunities could accelerate given the anticipated increase in retirements in the growing sector in the coming years and recent surge in sugar prices. Against a backdrop of strong but mobile capital supply this paper supports the completion of a guide for investment in the Australian sugar industry that is promoted to both domestic and international investors.

10 Acil Allen Consulting analysis for the Australian Sugar Alliance, 2020.

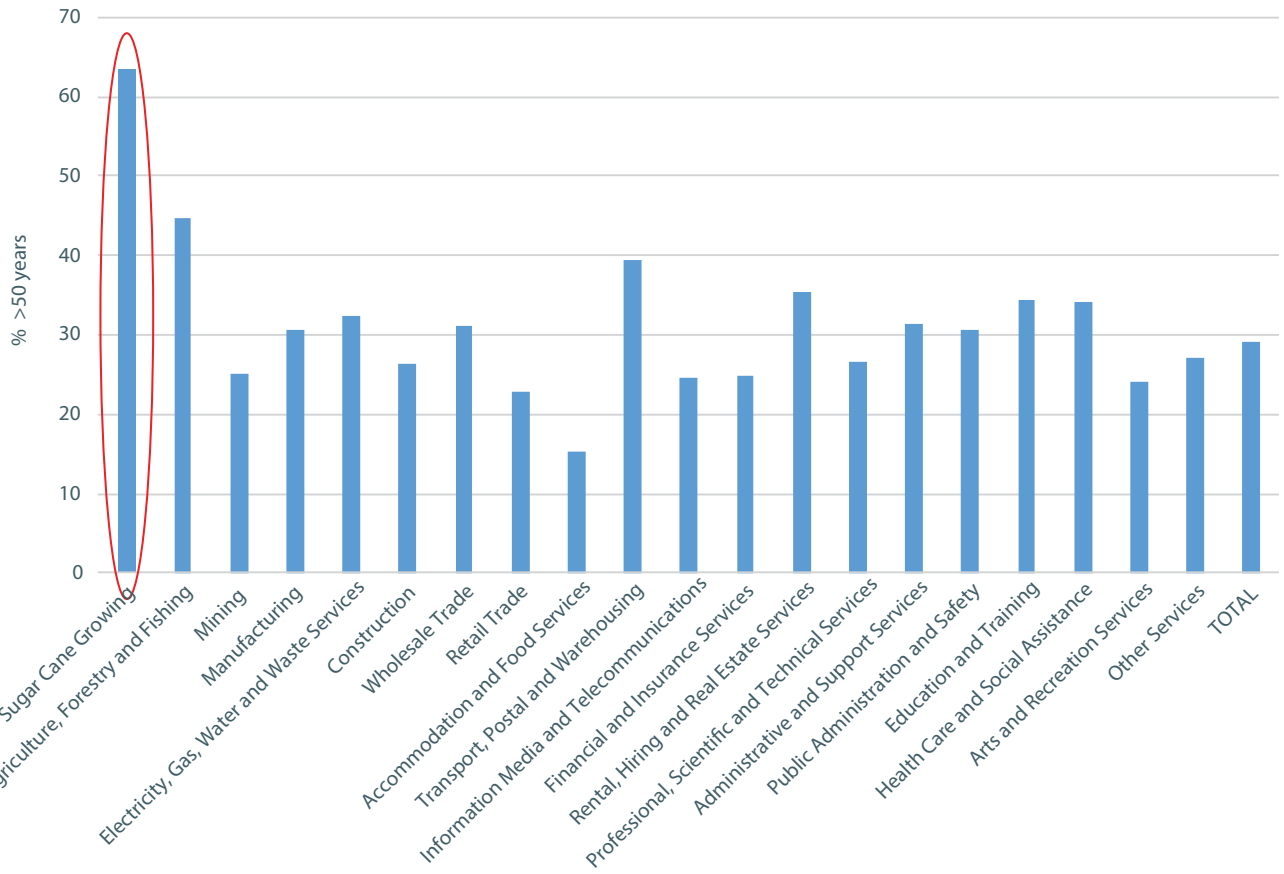
A complementary set of reforms to Australia's foreign investment laws would also be required to harness foreign investment potential[11]. These reforms should include:

- Benign acquisitions in non-sensitive sectors such as sugar are exempted from all of the proposed national security provisions in the *Foreign Investment Reform (Protecting Australia's National Security) Act 2020* ;
- The requirement for an 'open and transparent' sale advertising process be removed[12];
- Legislated definitions of 'national interest' and 'national security' against which proposed investments are to be measured to be provided in the *Foreign Investment Reform (Protecting Australia's National Security) Act 2020*;
- FIRB fees (approximately 0.6% of the consideration) should not be a tax on investment and should be based on cost recovery; and
- The fees associated with any exemption certificates should be payable retrospectively, or if paid up front, refundable if investments up to the stated limit are not completed under the exemption within a certain time period.

