



# Sugar in Australia: A Food System Approach

Competing Issues, Diverse Voices, and  
Rethinking Pathways to a Sustainable Transition

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and Rethinking Pathways to a  
Sustainable Transition

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The George Institute acknowledges the Gadigal People of the Eora Nation as the First Custodians of the land on which our Australian Office is situated. We pay our respect to Elders past, present and emerging.

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Probably no single food commodity on the world market has been subject to so much politicking as sugar. If it earlier was too important to be left to West Indian planters, it later became too important to be left entirely exposed to market forces. Sucrose was a source of bureaucratic, as well as mercantile and industrial, wealth. Once the magnitude of its market and potential market was grasped, maintaining control over it became important. Sugar led all else in dramatizing the tremendous power concealed in mass consumption.

**On Sugar—Sidney Mintz, *Sweetness and Power*<sup>1</sup>**

We travel together, passengers on a little space ship, dependent on its vulnerable reserves of air and soil; all committed for our safety to its security and peace; preserved from annihilation only by the care, the work, and, I will say, the love we give our fragile craft. We cannot maintain it half fortunate, half miserable, half confident, half despairing, half slave—to the ancient enemies of man—half free in a liberation of resources undreamed of until this day. No craft, no crew can travel safely with such vast contradictions. On their resolution depends the survival of us all.

**On Planetary Health—Adlai Stevenson, *US Ambassador to the United Nations, 1965*<sup>2</sup>**



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## Foreword

It has been widely acknowledged since the Declaration of Alma Ata in 1978 that public health extends well beyond the absence of disease.<sup>3</sup> The Global Charter for the Public's Health identifies protection, prevention and health promotion as being critical.<sup>4</sup> Policies for healthier communities need to go beyond disease prevention to consider social, commercial and environmental factors.

These broader issues include employment, mental health factors, productivity, climate, economics and the environment—and the challenge to a full and open discussion about sugar involves accounting for all these factors.

Sugar is a valuable commodity and an important export item for Australia. It is a valued ingredient in many foods. It is also a serious threat to human health.

A comprehensive assessment of the policy impact of sugar is well overdue. Effective policy can only be achieved when a broad understanding of the various interrelated and competing factors is achieved.

The George Institute for Global Health has thrown down the gauntlet to policymakers. How can Australia simultaneously support an important industry, protect health and value the environment? Are the conflicts simply too great to resolve? Or, is it possible, through careful dialogue, to find sensible solutions that account for the common good, self-interest, livelihoods, profits—and so much more?

The present challenges are great. However, so were those that our public health predecessors faced when they developed a comprehensive approach to issues such as tobacco and motor car-related injury and death.

Some argue that sugar is the new tobacco, though the complexities of effective policy approaches do not allow for such simple analysis. However, it is possible to extrapolate some of the successes and other lessons from tobacco policy to determine the most effective method for managing the effects of sugar on human health. Similarly, it might be possible to draw on the ideas relating to the policy development of motor car-related incidents of morbidity and mortality.

These public health interventions, although quite different, did have some common factors. For example, the use of regulation combined with comprehensive media campaigns proved to be important in both cases.

Effective media campaigns are critical prior to the introduction of restrictive regulation, as they ensure that public understanding and support are established. This approach was a key factor for success in both these policy areas.

Industry arguments commonly asserted that adults can make their own decisions. Anything else, they argued, would be a 'nanny state' approach. They regularly support community campaigns knowing that they have little influence on their own. The real value lies in garnering community support for regulative or legislative change.

The Australian community has a basic understanding of the dangers relating to the over-consumption of sugar. However, less well-understood is the extensive use of sugar in pre-prepared foods that are available as packaged foods in the supermarket. This report examines ultra-processed foods in the context of diet-related disease. However, more importantly, it highlights effects on health through the over-consumption of sugary soft drinks.

Sending price signals is an effective tool for public health success. Motor car-related policy used higher and higher fines for speeding and driving under the influence of alcohol. For tobacco, constantly increasing taxation lifted price of cigarettes. A tax on sugary soft drinks has been a demand from numerous public health professionals and groups. At this stage, the calls have fallen on deaf ears nationally in both the government and in the opposition.

The concerns of those working in the sugar industry, those working in public health and those concerned with environmental protection must be considered. The international price of sugar has, at best, flatlined in the past decades, and without the subsidies that other governments provide, Australian farmers are much more vulnerable.

Taxes on tobacco were originally used to help farmers switch to growing other products in Australia. In the Victorian highlands, it is still possible to see tobacco-drying sheds on farms that have decades ago stopped to produce other crops. Perhaps the same sort of hypothecation could be made for sugar farmers. However, this hypothecation would be in addition to the funds that the New South Wales and Queensland governments currently contribute to supporting sugarcane farmers in improving their environmental and management practices.

Complexity should not impede a comprehensive approach to the consideration of an issue such as sugar's role in our society. Although all interests must be considered, priority must be given to health in its broadest context. For Australia to develop effective policies, it is time for this sort of discussion to begin.

**Dr Michael Moore AM PhD**

Distinguished Fellow,  
The George Institute for Global Health



## Executive Summary

Much discussion and many debates have occurred in recent years regarding the topic of sugar. However, there has been scarce examination of this topic from a whole-system perspective in Australia. This report aims to conduct such an analysis. Adopting a food systems lens, this report both examines the various stages of Australia's sugar system and incorporates the narrative of the voices invested in it. The aim is to facilitate further discussion and debate regarding how a more sustainable system might eventuate for the benefit of people and planet.

Sugarcane is Australia's number one agricultural crop by volume and the 18th most valuable agricultural product, generating \$1.1 billion in revenue. Ubiquitous in the food supply, sugar is mostly consumed via industrial foods that consumers generally comprehend as being high in sugar (e.g., sugary drinks, sweet biscuits, cakes, muffins and chocolate).

These products are mainly manufactured and heavily marketed by a handful of transnational food corporations as part of a \$104.2 billion processed food and drink industry; they are primarily sold via one of the two largest supermarket chains operating in Australia.

In response to a growing awareness of sugar's effects on health, intakes have recently reduced, especially among children who now consume fewer sugary drinks. However, despite health concerns, high intakes yet persist, with almost half the population regularly consuming sugar amounts in excess of public health recommendations. Rates of sugar intakes total to approximately 13 teaspoons a day—almost 20 kilograms a year—with some population groups consuming considerably more (e.g., teenage boys [20 teaspoons] and Aboriginal and Torres Strait Islander peoples [17 teaspoons]).

The over-consumption of sugar is linked to some of Australia's most serious public health issues—notably overweight and obesity, which affect 11.2 million adults and 1.2 million children. Excess weight may increase the risk of developing several chronic diseases; however, the health effects of sugar do not start and end with its ability to load extra calories into a person's diet. There are also non-weight related health effects that challenge the long-held, rather one-dimensional, perspective that all calories (or kilojoules) are created equal.

Australia's sugar industry has made significant progress in implementing measures to reduce its environmental effects. For example, the entire New South Wales sugar industry is certified to the

globally recognised Bonsucro standard. However, sugarcane is a significant user of natural resources. For example, it uses more water than any other crop grown in Australia, and there are ongoing concerns related to the heavy use of agrochemicals. Further, the Queensland sugar industry is located next to the sensitive ecosystem of the Great Barrier Reef, which is conservatively estimated to be worth \$56 billion, to support 64,000 jobs and to contribute \$6.4 billion to the Australian economy each year—in addition to its immeasurable ecological value. Sugarcane alone accounts for more than half the annual anthropogenic load of inorganic nitrogen entering the Great Barrier Reef catchment area, which promotes crown-of-thorns starfish, a predator of coral communities.

The industry's efforts to mitigate the external costs related to the production and consumption of sugar are important; however, they are constrained by the system's necessities of returning short-term profits, increasing market share, and competing in a global marketplace with lower environmental standards. Consequently, society bears the brunt of the sugar burden. One example would be the sizeable public funds that are provided to support the sugar industry. This includes \$92.9 million between 1997 and 2015, which was spent on research and development, and more than \$34.5 from 2017 - 2022, which is intended to help sugarcane farmers adopt more environmentally sustainable farming practices.

Shifting sugar intakes to be aligned with the World Health Organization's (WHO) recommendations would significantly alter the world's sugar market by reducing demand, lowering sugar prices and reducing Australia's market share. However, the costs associated with the current sugar system are not sustainable for people or planet.

What becomes clear in this analysis is that although there are significant social, environmental and health-related issues linked to sugar, sugar itself is not the issue; the issue is the contemporary, mainstream food system at large. This report concludes that reframing sugar to be a system issue is a crucial first step in the journey towards a new way of food. The necessary transition to a healthier, fairer and sustainable sugar system will require a radical overhaul of agrifood landscapes; it will also necessitate changes that reach right into the heart of the entire food system.



## Introduction—A Food Systems Approach

Food systems are defined by the Food and Agriculture Organisation as comprising ‘the entire range of actors and their interlinked value-adding activities involved in the production, aggregation, processing, distribution, consumption and disposal of food products’.<sup>5</sup> This concept is fluid, varying from place to place and across time.