6.2.2 FACILITATION OF DIFFERENT CANE LAND OWNERSHIP AND OPERATING MODELS

The significant ageing of the cane grower sector represents an additional and emerging risk but also renewal opportunities for the industry. Census data (2016) from the Australian Bureau of Statistics highlights that the 'sugar cane growing' industry maintains the oldest workforce within Queensland, with 64% of growers over the age of 50 as compared to the second 'oldest' industry being 'Agriculture, Forestry and Fishing', with 45 percent of growers over the age of 50 (Chart 7).

CHART 7: QLD CANEGROWERS AND ALL QLD INDUSTRY: % >50 YEARS OF AGE



Source: ABS 2016 Census

There are multiple ways positive changes in ownership and operating models can occur – including family succession planning, neighbours or rejuvenated growers purchasing adjoining blocks to lease, and share farming. Each is discussed below.

11 ASMC in its submission to the (Australian Treasury) evaluation of the 2021 foreign investment reforms highlighted concerns that Government had not achieved the right balance between encouraging much needed foreign investment and protection of the national interest and suggested changes to the framework for Government's consideration. See https://asmc.com.au/wp-content/uploads/2021/08/210818_ASMC-submission_Treasury-Review-2020-FIRB-legialtion-FINAL.pdf
12 See FIRB Guidance Note 3, Section F.

FAMILY SUCCESSION PLAN

In this case, the owner of the cane land makes arrangements to continue cane farming by ceding ownership and/or operational control to a relative who is likely to have neighbouring or other cane farming interests close by. The returns from the investment are potentially higher than other options as consolidation of multiple farming interests may bring purchasing leverage and the potential for lower cost inputs.

Once a common scenario given the extended family structure of the traditional grower base, anecdotal feedback is that family succession in the cane sector has decreased over the past decade. This may be because of shifts in generational sentiment toward farming, as younger generations migrate to the major cities to pursue higher education and earning opportunities. Tempering this is the more recent trend for younger generations to come 'back to the land' in the pursuit of stronger family connections and identity as well as burgeoning domestic and export demand for certain agricultural commodities.

NEIGHBOURING CANE FARMER PURCHASES CANE LAND

In this case, a neighbouring cane farmer purchases part or entirety of a contiguous cane farm and retains that land for cane farming. The returns from this type of investment are likely to be higher than other options as economies of scale bring purchasing leverage and the potential for lower cost inputs.

Furthermore, private sale transactions bring the additional benefits of:

- Lower sale transaction costs;
- Higher land values encouraging divestment and turnover of land; and
- Higher profitability encouraging larger (institutional) investors.

REJUVENATED GROWER PURCHASES CANE LAND (NON-NEIGHBOUR)

In this case, a party (a non-neighbour) with or without cane growing experience purchases a part or entirety of a cane farm. It is assumed that if already a grower in the region, their block/s are not neighbouring (contiguous). The returns from this type of investment could be favourable if economies of scale are achieved. However, this would not apply for a 'new' grower with no current land, limited experience or local knowledge.

FOREIGN DIRECT INVESTMENT INTO CANE LAND

In this case, foreign capital, mainly via managed funds (sovereign and pension funds), purchase cane land and corporatise the farm operations in the pursuit of returns in the vicinity of 7-9% per annum. These returns come in the form of land appreciation and the value of the cane farmed and sold.

Whilst this type of investment in Australia has been limited to horticulture, cotton and beef, dialogue with real estate agents in the Burdekin and Central (Mackay) growing regions suggest a growing interest for large cane land parcels in higher returning productivity zones. Whilst the injection of capital is welcomed, the 7-9% capital returns are high for cane land (over a typical sugar price cycle) and there is a risk that the land is sold for other purposes.

LEASE FARMING

In this case, the cane farmer leases the land under a commercial contract to a willing party, who operates the farm in close proximity to their current farm, however, does not take ownership of the cane farm. Lease payments from the lessor are typically 12-18% of revenues depending on sugar and cane prices. Depending on prices, this option could generate numerous benefits to the lessor and lessee including the ability for the lessor to stay in the region and higher incomes for both parties.

Feedback is that lease farming remains relatively underutilised in Queensland.

SHARE FARMING

In this case, the cane farmer shares the operations of the land under a commercial contract to a willing party without change in ownership of the cane farm. Typically, the entity 'farming in' earns around one third of shared revenues.

6.2.3 IMPROVED PRIVATE AND GOVERNMENT CAPITAL LOAN SCHEMES

Growers typically access capital from government and/or commercial lenders for acquisition or farm improvement purposes. In extreme seasons, access to capital in the event of natural disasters also occurs.