A food systems approach is cross-sectional and interdisciplinary; it weaves together insights of how food is produced, how it reaches the consumer and why it is consumed. In doing so, it cuts across different aspects of life, such as those that are:

- biological—the living processes used to produce food, the physiological drivers and effects of consuming foods and the subsequent sustainability for people and the planet
- economic and political—the power and control that individuals, groups and/or organisations exert over the different parts of the system
- social and cultural—the personal relations, community values and cultural traditions that affect people’s use of food.<sup>6</sup>

Using a whole system approach can help reveal the underlying causes of issues and provide insights regarding how they might be addressed. This report unpacks how the sugar system functions and illuminates how the costs and benefits are structurally mediated by incorporating insights from desk research and the perspectives gathered from interviews of system actors. The objective is to facilitate further discussion and debate regarding how a sustainable sugar system might eventuate.

This report is based on extensive desk research and 18 interviews with stakeholders across the value chain, sugar system researchers, and non-government organisations. The report is structured as follows:

**Part 1—The Australian sugar system.** This part outlines the structural arrangements of the current system, including key stages, actors and their economic value.

**Part 2—Influencers on the Australian sugar system.** This part surveys the outlook for sugar production and consumption in Australia, the actors and activities influencing these trends and the barriers to and enablers of change.

**Part 3—Impacts of the sugar system on planetary health and associated costs.** This part considers the main challenges related to the current system regarding environmental and health impacts and their associated costs.

**Part 4—A sustainable sugar system transition for planetary health.** This part reframes sugar as being a system issue and rethinks system transitions.





## Part 1. The Australian Sugar System

### Key Points

- By volume, more sugarcane is produced than any other crop in Australia and globally. Australia is the world's 10th largest sugar producer; however, with titanic industries in India and Brazil, Australia contributes less than three per cent to the global market.
- The sugarcane industry generates over \$1.1 billion in revenue annually, making it the 18th most valuable agricultural product in Australia. The industry is particularly important to the Queensland economy, in which more than 90 per cent of production occurs.
- Although the grower side of the industry is highly fragmented, with over 4,000 farmers, the drive for better economies of scale observes the remainder of the sugar system being increasingly dominated by large corporations. Australia's sugarcane is processed into sugar by 24 mills that are owned by eight companies. The sugar generates \$3.4 billion in revenue annually, with almost half the earnings being derived from exporting the product to neighbouring Asia.
- Sugar is fed through a consolidated processed food industry and into products such as sugary drinks (dominated by two manufacturers) and biscuits (dominated by one manufacturer). These products are sold through a food retail sector that is mainly controlled by two supermarket chains.
- Like the sugar industry, the processed food and drink industry is a sizeable part of the Australian economy, generating \$29.1 billion of GDP from 2015–16. It is estimated that sugary products contributed a \$12.8 billion revenue, representing over \$3.6 billion of the GDP in 2019.
- Average intakes of added sugar in Australia are 52 grams per day—the equivalent of 13 teaspoons. Intakes are notably higher in some sections of the population, including teenage boys (80 grams/20 teaspoons) and Aboriginal and Torres Strait Islander peoples (68 grams/17 teaspoons). Most added sugar in Australian diets originates from products in which sugar is a key ingredient, such as sugary drinks, sweet biscuits, chocolate biscuits, cakes, chocolate and confectionery.

### 1.1 Growing Sugarcane

The Australian sugar system consists of the actors and activities that influence sugar from production to consumption (see Figure 1). In Australia, more than 4,000 growers farm over 380,000 hectares of sugarcane, with most operating small- or medium-sized farms of fewer than 125 hectares (see Table 1). Both globally and in Australia, sugarcane production by volume outweighs any other crop (see Table 2). Australia typically produces over 30 million tonnes of sugarcane, and from 2018 to 2019, sugarcane was the 18th most valuable agricultural product in the country. It was estimated to contribute \$1.142 billion, representing 1.7 per cent of the total value of the agricultural sector (see Table 3).

Figure 1. The Simplified Australian Sugar System<sup>7</sup>

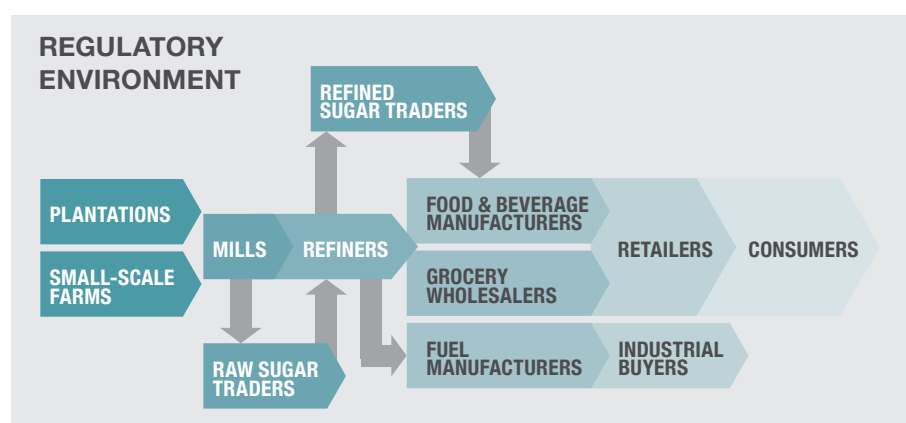


Table 1. Australian Sugar Industry Statistics, 2018–19<sup>8</sup>

Size and employment	2018
Growers	4,305
Mills	24
Milling Companies	8
Total Direct Employment	9,145
Total Direct & Indirect Employment	22,657
Hectares Harvested	382,498
<b>Production (kt)</b>	
Cane Crushed	32,492
Sugar Produced	4,725
Sugar For Export	3,700

Table 2. Top 10 Agricultural Crops Produced Globally and in Australia by Volume<sup>9,10</sup>

Rank	Global <sup>a</sup>	Australia	Crop	Volume (kt)
	Crop	Volume (Mt)		
1	Sugarcane	1,842	Sugarcane	33,507
2	Maize	1,135	Wheat	20,941
3	Wheat	772	Barley	9,254
4	Rice	770	Canola	3,893
5	Potatoes	388	Wine grapes	1,524
6	Soybeans	353	Cottonseed	1,497
7	Oil palm fruit	318	Sorghum	1,255
8	Sugar beet	301	Oats	1,227
9	Cassava	292	Potatoes	1,189
10	Vegetables <sup>c</sup>	291	Other pulses <sup>d</sup>	1,075

Notes: <sup>a</sup>2017 FAO data, <sup>b</sup>2018–19 ABARES data, <sup>c</sup>Includes vegetables that are not identified separately because of their minor relevance at the international level, with some that may be processed, including juiced, dehydrated, frozen <sup>d</sup>Faba beans, lentils, mung beans and navy beans



Table 3. Top 20 Australian Agricultural Products by Gross Value Contribution, 2018–19<sup>11</sup>

Rank	Classification	Commodity	Gross Value (\$m)	Percentage Gross Value of Total Agricultural Production
1	Livestock	Cattle and calves	11,286	16.6
2	Grains, oilseeds, pulses	Wheat	6,210	9.1
3	Horticulture	Fruit and nuts (excl. grapes)	4,902	7.2
4	Livestock product	Wool	4,505	6.6
5	Livestock product	Milk	4,371	6.4
6	Horticulture	Vegetables	4,148	6.1
7	Livestock	Lambs	3,626	5.3
8	Grains, oilseeds, pulses	Barley	3,062	4.5
9	Livestock	Poultry	2,846	4.2
10	Crop	Other crops <sup>a</sup>	2,600	3.8
11	Horticulture	Nursery, cut flowers and turf	1,674	2.5
12	Livestock	Cattle exported live	1,644	2.4
13	Industrial crop	Cotton lint and cottonseed	1,372	2.0
14	Forestry product	Softwood	1,361	2.0
15	Grains, oilseeds, pulses	Canola	1,324	1.9
16	Livestock	Pigs	1,236	1.8
17	Forestry product	Hardwood	1,214	1.8
18	Industrial crop	Sugarcane (cut for crushing)	1,142	1.7
19	Livestock	Sheep	1,041	1.5
20	Industrial crop	Wine grapes	975	1.4

Note: <sup>a</sup> Mainly fodder crops

Most sugarcane farms are family owned and operated, and have often been held in the family for generations.<sup>12</sup> The grower side of the industry is highly fragmented, with each farm owner having a market share of less than 0.1 per cent and the two largest operators—MP Australia Holdings Pty Ltd and Finasucre Investments (Australia) Pty Ltd—commanding a mere three per cent of the market each.<sup>13</sup> Therefore, no player holds significant power.