There are numerous agricultural commercial lenders in Australia including NAB, Suncorp and Rabobank whilst both the Australian Government, through the Regional Investment Corporation (RIC), and the Queensland Government, through the Queensland Rural and Industry Development Authority QRIDA, also provide capital at or close to bond rate values.

This paper supports a review to assess whether RIC and [QRIDA] funding programs assist with on-farm productivity improvements and positive new ownership and operation approaches. Issues for review would include market knowledge of products, approval times, paperwork burden and security requirements (ratios).

6.3. IMPROVED FARM PROFITABILITY

6.3.1 REDUCTIONS IN REGULATED WATER AND ELECTRICITY CHARGES

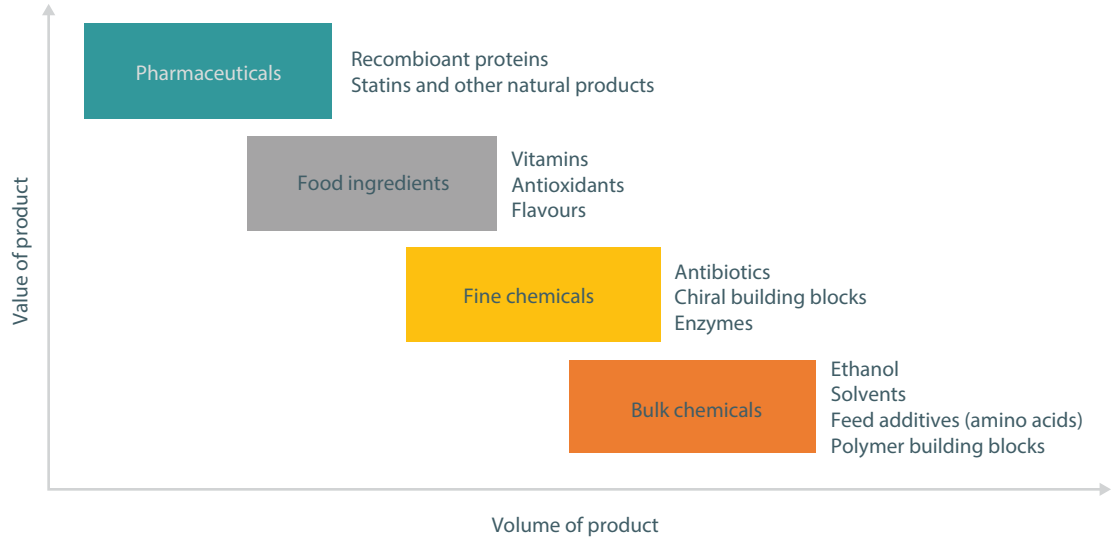
The sector regularly cites increasing water and electricity costs as significant burdens and areas where supply costs have increased substantially. This paper supports further work to make water and electricity costs affordable for growers as well as farm consolidation given the known link between increasing farm sizes and increasing economies of scale and per unit cost reductions[13]. Consideration should be given to higher Government imposed efficiency dividend requirements on Government Owned Corporation (GOC) providers and changed pricing models to encourage greater efficiencies and lower costs.

Cane planting represents a significant component of grower costs and support should be given to the commercialisation of seed planting as a way to reduce costs and encourage more growers to the sector.

6.3.2 IMPROVED POLICY CERTAINTY AND INCENTIVES FOR REVENUE DIVERSIFICATION

Given significant advances in technology, there are now dozens of energy, food, alcohol and chemical products that can be manufactured from the sugar industry value chain and these goods have significantly different market values and market demand (volume). These bio products can be thought as 1st generation such as ethanol and cogeneration from bagasse to the emerging 2nd generation products such as pharmaceuticals, food ingredients, fine chemicals and bulk chemicals manufactured from raw sugar through synthetic biology (Chart 8).