There are now 1,000 fewer sugarcane farms than there were 15 years ago, with smaller farmers selling their land to larger operators.<sup>14</sup> The continual pressure is to remain price competitive, with larger operations benefitting from cost savings through economies of scale and generally performing better financially.<sup>15</sup>

I don't think farming means as much to me as what it did to my father, certainly. I think he was a farmer in the true sense of the word. Even on a Sunday, when he wasn't working on the farm, he would be working in his garden—so he would be growing vegetables and producing things with his hands. I'm more of a businessman who farms, if that makes sense. The cane farm, to me, is a business. I get enjoyment and satisfaction from growing the crop and growing it well—and I certainly have pride in that, but it's more business orientated as opposed to love. I don't believe any of our generation are farming the land with our hands and with the toil that the previous generations did. It's a different game nowadays.

**Research Participant—Fourth-Generation Sugarcane Farmer**

There's different financial pressures and different expectations of standards of living. If you are not farming on a bigger scale and using your capital efficiently, then you're not in the game. The day of the small farmer, I don't believe, fits anymore. The economics just don't work.

**Research Participant—Fourth-Generation Sugarcane Farmer**



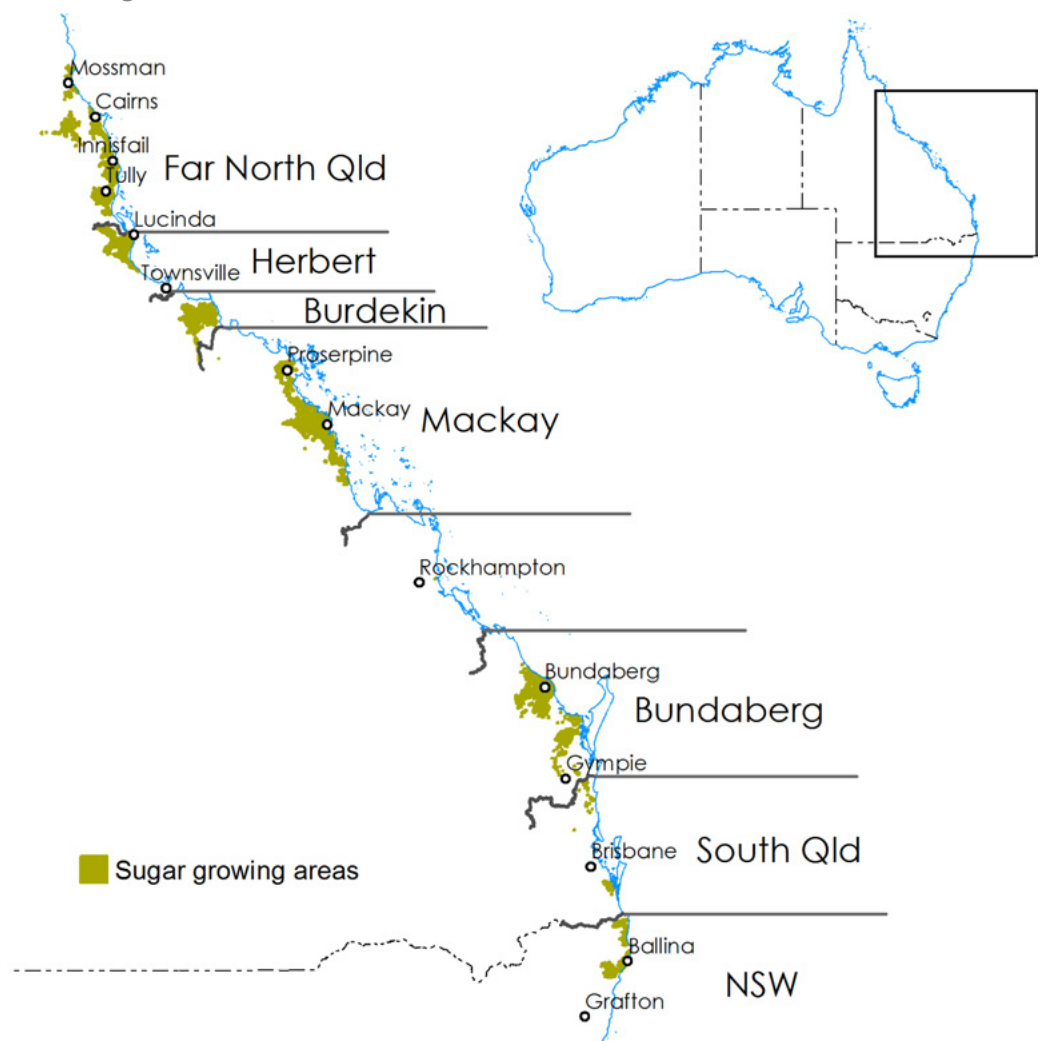
An Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) report in 2015 found that almost a quarter (22 per cent) of farmers expected that they would retire or sell their farms in the next five years.<sup>16</sup> Apart from the growers, there is also a wider economy that is dependent on the production of sugarcane, with over 22,000 people who are employed indirectly (see Table 1). As one participant explained:

When you look at what's provided: you've got the growers, a harvesting transport operation, a milling operation, another transport operation that goes off the back of that and a refining operation. And then you look back into the community itself and see what's reliant on the [sugar] industry being successful, and you've got so many different suppliers that, effectively, if we weren't there, they wouldn't be there. And then, you go through to the communities themselves with all the families. There's such a lot of reliance on the [sugar] industry ... you just don't get the same impact out of most other agricultural industries. It's an integrated system and in the rural communities, [sugar] is what makes them survive.

**Research Participant—Australian Sugarcane Grower and Miller Representative**

Sugarcane is grown as a large-scale monoculture. It requires an abundance of sunshine and water and is best suited to semitropical and tropical climates. The industry operates across a 2,100 kilometre stretch of northern New South Wales and Queensland, with most of the crop grown within 50 kilometres of the sea (see Figure 2). More than 90 per cent of production occurs in Queensland due to the more favourable climatic conditions and a legacy of historical government assistance (e.g., capital investment and infrastructure) that supported the industry's establishment.<sup>17</sup> Sugarcane is particularly important to the Queensland economy, as it is second only to meat (mainly beef) in terms of value of production.<sup>18</sup>

Figure 2. Australian Sugarcane Regions<sup>19</sup>



## 1.2 The Harvesting and Processing of Sugarcane

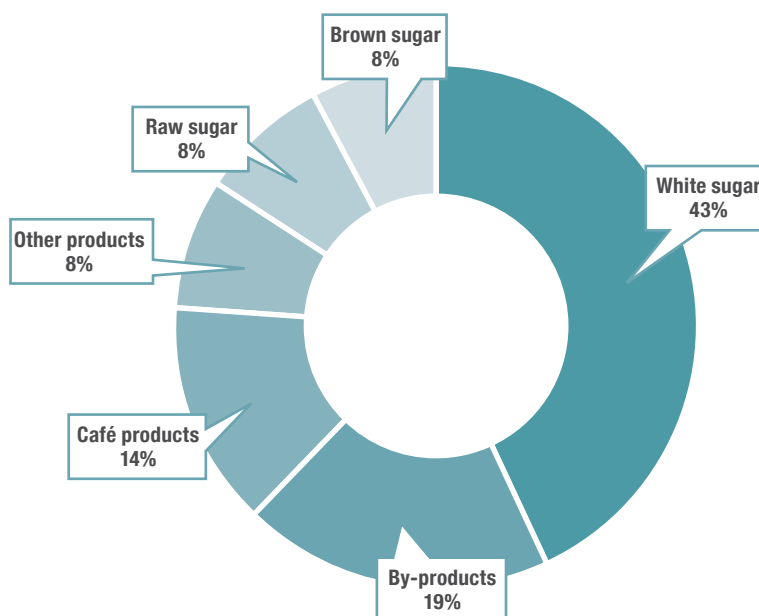
Australia's primary sugarcane industry is highly mechanised and subject to strict labour regulations.<sup>20,21</sup> It is often only the farmer or seasonal skilled labourer who is employed during harvest time. Once harvested, the sucrose content of sugarcane starts to diminish and it must thus be processed in a timely manner by a nearby mill. This signifies that domestic processors are the producers' only direct market. Growers are secured into supply arrangements with the mills:

Sugarcane is a ratooning crop, which means you plant it once and you'll probably get three or four seasons out of it. A grower will sign a delivery contract with the sugar mill that usually has multiple seasons, and so they're effectively locked into production for a number of years, both in terms of the variety of crop and the contractual obligation to deliver. Within three to five years, they could get out of cane entirely if they wanted to, but they can't just decide today [that] 'I'm going to not grow cane in six months' time' because they're contractually obliged to do so.

### Research Participant—Cane Farmer Peak Body Representative

Processing sugarcane initially occurs in mills, in which the cane is crushed through rollers to separate the sucrose-containing juice from the fibre (bagasse). The juice is then purified, concentrated and crystallised to produce raw sugar, which is then transported to a refinery to be decolourised, purified and produced as white 'refined' sugar (see Figure 3). Refined white sugar is consumed directly as table sugar, or it is incorporated into industrial food and drink products.