CHART 8: SYNTHETIC BIOLOGY APPLICATIONS



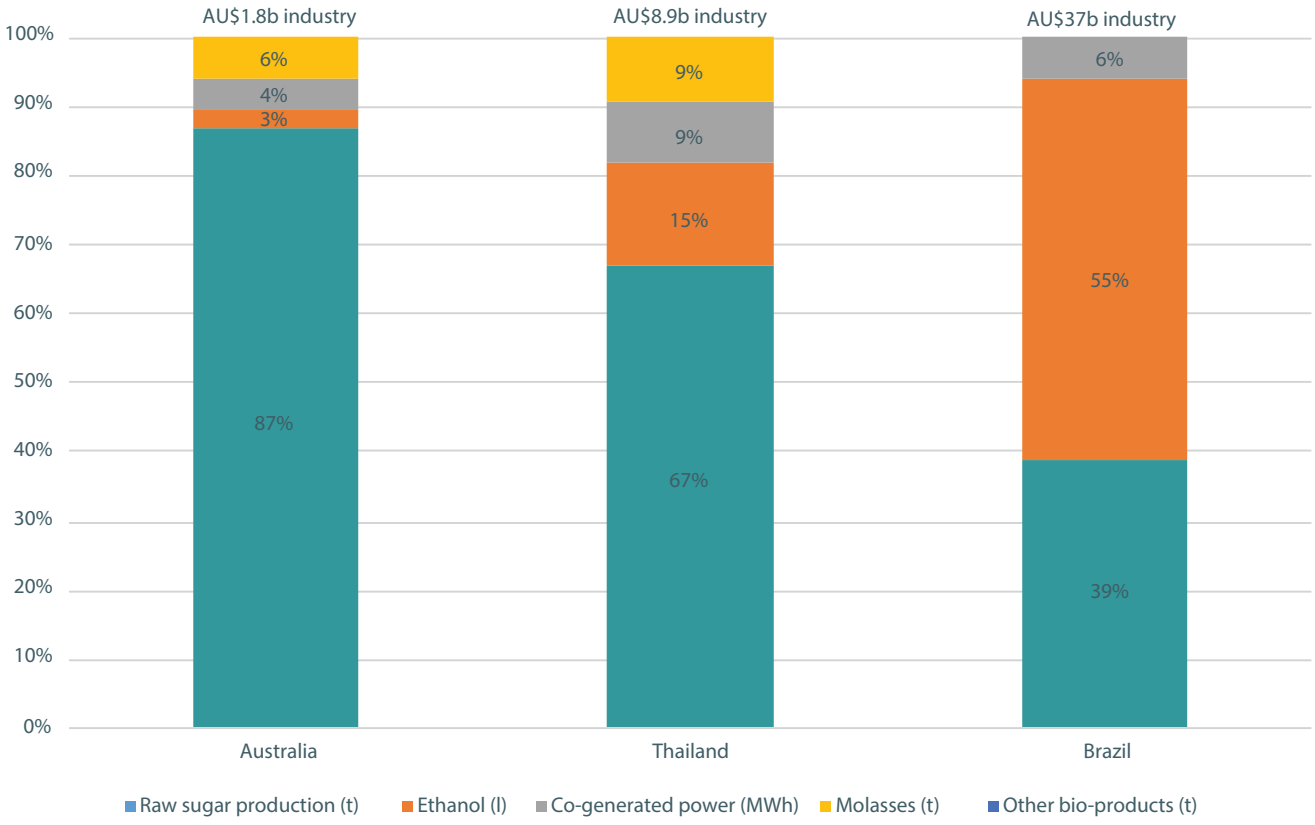
Source: CSIRO and adapted from Nielson, 2020.

13 http://data.daff.gov.au/data/warehouse/9aab/9aabf/2015/asffpd9absf20151218/AustSugarcaneFrmFinPerform2013-14_v1.0.0.pdf

Whilst the sugar manufacturers will make decisions based on their individual circumstances, the ability to generate more revenue from each tonne of cane processed and share a portion of these increased returns with growers under a shared value creation and/or investment approach portion of these will be important to keeping growers viable and achieving 34Mt of annual production. It should be noted that diversification strategies are a complement to the 34Mt per annum target, and do not replace this important goal.

To date, the global sugar industry has concentrated with varying success on the 1st generation of bio diversification products such as ethanol and cogeneration. Despite the availability of significant latent volumes of bagasse feedstock and ability to significantly increase ethanol and cogeneration output[14], Australia's investment has been low compared to its main competitors Thailand and Brazil. Chart 9 shows that in 2019 only 13% of Australia's total revenues came from non-raw sugar revenues, whilst in Thailand and Brazil 33% and 61% of total revenues respectively come from non-raw sugar sales.

CHART 9: REVENUE MIX OF THE AUSTRALIAN, THAI AND BRAZILIAN RAW SUGAR INDUSTRIES



Source: ASMC, UNICA and the Thai Sugar Milling Association

Unfortunately, there remain significant obstacles in investing in both first and second generation diversification opportunities. For electricity cogeneration and ethanol for example, there remains sufficient uncertainty and lack of incentives in Australia's policy and regulatory settings to incentivise new investment. For second generation bio opportunities such as synbio, the technology in some respects remains infant and partnerships across the supply chain are needed to commercialise them.

14 Per ASMC's submission to the ARENA Bioenergy Roadmap, Australian sugar manufacturing operations have significant latent feedstock and capability to increase their current production of ethanol and electricity bioenergy, as well as broaden the kinds of bioenergy produced. ASMC and L.E.K Consulting analysis demonstrates that under the right commercial and policy settings, total ethanol production could increase from 60 ML to 216.25 ML per annum and total electricity production from 438 MW to 1,268 MW per annum.