**Figure 3. Segmentation of Processed Sugarcane-Based Products, 2018–19<sup>22</sup>**



SOURCE: IBISWORLD

Note. Café products include single-serve portions and sugar cubes. Other products include sugar-based syrups for human consumption, such as golden syrup and treacle.

In 2018, 33,502 kilotonnes of sugarcane produced 4,725 kilotonnes of sugar and the industry's revenue was \$3.449 billion the same year (see Table 1).<sup>23</sup> The International Sugar Organisation reports that Australia is the world's 10th largest producer of sugar; however, supply is heavily skewed towards a handful of major players, including India and Brazil (see Table 4). Contributing less than three per cent of global production, Australia is a price taker in the world market (see Section 2.3.2).<sup>24</sup>



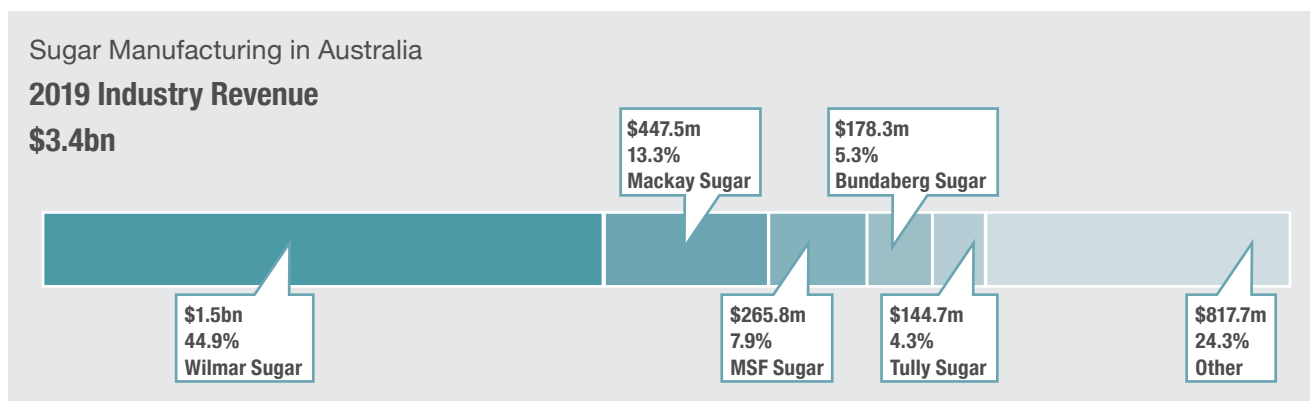
Table 4. Top 10 Sugar Producers, Consumers, Importers and Exporters, 2018 (Mt)<sup>25</sup>

Rank	Producers		Consumers		Importers		Exporters	
1	India	33.30	India	25.39	Indonesia	5.23	Brazil	21.26
2	Brazil	29.29	EU-28	17.94	China	5.06	Thailand	11.04
3	EU-28	18.18	China	16.10	USA	2.37	Australia	3.09
4	Thailand	15.44	Brazil	10.47	Malaysia	1.95	Guatemala	1.63
5	China	10.71	USA	10.19	Algeria	1.77	EU-28	1.61
6	USA	7.78	Indonesia	6.89	Korea, Rep. of	1.61	Mexico	1.58
7	Pakistan	6.28	Russian Fed.	5.82	Saudi Arabia	1.31	Pakistan	1.15
8	Russian Fed.	6.18	Pakistan	5.25	Egypt, Arab R.	1.29	India	0.88
9	Mexico	5.92	Mexico	4.27	Canada	1.23	Colombia	0.64
10	Australia	4.64	Egypt, Arab R.	3.30	Japan	1.26	Ukraine	0.58
	World Total	178,612	World Total	172,441				

Notes: Figures provided are for total sugar (beet and cane, raw and white/refined); considering cane alone would remove the EU from the top 10 and affect some of the ordering of the other countries shown.

In contrast to the producer side of the system, the manufacturing sector is increasingly becoming highly concentrated. In 1980, 19 companies operated 33 mills; but today, only eight companies operate 24 mills, with the largest manufacturer, Wilmar Sugar, controlling almost half the industry and foreign ownership a dominating feature (see Figure 4 and Table 5).<sup>26</sup> There are three refineries in Australia, two of which are owned by Mackay Sugar and the third by NSW Sugar Milling Co-Operative (see Table 5).

Figure 4. Market Share of Major Sugar Manufacturers in Australia 2018–19<sup>27</sup>



SOURCE: IBISWORLD

Table 5. Australia-Based Sugar Mills and Refineries<sup>28, 29</sup>

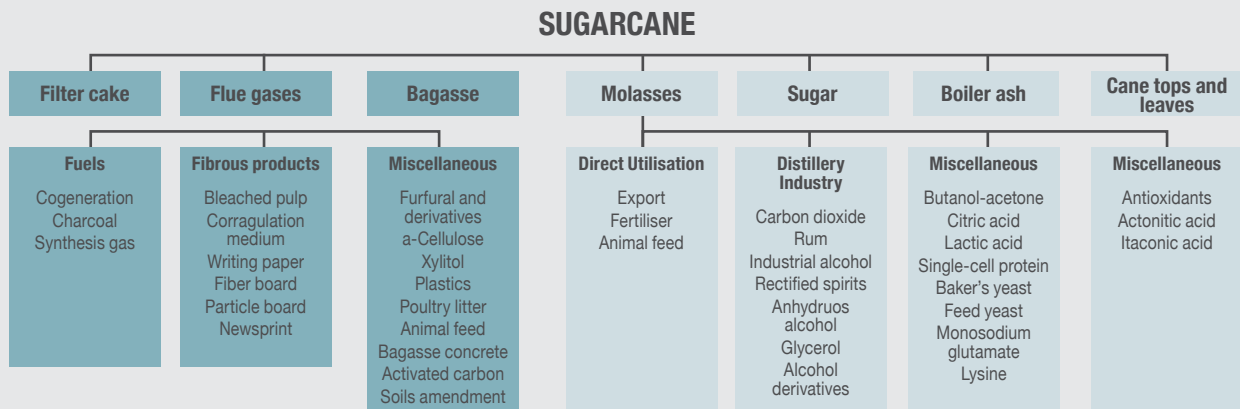
Company	Ownership	Mills	Refineries
Wilmar Sugar Australia	Wilmar International (Singapore)	Macknade, Victoria, Invicta, Kalamia, Pioneer, Inkerman, Proserpine and Plane Creek	
MSF Sugar Ltd	Mitr Pohl (Thailand)	Mulgrave, South Johnstone, Tableland and Maryborough	
Tully Sugar Ltd	China National Cereals, Oil and Foodstuffs Corporation/COFCO (China)	Tully	
Mackay Sugar Ltd	Nordzucker (German) owns 70% share	Fairleigh, Racecourse, Marian and Mossman	Racecourse and Yarraville
Bundaberg Sugar Ltd	Finasucre (Belgium)	Millaquin and Bingera	
Isis Central Sugar Mill Company Ltd	Privately owned (Australia)	Isis	
Sunshine Sugar	Co-operative	Harwood, Condong and Broadwater	Harwood Refinery
W H Heck and Sons Pty Ltd	Privately owned (Australia)	Rocky Point	



### Box 1. Sugarcane By-Products

Several by-products are produced from sugarcane, including molasses and bagasse (see Figure 5). The former is fermented to produce ethanol, or it is sold as animal feed, while the latter is burned as a fuel to supply steam and electricity for the milling process. Due to mounting pressures related to climate change, increasing pollution (most notably plastic) and the finiteness of fossil resources, increasing attention is being paid to growing a bio-based economy or bioeconomy.

Figure 5. Sugarcane-based Products<sup>30</sup>



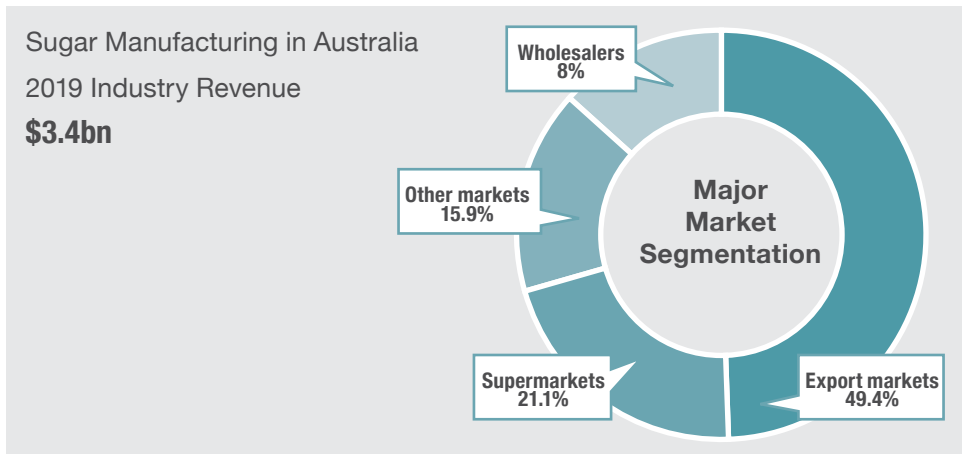
The FAO defines bioeconomy as ‘the production, utilization and conservation of biological resources, including related knowledge, science, technology and innovation, to provide information, products, processes and services across all economic sectors aiming toward a sustainable economy’.<sup>31</sup> Australia’s sugar-based bioeconomy is still in its infancy, particularly when compared to Brazil’s sugar industry that, as one participant noted, ‘has had a revolution. Brazil doesn’t market itself as a sugar producer but as an energy provider, because what comes out of the mill now is mostly energy.’

Queensland currently has three biorefinery plants—one of which, owned by Wilmar Sugar, that can produce 60 million litres of molasses-based ethanol a year.<sup>32</sup> The Queensland government aims to expand this capacity, having recently identified ‘biofutures’ as a priority industry and having developed a 10-year roadmap and action plan to grow the state’s bioproducts and biotechnology market into a \$1 billion industry by 2026.<sup>33</sup>

### 1.3 Domestic and International Markets for Sugar

In the Australian supply chain, some refined sugar is sold directly to consumers through supermarkets or wholesalers as household sugar. Some is purchased by food and drink manufacturers for incorporation into their products (shown as ‘Other markets’ in Figure 6). Australia produces significantly more sugar than is needed to meet domestic needs, with approximately half (by revenue) being exported.

Figure 6. Major Markets for Australian Sugar by Revenue, Split 2018–19<sup>34</sup>



SOURCE: IBISWORLD



In 2018, Australia exported three million tonnes of raw sugar (67 per cent of production by volume), making it the third largest exporter—though the country ranked significantly behind leading exporters such as Thailand (11 million tonnes) and Brazil (21 million tonnes) (see Table 4). Australia has taken advantage of its geographical position to significantly contribute to Asia’s sugar bowl, with South Korea, Indonesia and Japan estimated to comprise 78 per cent of Australia’s total sugar exports from 2018 to 2019.<sup>35</sup> Generally, the New South Wales sugar industry supplies the domestic market with raw and refined sugar and the Queensland industry produces raw sugar for export:

Australia is a reliable supplier. So, if you are an industrialist in Japan, China or South Korea, you know that Australia will always be able to meet its contract. Even when the state gets hit by cyclones or very severe droughts, we have, as a country, never failed to meet our contract obligations.

**Research Participant—Australian Sugar Historian**

#### 1.4 Food and Drink Manufacturing

Sugar plays numerous roles in the production of food and drink products, with the amount varying greatly depending on its purpose. Sugar is incorporated into a variety of products in the supply chain, predominantly because it is a relatively inexpensive method of enhancing taste. The ubiquity of sugar in food supply has been highlighted as one factor that contributes to excessive consumption:

I think the food manufacturers have got to have a good look at themselves and ask, ‘Do we really need to put this amount of sugar into the fruit loops that mums buy for kids for their brekkie?’ You can have a glass of orange juice with your breakfast, thinking it would be a good start for the day, but if you dig into the label, some of the brands are loaded with extra sugar. The manufacturing sector has put a lot of sugar into their products to make them more saleable as a tastier option, I guess. In a way, that has supported us because they’ve bought all our sugar. But, there’s a lot of people that are consuming sugar that may not know just how much sugar they are actually consuming because of where it is within their diet.

**Research Participant—Fourth Generation Sugarcane Farmer**

Reaching 82 per cent, processed food and drink production constitutes the largest portion of Australia’s food and grocery industry—with a turnover of \$104 billion from 2015 to 2016 and an employment record of over 200,000 people.<sup>36</sup> The sector is a core part of the economy, contributing \$26 billion to Australia’s total GDP of \$10,798 billion from 2015 to 2016.<sup>37</sup> Most of the processed food and drink that is consumed in Australia is produced domestically and uses both home-supplied and imported ingredients.<sup>38</sup> Overall, Australia is a net exporter of processed food and drinks to key markets in the United States (US), China and Japan.<sup>39</sup>



In terms of sugar sold to companies that are located in Australia, the largest purchasers are manufacturers of soft drinks—though their share has declined in recent years due to a drop in sugary drink sales—followed by chocolate and confectionery manufacturers, cake and pastry manufacturers and ice cream manufacturers.<sup>40</sup> When combined, sugary products within these industry sectors contributed approximately \$12.8 billion in revenue, attributing over \$3.6 billion to the GDP in 2019 (see Table 6).





**Table 6. Major Australian Manufacturers of Sugary Food and Drink Products and Their Expected Market Share and Revenue, 2019–20<sup>41, 42, 43, 44</sup>**

Sector	Major Companies	Market Share (%)	Revenue 2019–20 (\$ bn)	Industry Value Added 2019–20 (\$ bn)
Soft Drink Manufacturing			4.3	1.3
	Coca-Cola Amatil Ltd Brands: Coca-Cola, Sprite, Fanta, Lift, Kirks, Deep Spring, Mount Franklin, Pump, Powerade, Barista Bros, Fuze Tea, Keri Juice Blenders, Monster and Mother	37	1.6	
	Asahi Holdings Australia Pty Ltd Brands: Pepsi, Schweppes, Solo, Mountain Dew, Gatorade, Phoenix Organic, Sunkist	15	0.6	
	Other soft drink manufacturers	48	2.1	
Chocolate and Confectionery Manufacturing			6.3	1.6
	Mondelez Australia Holdings Pty Ltd Brands: Cadbury, The Natural Confectionery Company, Sour Patch Kids, Pascall	11	0.7	
	Wrigley Uno 2 Australia Pty Ltd Brands: Mars Bar, Snickers, M&M's Skittles, Twix, Milky Way, Starburst, Extra, Eclipse, 5 gum	10	0.6	
	Nestle Australia Ltd Brands: Aero, Milkybar, Kit Kat, Smarties, Allen's, Life Savers	8	0.5	
Cake and Pastry Manufacturing <sup>a</sup>	Other chocolate and confectionery manufacturers	71	4.4	
			1.4 (0.7)	0.6 (0.3)
	Patties Foods Pty Ltd <sup>b</sup> Brands: Four 'n' Twenty, Herbert Adams, Nanna's, Patties Pies, Chefs Pride, Boscastle	16	0.2	
	McCain Foods (Aust) Pty Ltd Brands: Sara Lee	8	0.1	
Biscuit Manufacturing <sup>c</sup>	Other cake and pastry manufacturers	76	1.1	
			0.8 (0.4)	0.3 (0.1)
	Arnott's Biscuits Holdings Pty Ltd Brands: Tim Tam, Vita-Weat, Shapes, Scotch Finger, Cruskits	71	0.6	
	Green's Foods Holdings Pty Ltd Brands: Paradise, Waterthins, Waterwheel, Roccas Deli	12	0.1	
Ice Cream Manufacturing	Other including Modern Baking Company, Byron Bay Cookie Company, Kez's Kitchen, Mondelez	17	0.1	
			1.1	0.3
	Regal Cream Products Pty Ltd Brands: Bulla Dairy Foods, Cadbury Ice Cream	25	0.3	
	Peters Food Group Pty Ltd Brands: Peters, Connoisseur, Proud & Punch, Gelato Fiasco	25	0.3	
	Unilever Australia Group Pty Ltd Brands: Streets, Weis	21	0.2	
	Norco Co-operative Ltd Brands: Private label products for Coles, Woolworths and ALDI, Sara Lee	10	0.1	
	Other	19	0.2	