6.3.3 REPLACEMENT OF PRE-CONTRACTION ARBITRATION AND REMOVAL OF *GROWER CHOICE* CLAUSES

A major barrier to the sugar manufacturing sector considering or investing in bioenergy expansion or diversification projects is the uncertainty created by mandatory pre-contract arbitration and *Grower choice* provisions contained in both the *Sugar Industry (Real Choice in Marketing) Amendment Act 2015* (Qld) and the *Competition and Consumer (Industry Code – Sugar) Regulations 2017* (C'wth) (commonly known as the Sugar Industry Code of Conduct).

The pre-contract arbitration laws discourage investment in diversification such as cogeneration of electricity and ethanol production because of the risk that post-investment revenue will be expropriated through arbitrated cane supply agreements.

The *Grower choice* provisions are also problematic as they link a grower's cane price to the sugar price but this will not be the case if cane juice is used to make other products in a juice to fermented jet or ethanol future for example.

6.4 PROTECTING EXISTING AND COMMERCIALISING GEOGRAPHICALLY DISTANT CANE LAND

6.4.1 IMPROVED PRIME AGRICULTURAL LAND PROTECTIONS

The sugar industry continues to lose cane land to competing uses, compromising the viability of some sugar manufacturing operations.

A key component of Queensland's planning system is the State Government's 2017 State Planning Policy (SPP) (2017). The SPP and accompanying Act sets the state interests that apply to plan making, and local governments are encouraged to give effect to these interests through each planning scheme.

While the transition of land use to other crops such as macadamia nuts and avocados is consistent with the SPP, the loss of cane land to non-agricultural developments such as solar farms, accelerated by government policies and investment, is not and represents an emerging threat to the sugar industry.

Moreover, when local governments have acted to protect sugar manufacturing viability and reject solar farm development applications, the ambiguity and lack of protections in the SPP and the 'State interest – Agriculture' statement have led to adverse outcomes.

For example, in a Planning and Environment Court decision (2018) regarding the proposed Mirani Solar Farm, the Court took a narrow view. It approved the solar development stating that the site was:

> *'ideally suited for a proposal of the type intended' and that, 'on balance, there were no realistic alternative sites for a proposal of the type envisaged; and that the alienation of the land for 40 years would not have, or be likely to have, a measurable effect on the viability of the sugar milling company in question (Mackay Sugar) or any other mill or associated enterprise.'*

This decision was made despite the land in question having a nearby, dedicated cane railway line and other suitable sites, where cane was not grown, available 10 kilometres away.

Likewise, in 2015 the State Planning Minister overturned the Burdekin Shire Council's rejection of the Clare solar development proposal and supported the development application on the grounds of land compatibility, renewable energy and job creation.

To provide certainty to industry in the face of emerging threats, the Government must re-establish policies that better protect GQAL by adopting a broader definition of 'State interest – Agriculture' in the SPP.

Positively, the SPP (2017) makes a number of supportive broad statements:

> '*The resources that agriculture depends on are protected to support the long-term viability and growth of the agricultural sector', and*
>
> *'Queensland's agricultural resources are of State and national importance and should be protected in State, regional and local planning policies from incompatible uses and irreversible impacts that would compromise existing and potential productivity'.*

However, when put to the legal test, the SPP is not sufficient to protect much of the cane land that surrounds the State's sugar manufacturing operations. This in turn has eroded industry's confidence in the security of local council planning decisions.

Ideally, a broader 'State interest –Agriculture' policy would be added to the SPP that explicitly exempts all GQAL from incompatible development if that land has been significantly improved and is strategically essential to the region. For example, cane land that has been significantly improved through complementary investment in rail or sponsored irrigation water infrastructure would be considered strategically important not only in terms of sugar manufacturing viability and regional prosperity, but also to the viability of the other infrastructure users who rely on such infrastructure being available and utilised.

6.4.2 INFRASTRUCTURE DEVELOPMENT TO ACHIEVE HORIZONTAL EXPANSION

The footprint of land available to grow sugarcane that can be processed through existing sugar manufacturing infrastructure in Queensland is close to exhausted. However there are at least six areas in the State that could be part of a horizontal expansion of the existing industry with the addition of critical infrastructure.