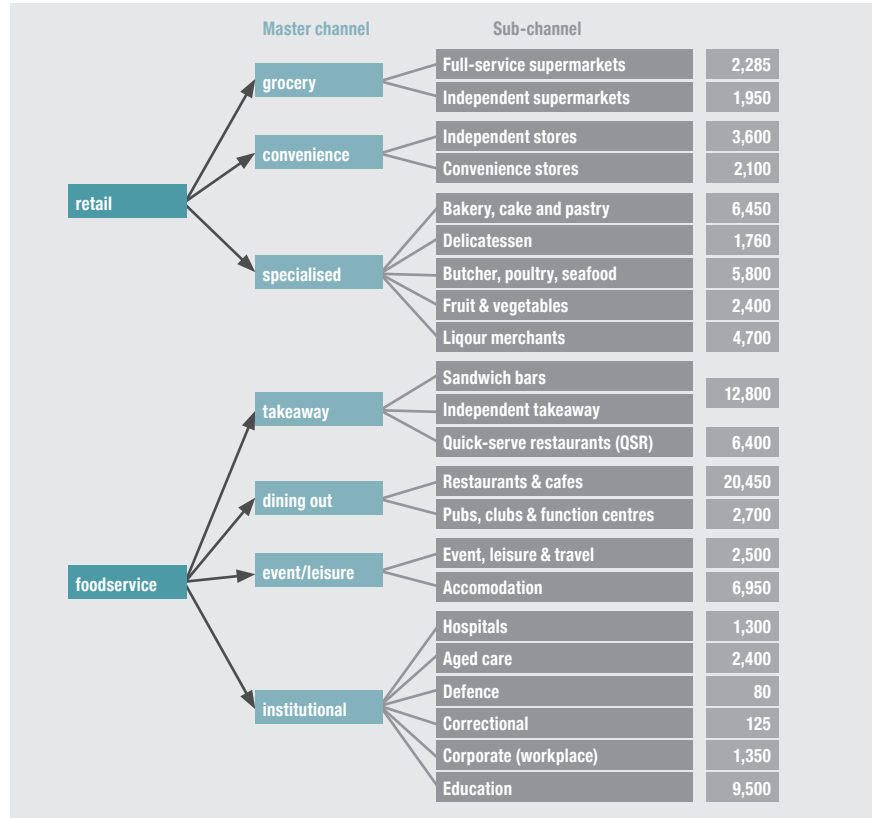
Notes: All figures are for total market, including imports and exports, and thus may contain sugar sourced from or consumed in other countries. <sup>a</sup>The cakes and pastry manufacturing industry includes both sweet and savoury products, the latter of which will contain little added sugar. Savoury pastries are the largest segment of this industry. The total revenue figure includes savoury pastries and the bracketed figure is based on cakes (27.5% of revenue) and sweet pastries (25.0% of revenue). The IVA was calculated using same ratio (52.5%). <sup>b</sup>Mainly focused on savoury pastries. <sup>c</sup>The biscuit manufacturing industry includes both sweet and savoury products, the latter of which will contain little added sugar. The total revenue figure includes savoury biscuits and the bracketed figure is based on sweet biscuits (28.7% of revenue) and chocolate biscuits (16.4% of revenue). The IVA was calculated using same ratio (45.1%).



### 1.5 Retail and Food Service

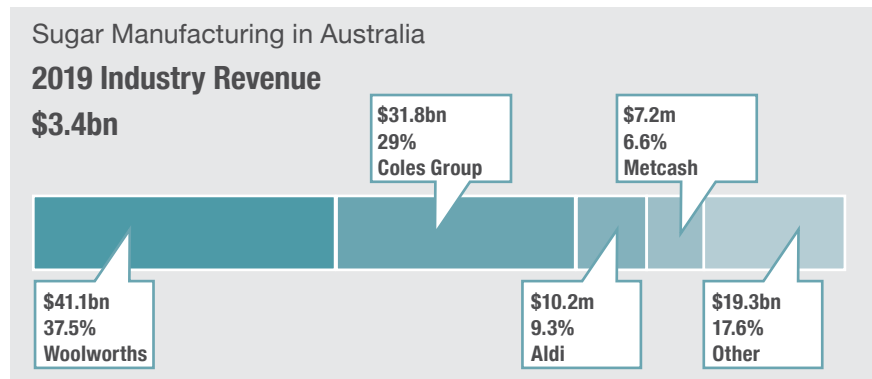
The main routes through which consumers obtain food can be broadly divided into retail (e.g., supermarkets, convenience stores and specialised stores such as bakeries) and food services (e.g., takeaways, restaurants and institutions) (see Figure 7).

Figure 7. Consumer Food Purchase Channels: Outlet Types and Numbers<sup>45</sup>



The market share of food service—otherwise referred to as the ‘out of home’ segment—has grown considerably, increasing from a quarter of food spending 30 years ago to more than a third of food spending from 2015 to 2016.<sup>46</sup> Nevertheless, the bulk of food is still being purchased from retailers, and the sector is dominated by a duopoly of the two major supermarkets, Woolworths and Coles, that together account for over two-thirds (67 per cent) of the market (see Figure 8). However, the supermarket giants are being increasingly pressured by Aldi and Costco, and the recent entry of AmazonFresh and Lidl into the Australian food retailing sector is likely to further intensify the competition.<sup>47</sup>

Figure 8. Market Share of Major Food Retailers in Australia, 2019–20<sup>48</sup>



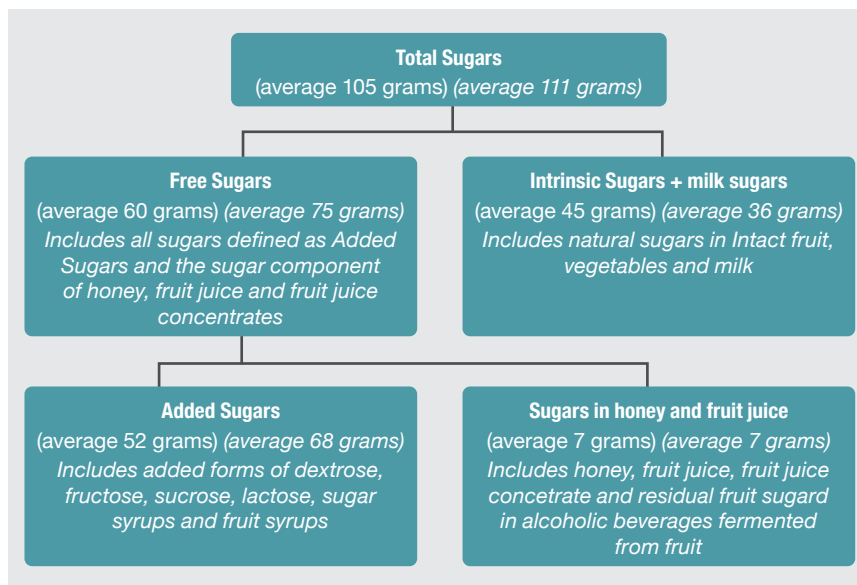
SOURCE: IBISWORLD



## 1.6 Sugar Consumption

The most recent national dietary survey was conducted in the period 2011 to 2012 and reported that Australians typically consume a total of 105 grams of sugar a day. Approximately half of this—52 grams, the equivalent of 13 level teaspoons—is derived from added sugars, which is significantly above recommended amounts (see Figure 9).<sup>49</sup>

**Figure 9. Average Consumption of Total, Free and Added Sugars in Australia, 2011–12 (Aboriginal and Torres Strait Islander peoples, 2012–13 shown in italics)<sup>50, 51</sup>**



Although consumption figures are helpful for considering how the Australian population broadly compares with recommended maximum intakes, it is important to recognise that mean figures mask consumption patterns in some notable subgroups:

- Sugar intakes are particularly high in teenage boys aged 14 to 18, who are consuming more than 80 grams (20 level teaspoons) of added sugar a day on average (see Table 7). The top 10 per cent of this group consumes 148 grams (37 level teaspoons) a day.<sup>52</sup> Sugar intakes are highest among the most disadvantaged groups in inner regional areas and in adults who have lower levels of educational attainment.<sup>53</sup>
- A separate analysis of Aboriginal and Torres Strait Islander peoples also reports higher consumption levels. This group displays mean intakes of added sugar at 68 grams (17 level teaspoons), which amounts to an additional 16 grams (four level teaspoons) per day than the non-Indigenous population (see Figure 9, italicised information).

**Table 7. Mean Consumption of Added Sugars by Age and Sex in Australia, 2011–12<sup>54</sup>**

Sex	Age Group							
	2–3 yr	4–8 yr	9–13 yr	14–18 yr	19–30 yr	31–50 yr	51–70 yr	71 + yr
Males (tsp)	8	13	17	20	19	15	12	11
Females (tsp)	8	11	15	16	13	11	9	5

Notes: 1 level teaspoon = 4 grams. Data rounded to nearest whole number.



**Box 2. Sugar Intake Recommendations**

Sugar intake recommendations reflect maximum intakes, above which adverse health effects may occur (see Section 3.2).<sup>55</sup> In 2015, the WHO updated their guidelines for sugars, issuing a strong recommendation for the reduction of free sugars to less than 10 per cent of total energy for all ages (see Table 8).<sup>56</sup> The Australian Dietary Guidelines also recommend limiting the consumption of foods and drinks that contain high amounts of added sugars, based on tooth decay evidence and the link between the consumption of sugary drinks and weight gain in children and adults.<sup>57</sup>

**Table 8. Recently Published Guidelines for Sugar Intakes<sup>58, 59</sup>**

Organisation (yr)	Recommendations
World Health Organization (2015)	Strong recommendation to reduce the intake of free sugars to less than 10 per cent of energy for adults and children  Conditional recommendation for a further reduction of free sugars to less than 5 per cent of energy for adults and children <sup>a</sup>
UK Scientific Advisory Committee on Nutrition (2015)	Free sugars should not exceed 5 per cent of total dietary energy from two-years-old and upwards

**Notes:** <sup>a</sup>The WHO advises that the conditional recommendation is made due to the lack of certainty ‘about the balance between the benefits and harms or disadvantages of implementing a [further] recommendation’. <sup>b</sup>The UK guidelines recommend a limit of 5 per cent of energy from free sugars to support a moderate degree of weight loss for the majority of people, based on a reduction of 418kJ/person/day (100kcal/person/day).<sup>60</sup>

The WHO recommendations are provided as a relative figure of less than 10 per cent of energy from free sugars for both adults and children (hereafter referred to as WHO-10), rather than as an absolute amount. This signifies that an individual with greater energy needs is afforded a higher absolute amount of sugars per day than an individual with lower energy needs (see Table 9). As such, the ‘highest’ maximum intake of approximately 59 grams (15 level teaspoons) of free sugars is recommended for males in the 19–30 years age group. This demonstrates that an element of translation is needed to convert guidelines to facilitate consumer understanding.

**Table 9. Maximum Recommended Intakes of Free Sugar per Day by Age and Sex**

Age (years)	Males		Females		Males		Females	
	Free Sugars (g)	Free Sugars (tsp)	Added Sugars (g)	Added Sugars (tsp)	Free Sugars (g)	Free Sugars (tsp)	Added Sugars (g)	Added Sugars (tsp)
		10%		5%		10%		5%
2–3	25	6	13	3	24	6	12	3
4–8	33	8	17	4	31	8	15	4
9–13	44	11	22	6	40	10	20	5
14–18	58	15	29	7	47	12	24	6
19–30	59	15	30	8	48	12	24	6
31–50	57	14	28	7	46	12	23	6
51–70	52	13	26	7	44	11	22	6
>70	48	12	24	6	42	11	21	5

**Notes:** Calculated using NRVs (Tables 1–3, pp.16–19) for energy based on BMI of 22.5 using PAL of 1.6.<sup>61</sup> Age groups averaged. Rounded to nearest whole number. 1 level teaspoon = 4 grams sugar.



### 1.6.1 Foods Contributing to Sugar Intakes

The main contributors to sugar intakes are products that both contain high amounts of sugar as a proportion of total ingredients and that are consumed regularly and/or in large amounts (see Table 10). As expected, the notable categories of these products include sugary drinks, sweet biscuits, cakes, chocolate and confectionery:

One of the really interesting insights that we got as an industry from being involved with the project committee for the Health Star Rating was that there was a whole lot of consumer research that the government was doing to try to get a bit of a lens on what consumers thought about different products; and there were two categories of products that consumers understood really well. One was confectionery and one was soft drinks. Consumers are, as per the government research, under no misapprehension around what these products contain from an ingredient perspective. But then you get to something like a ready-made soup or a frozen pizza, for example, and there was a lot of confusion around the sort of nutritional value of those types of product.

#### Research Participant—Soft Drink Manufacturers’ Peak Body Representative

Table 10. Leading Contributors of Added Sugars by Food Group, 2011–12<sup>62</sup>

Category	Age Group (years)										
	2–3	4–8	9–13	14–18	19–30	31–50	51–70	71 and over	2–18	19 and over	Total 2 years and over
	Proportion of Added Sugars (%)										
	Persons										
Soft drinks, flavoured mineral waters, cordials, and fruit/vegetable drinks	26.8	27.9	32.7	39.1	38.8	30.9	23.1	17.2	33.4	30.3	31.0
Electrolyte, energy and fortified drinks	0.0	0.2	0.8	3.0	4.7	2.7	0.6	0.1	1.4	2.6	2.3
Other non-alcoholic beverages incl. tea, coffee	2.6	1.7	2.6	1.8	1.8	1.5	1.7	1.3	2.2	1.6	1.7
Flavoured milks and milkshakes	1.3	3.0	3.9	3.6	2.9	2.3	1.5	1.5	3.4	2.2	2.5
Breakfast cereals incl. ready to eat and hot porridge type	3.3	4.1	3.4	2.7	2.7	2.7	3.1	3.9	3.4	2.8	3.0
Sweet biscuits	9.9	6.5	5.9	4.0	3.8	3.6	4.9	7.5	5.7	4.3	4.6
Cakes, muffins, scones, cake-type-desserts	12.2	13.1	11.5	7.7	7.0	9.7	11.4	13.5	10.6	9.6	9.9
Other cereal-based products and dishes incl. savoury biscuits, pastries	3.5	3.7	4.5	5.3	4.0	4.0	4.0	3.1	4.4	4.0	4.0
Yoghurt	7.7	4.1	1.5	0.8	1.6	2.0	2.6	1.6	2.3	2.0	2.1
Frozen milk products	3.4	5.9	6.8	4.7	3.6	3.5	5.2	6.4	5.6	4.2	4.5
Sugar, honey and syrups	2.7	3.8	4.6	6.3	7.2	13.8	15.3	16.6	4.9	12.4	10.6
Jam and lemon spreads, chocolate spreads, sauces	3.7	3.8	1.6	1.8	1.4	2.0	3.2	5.8	2.3	2.5	2.4
Chocolate and chocolate-based confectionery	6.6	5.2	6.2	5.7	4.4	5.9	7.1	4.3	5.8	5.6	5.6
Other confectionery	4.3	4.2	4.1	2.9	2.8	2.7	2.9	3.4	3.7	2.8	3.0
Total	88	87.2	90.1	89.4	86.7	87.3	86.6	86.2	89.1	86.9	87.2



## Part 2. Influencers on the Australian Sugar System

### Key Points

- Although sugar intakes have decreased in recent years, Australians remain heavy consumers of sugar. Demand is underpinned by a universal preference for sweetness and a food environment that, for the purposes of maximising profits and growing market share, overwhelmingly emphasises and encourages the purchase and consumption of sugary products. This is achieved through pervasive marketing and advertising practices such as product placement and price promotions in supermarkets, as well as the sponsorship of sports clubs.
- Elevated sugar consumption ensures that the demand for sugar and sugary products persists, despite the media's increasing attention on sugar's negative health effects. The sugar system adapts to the environment in which it operates. Emergent responses include product innovation, reformulation and investment in brands that have a lesser amount of sugar—actions that seek to maintain market share in an increasingly difficult operating environment, if not to generate new platforms from which businesses can grow market share.
- Government agencies at a state, territory or national level have competing influences on the sugar system. On one side, they seek to enact informational or educational policies, such as food labelling or restricting the advertising and/or sale of sugary products in select instances. Conversely, they provide significant financial support to the sugar industry to ensure its economic viability and competitiveness on the global stage.
- The availability, consumer acceptability and technical applicability of sugar substitutes also influences the sugar system. A survey of nearly 6,000 randomly selected products found that sugar substitutes may outcompete sugar in terms of product usage in the Australian marketplace, with 69 per cent of products containing non-nutritive sweeteners compared to 61 per cent of products containing white sugar.

### 2.1 Trends and Outlook for Sugar Consumption and Production

#### *Sugar Consumption*

Although sugar intakes are still far higher than recommended levels, the amount of sugar that Australians consume has decreased in recent times:

- In 1995, 54 per cent of the population exceeded WHO-10.
- From 2011 to 2012, 46 per cent of the population exceeded WHO-10.

As both an absolute amount and as a relative proportion of energy, the consumption of added sugars has dropped from 10.7 per cent of energy to 9.5 per cent, and to 12 grams less per day: for free sugars, consumption has dropped from 12.5 per cent to 10.9 per cent of energy, and to 15 grams less per day.<sup>63</sup> Nearly all this reduction can be attributed to large drops in the consumption of sugary drinks in children (including fruit juice, if considering free sugars more broadly) (see Figure 10). In children aged two to 18 years, the mean added sugar consumption has fallen from 84 to 58 grams, or from 14.4 per cent to 11.3 per cent of energy. This starkly contrasts with the results for adults, who only exhibited a drop of 57.9 to 50.6 grams, or from 9.5 per cent to nine per cent of energy from added sugars (see Table 11).



Figure 10. Consumption of Free Sugars as a Proportion of Energy Intake, 1995 to 2011–12<sup>64</sup>

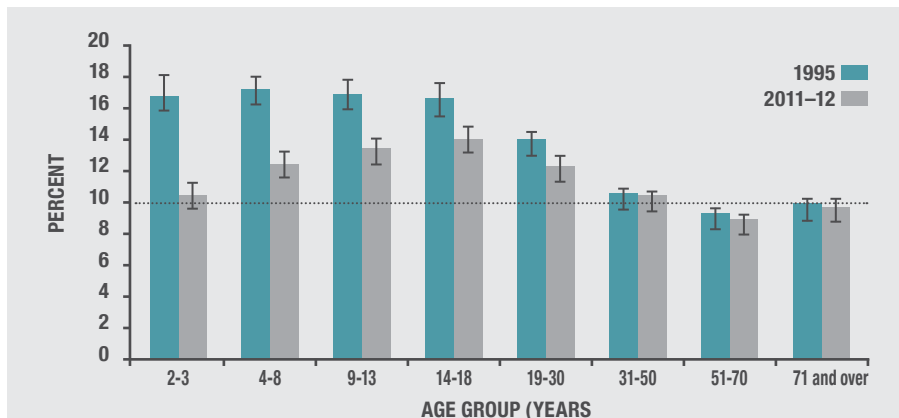


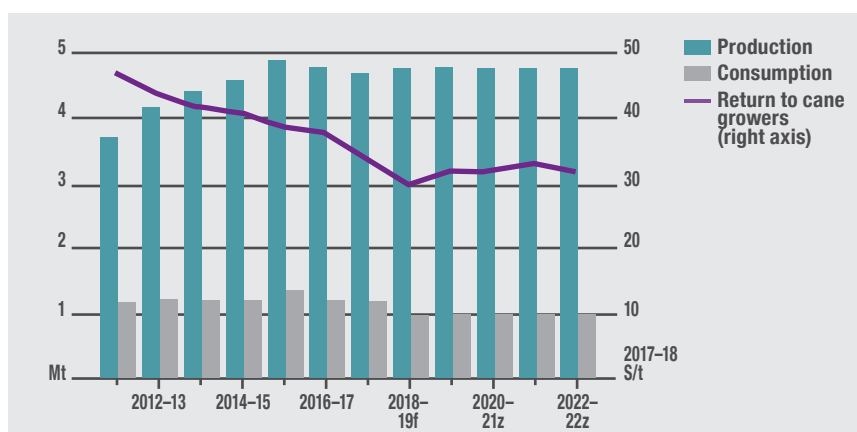
Table 11. Free and Added Sugar Consumption, 1995 and 2011–12, All Persons<sup>65</sup>