1. On the Atherton Tableland, a further 1,000 to 1,500 hectares could be converted to sugarcane growing on the back of more irrigation water becoming available. The challenging aspect of this is that it would require a new dam with the existing Tinaroo scheme at capacity.
2. In a region where competition for land is very high, the Isis Central Sugar Mill near Childers has explored an option to open up between 1,000 to 2,000 hectares of land for sugarcane growing in the North Burnett hinterland, some 50 kilometres to the south-west of these manufacturing operations. Transporting the sugarcane to the manufacturing operations would likely need to occur by rail to make this a viable option. Constraints include the cost of the rail infrastructure improvements, development of a regional irrigation scheme in the Biggenden-Gayndah area using water from the Mary River and Vegetation Management Regulations concerning Category C (high value regrowth) and Category R (vegetation around watercourses) that would apply to some of the land in the targeted area.
3. 23,000 hectares of additional land has been identified as suitable for sugarcane growing in and around the traditional areas supplying crops to sugar manufacturing operations in the Burdekin region, both to the north and south of the Burdekin River. For this land to come into production, there would be a need for an extension of the Burdekin River Irrigation Area with an associated increase in water storage capacity as well as an extension of the cane railway network.
4. 7,000 hectares of additional land has been identified near the Victoria mill in the Herbert and this will require an extension of the cane rail network.
5. 5,000 hectares of additional land has been identified near the Proserpine mill and this will require an extension of the cane rail network and irrigation scheme.
6. 4,000 hectares of additional land has been identified near the Plane Creek mill and this will require an extension of the cane rail network and irrigation scheme.

Totalling 58,500 hectares, this land if it could be commercialised would produce another 4.2Mt of sugar cane supply at 10-year yield averages. Considerable more work and market soundings are however required to understand the true feasibility of bringing this acreage into cane production.

There have been two sugarcane-based greenfield developments mooted in the past ten years in Queensland. One was in the Pentland area and comprised a mix of sweet sorghum and sugarcane cropping and the other was near Georgetown in the lower Gulf region between the Gilbert and Etheridge Rivers. Both have not progressed, essentially because of a lack of certainty over sufficient water resources becoming available and a shortfall in outside investment interest.

7 CONCLUSION

In response to the threats of falling cane volumes, sugar manufacturing under-utilisation and poor sugar manufacturing and cane grower financial sustainability, the Queensland sugar industry will pursue a 34Mtpa cane supply target and value-add revenue diversification over the next 10 years.

Modelling undertaken by ASMC suggests that from a baseline of 30.4Mt a 34Mtpa target is very challenging and much more aggressive E&A, variety adoption, land maintenance and horizontal expansion initiatives will be required.

The root causes of sugar manufacturing under-utilisation in the industry are falling cane supply (in trend terms) caused by flat cane yield growth and falling land under cane (also in trend terms). Beyond improvements in weather and global sugar prices, the key options to achieve Target 34 are outlined in Table 6.

TABLE 6: SUMMARY OF POTENTIAL ACTIONS

KEY THREATS	ROOT CAUSES	BROAD OPTIONS TO ADDRESS ROOT CAUSES AND ACHIEVE TARGET 34	SPECIFIC POTENTIAL ACTIONS (OUTLINED IN THIS REPORT) (NON-EXHAUSTIVE)
Sugar manufacturing under-utilisation and Compromised sugar manufacturing and grower financial sustainability	Flat cane yield growth contributing to falling cane volumes	Improved R&D and variety development and adoption	Not addressed in this report.
		More effective Extension & Adoption	A stronger risk based approach underpinning the delivery of current E&A services and a transition to a more market-orientated, outcomes based approach as farm consolidation occurs.
		New farm ownership and operating models	Development of an industry in-bound investment document that outlines the benefits and opportunities of cane farming to domestic and international investors. Changes to the FIRB laws to encourage foreign investment. Providing assistance and actively facilitate growers to work through divestment, succession, leasing and share farming opportunities. A review of government capital loan schemes to ensure products promote productivity and positive ownership and operating models.
		Improved farm profitability	Reductions in regulated water and electricity costs. Support for the commercialisation of seed planting. Improved policy certainty and incentives that promote diversified revenue streams from sugar manufacturing waste products. Replace the pre-contract arbitration and remove the Grower choice provisions in the *Sugar Industry (Real Choice in Marketing) Amendment Act 2015* (Qld) and the *Competition and Consumer (Industry Code – Sugar) Regulations 2017* (C'wth)
	Falling area of cane contributing to falling cane volumes	Regulatory land protections	Strengthening of the prime agriculture land protections in State Planning Policy.
		Addressing barriers to commercialising geographically distant land	Infrastructure incentives (transport and water mainly) required to promote horizontal expansion. Improved land, environmental and easement approvals.

APPENDIX A – QUARTILE DETERMINATION METHODOLOGY

OVERVIEW

This report examines possible cane supply paths for the Southern, Central, Herbert, Burdekin and Northern Queensland sugar manufacturing regions, and specifically in sugar manufacturing regions where ICSM, MSF, MSL, Wilmar and TSL operate.

It does this by applying 2019 as a baseline and estimating potential increases and decreases in cane supply over a 10-year period based on:

1. The area of land that may be available for sugarcane cultivation;
2. Grower's adoption of higher yielding varieties; and
3. The successful delivery of extension and adoption services and specifically, how much land and tonnes of cane might be 'uplifted' in cane yield performance (i.e. tonnes/hectare).

In estimating this uplift, yield performance quartiles based on cane yields of farms within all productivity area zones were calculated between the years 2013-2019. Using 2019 as the baseline, the amount of cane and land within each of these yield quartile bands was calculated by each productivity zone and then aggregated up to the relevant sugar manufacturing region level.

ASMC member representatives then provided assumptions about the following for each sugar manufacturing region:

1. How much land from each quartile is likely to be lost over the next 10 year period (for example, 25% of Quartile 1 land is expected to be lost to other purposes, 10% of Quartile 2 land is expected to be lost to other purposes etc.). The model then worked out the estimated loss in cane volumes;
2. The likely increase in cane volumes from growers improving their variety selection (with the model working out the likely increase in cane volumes); and
3. The likely increase in cane volumes from improved extension and adoption delivery and the 'uplifting' of growers from a lower quartile of yield performance to higher quartiles. For example from the median performance of Quartile 2 to the median performance of Quartile 3.

STEP-BY-STEP

The following describes the data collection and analysis that was completed to derive the quartiles and the uplifts.

Step 1: By sugar manufacturing region and each productivity zone and farm, each ASMC member supplied the cane yield (t/ha) of each farm for every year between 2013-2019. An average yield by farm over those years was then calculated (Table 1 provides a sample). For most productivity zones there were between 5-60 farms.

TABLE 7: CALCULATING AVERAGE YIELDS BY FARM AND BY PRODUCTIVITY ZONE (SAMPLE OF DATA)

REGION	PROD ZONE	FARM #	2019 HA HARVESTED	2013	2014	2015	2016	2017	2018	2019	2013–2019 AVG
Undisclosed	Boonaner	980		78	68	90	96	81	91	0	84
Undisclosed	Boonaner	988	55	83	94	98	88	80	74	67	83
Undisclosed	Boonaner	1015	12	0	0	0	72	67	71	83	73
Undisclosed	Boonaner	1023	24	79	70	85	85	65	69	68	75
Undisclosed	Boonaner	1031	48	58	57	86	64	70	63	41	63
Undisclosed	Boonaner	1039	34	68	69	80	62	63	59	49	64
Undisclosed	Boonaner	1047	59	74	84	99	94	72	75	61	80
Undisclosed	Boonaner	1066	25	72	82	86	79	68	64	57	73
Undisclosed	Boonaner	1074	4	0	0	0	0	0	0	69	69
Undisclosed	Boonaner	1095	16	86	72	83	98	71	69	58	77
Undisclosed	Boonaner	1103	33	83	82	97	81	55	68	63	76

Step 2: Based on the median (middle score) of all the 2013-2019 farm yield averages, a quartile distribution was calculated by each productivity zone. For example, in the 'Boonaner' productivity zone (refer to the example at Table 1 above), the quartile spread across the 78 farms became Quartile 1 (46-65 t/ha), Quartile 2 (66-76 t/ha), Quartile 3 (77-84 t/ha) and Quartile 4 (85-103 t/ha).

For these purposes Quartile 1 picks up the poorest yielding 25% of blocks, Quartile 2 the second poorest yielding 25% of blocks, Quartile 3 the third highest yielding 25% of blocks and Quartile 4 the highest yielding 25% of blocks. Using 2019 data, each individual farm (and corresponding volume of land and cane tonnes produced) was then allocated a quartile. Table 2 summarises the 'Boonaner' productivity zone quartile distribution of cane tonnes produced and the corresponding volumes of land in 2019.

TABLE 8: SORTING LAND HECTARES AND CANE PRODUCTION INTO YIELD QUARTILES (BY PRODUCTIVITY ZONE) (2019)

	PRODUCTIVITY ZONE: BOONANER			
	QUARTILE 1 POOREST PERFORMING 25% (46-65 T/HA)	QUARTILE 2 SECOND POOREST 25% (66-76 T/HA)	QUARTILE 3 THIRD BEST 25% (77-84 T/HA)	QUARTILE 4 BEST PERFORMING 25% (85-103 T/HA)
Land (ha)	583	484	661	710
Cane supply (t)	17,394	31,121	47,728	59,799

Step 3: This step was repeated for all productivity zones in the sugar manufacturing region and the respective 2019 land volumes and cane tonnes produced summed by quartile and aggregate quartile distribution percentages calculated to produce sugar manufacturing region level data (figures below are representative).

TABLE 9: AGGREGATED PRODUCTIVITY ZONE LAND (HA) BY QUARTILES

PROD ZONE	QUARTILE 1	QUARTILE 2	QUARTILE 3	QUARTILE 4
1.	360	438	441	277
2.	113	135	174	1,354
3.	666	390	90	16
4.	774	582	479	292
5.	616	535	509	397
6.	225	585	1,599	2,489
7.	219	306	657	2,199
8.	461	621	511	555
TOTAL	**3,435**	**3,591**	**4,460**	**7,579**
%'S	**18%**	**19%**	**23%**	**40%**

TABLE 10: AGGREGATED PRODUCTIVITY ZONE CANE TONNES BY QUARTILES

PROD ZONE	QUARTILE 1	QUARTILE 2	QUARTILE 3	QUARTILE 4
1.	23,082	32,244	39,089	28,237
2.	10,911	17,254	23,729	213,314
3.	49,712	41,780	10,985	2,308
4.	68,235	63,760	57,409	46,251
5.	60,066	65,046	68,519	69,013
6.	13,318	46,890	146,630	305,710
7.	13,237	24,686	58,847	258,676
8.	40,328	67,367	61,683	83,351
TOTAL	**278,890**	**361,028**	**466,892**	**1,006,859**
%'S	**13%**	**17%**	**22%**	**48%**

Step 4: By way of interpretation, and in relation to Table 3, across all productivity zones in this sugar manufacturing region, and in 2019, 18% of the land generated yields at the poorest 25% of yield performance, 19% of the land generated yields at the second poorest 25% of yield performance, 23% of the land generated yields at the third best 25% of yield performance and 40% of the land generated yields at the best performing 25% of yield performance.

Further, and in relation to Table 4, across all productivity zones in this manufacturing region, and in 2019, 13% of cane production was at yields at the poorest 25% of yield performance, 17% of cane production was at yields at the second poorest 25% of yield performance, 22% of cane production was at yields at the third best 25% of yield performance and 48% of cane production was at yields at the best performing 25% of yield performance.

Step 5: Senior ASMC member representatives of each then advised what 'uplifts' were possible in terms of successful implementation of extension and adoption programs. That is, what percentage of land in each quartile at the manufacturing region level could be 'uplifted' to achieve the median yield performance in a higher quartile. For example, and with reference to Table 3, 25% of the land in Quartile 2 (3,591 ha) is uplifted to achieve the median yield performance of Quartile 3. These representatives were also asked about their expectations of how much land in certain quartiles is expected to be lost and what yield improvements from improved variety adoption were possible at each quartile. Table 2 in section 5.1 of this report outlines the full assumptions of the modelling.

APPENDIX B – UPLIFT METHODOLOGY

Table 10, Appendix A shows that in 2019 the operation received 2,113,772t of cane and this cane was harvested from 19,065ha.

After calculating the average yields of each farm over the period 2013-2019, the minimum, maximum and median cane yields for each of this operation's eight productivity zones was calculated and the four quartile ranges were calculated.

These quartile ranges were different for each productivity zone and the percentage of 2019 tonnes harvested and allocated to each quartile also differed.

Operations management for this particular operation advised ASMC that over the next 10 years they expected:

1. In relation to variety selection and adoption:

- Growers in Q1, Q2, Q3 and Q4 to adopt new varieties and increase their yields by 0.2% pa in years 1-7 of the forecast
- Growers in Q1, Q2, Q3 and Q4 to adopt new varieties and increase their yields by 1% pa in year 8 of the forecast
- Growers in Q1, Q2, Q3 and Q4 to adopt new varieties and increase their yields by 1.5% pa in year 9 of the forecast
- Growers in Q1, Q2, Q3 and Q4 to adopt new varieties and increase their yields by 2% pa in year 10 of the forecast
- 100% of the land in Q1, Q2, Q3 and Q4 would be subject to the adoption of new varieties.

The model predicted that by the 10th year, this rate of variety adoption would increase cane supply by around 128,429 tonnes.

2. In relation to extension and adoption:

- Growers currently performing in Q1 would not benefit from E&A as 0% would achieve a Q2 (median) level of yield performance by the end of the 10 years, 20% of growers are forecast to move from Q1 to Q3, 20% are forecast to move from Q1 to Q4, 25% could move from Q2 to Q3, 0% would move from Q2 to Q4 and 20% would move from Q3 to Q4.

The model predicted that by the 10th year, this rate of E&A would increase cane supply by 94,494 tonnes.

3. In relation to land losses:

- 25% of the land currently achieving at Q1 (yield performance) would eventually be lost to other competing land uses.
- 0% of the land currently achieving at Q2, Q3 and Q4 (yield performance) would eventually be lost to other competing land uses.

4. The model predicted that by the 10th year, this rate of land loss would decrease cane supply by 81,269t.

The net result is an additional 141,654t. On 2019 performance, this would see cane supply increase to 2,255,426t. With a sugar manufacturing capacity of 2,750,000t, this sugar manufacturing operation would still be at under-capacity.

AUSTRALIAN Sugar Milling COUNCIL

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