	2-3	4-8	9-13	14-18	19-30	31-50	51-70	71+	Children Total (2-18 years)	Adults Total (19+ years)	Population Total (2+ years)
<b>Free Sugars g/day (% energy/day)</b>											
<b>1995</b>	67g (17%)	84g (17%)	102g (17%)	117g (17%)	94g (14%)	65g (11%)	50g (9%)	46g (10%)	97g (17%)	67g (11%)	74 (13%)
<b>2011-12</b>	41g (11%)	56g (13%)	72g (13%)	81g (14%)	73g (12%)	59g (10%)	48g (9%)	46g (10%)	66g (13%)	58g (10%)	60g (11%)
<b>Change</b>	-26g (-6%)	-18g (-4%)	-30g (-4%)	-36g (-3%)	-21g (-2%)	-6g (-1%)	2g (0%)	0g (0%)	-33g (-4%)	-9g (-1%)	-14g (-2%)
<b>Added Sugars g/day (% energy)</b>											
<b>1995</b>	53g (13%)	71g (14%)	91g (15%)	104g (15%)	82g (12%)	56g (9%)	42g (8%)	38g (8%)	84g (14%)	58g (10%)	64g (11%)
<b>2011-12</b>	32g (8%)	48g (11%)	64g (12%)	73g (13%)	65g (11%)	52g (9%)	42g (8%)	39g (8%)	58g (11%)	51g (9%)	52g (10%)
<b>Change</b>	-21g (-5%)	-23g (-3%)	-27g (-3%)	-31g (-2%)	-17g (-1%)	-4g (0%)	0g (0%)	+1g (0%)	-26g (-3%)	-7g (-1%)	-12g (-1%)

Note: Figures rounded to nearest whole number.

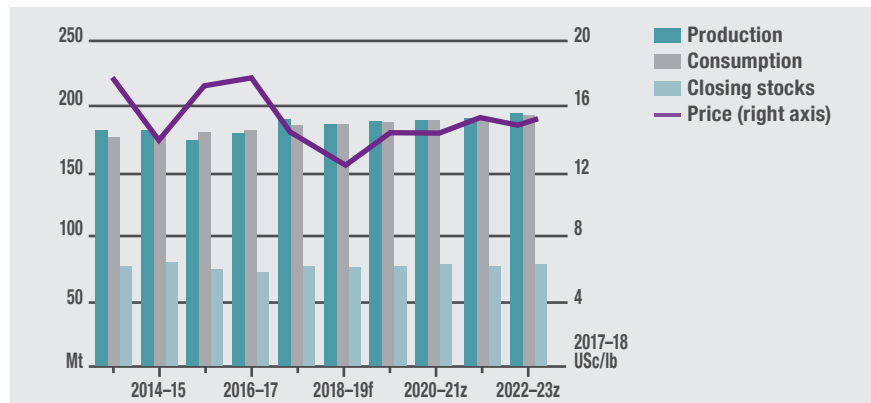
Without more recent dietary survey data, it is uncertain whether such declines in sugar intakes have continued. ABARES reported that apparent per capita sugar consumption has changed from 53 kilograms per year in the period 2012–13 to 49 kilograms per year in the period 2016–17, while consumption remained steady at 1.2 million tonnes at the population level (see Figure 11). It is expected that consumption at the population level will be maintained at 1.2 million tonnes through to the period 2018–19, as population growth will continue to counter the declining consumption at an individual level.<sup>66</sup> By the period 2022–23, consumption at the population level is projected to be 15 per cent lower than that of the period 2017–18, with an overall reduction to one million tonnes.<sup>67</sup> Although this shift downwards in sugar intake levels is positive news from a public health perspective, excessive sugar consumption for a large share of the Australian population yet remains the norm.

Figure 11. Historical and Forecasted Sugar Production, Consumption and Returns to Cane Growers, Australia, 2011–12 to 2022–23<sup>68</sup>



Global sugar production in the period 2017–18 is projected to increase by six per cent, reach 190 million tonnes and, over the medium term, increase gradually to approximately 195 million tonnes by the period 2022–23 (see Figure 12).<sup>69</sup> Australian sugar exports are concurrently expected to remain unchanged at approximately 3.9 million tonnes up until the period 2022–23, when they are projected to be worth \$1.8 billion.<sup>70</sup> Weighing this against a predicted global sugar consumption of 185 million tonnes in the period 2017–18, the global sugar industry currently produces more sugar than is required to meet consumer demand, and the resulting build-up of sugar stocks is estimated to be close to 77 million tonnes.<sup>71</sup>

**Figure 12. World Sugar Indicators, 2013–14 to 2022–23<sup>72</sup>**



## 2.2 Influencers on Sugar Consumption

### 2.2.1 Preference for Sweet Tastes

Numerous factors determine what and how much we eat; however, above all, taste is paramount. Although all humans like sweetness, some prefer a greater level of sweetness than others. Studies have consistently demonstrated that children have a heightened preference for sweet tastes that declines from around mid-adolescence.<sup>73</sup> This age-related decline during childhood, adolescence and adulthood has also been observed in other mammals, and although the causes have not yet been identified, it has been suggested that an enhanced liking for sweetness may be linked to a growing child’s need for calories.<sup>74</sup>

Sweetness being universally liked is the principal reason why sugar is commonly used in product development, with industry operators regarding sugar as the ‘gold standard’ for sweetness.<sup>75</sup> The stronger proclivity for sweetness as observed in infants and children leads to increased sugar content in products targeting this consumer segment—thereby contributing to high sugar intake levels in this age group.<sup>76, 77</sup>

### 2.2.2 Consumer Perception

The limited research that has been conducted relating to consumer perceptions of sugar in Australia suggests that Australians generally understand that too much sugar is not healthy and that they can identify products containing high amounts of sugar—though not necessarily the precise amount.<sup>78</sup> However, concern regarding the negative effects of sugar are not a new occurrence. In recent years, campaigns such as ‘I Quit Sugar’, ‘Sugar by Half’ and ‘That Sugar Movement’, documentaries and films such as *That Sugar Film*, and emerging discussions of taxes on sugary drinks have generated considerable debate in the Australian (and global) media:

Increasing public concern about obesity; other health-related public concerns surrounding consumption of sugar-sweetened beverages; possible new or increased taxes on sugar-sweetened beverages by government entities to reduce consumption or to raise revenue; additional governmental regulations concerning the marketing, labelling, packaging or sale of our sugar-sweetened beverages; and negative publicity resulting from actual or threatened legal actions against us or other companies in our industry relating to the marketing, labelling or sale of sugar-sweetened beverages may reduce demand for, or increase the cost of, our sugar-sweetened beverages, which could adversely affect our profitability.

#### **Coca-Cola Annual Filings to Shareholders<sup>79</sup>**

In light of this, many people have likely had their awareness of sugar as a health issue increased, resulting in behaviour changes such as reduced sugary drink consumption. This demonstrates how an innate liking of sweetness may be modulated.



### 2.2.3 *The Food Environment*

Manufacturers, retailers and food service operators offer several choices that vary in sugar content. However, the mainstream contemporary food environment, or the ‘choice architecture’, emphasises products that contain higher amounts of sugar and, in this way, promotes purchase and consumption and increases the demand for sugar.<sup>80</sup> Some examples of this emphasis are as follows:

#### *In-store Promotions and Product Placement*

Promotions in stores and in supermarket catalogues/circulars are predominantly for unhealthy food and drink products, including many that are high in sugar.<sup>81, 82</sup> Promotions can relate to price discounting and product placement, with catalogue promotions generally mirroring prominent in-store ‘impulse’ locations such as end-of-aisle/gondola end displays. The promotion of unhealthy products is even more pronounced in socio-economically disadvantaged neighbourhoods.<sup>83, 84</sup>

Although sugary products do not necessarily have higher margins per unit for the retailer, relative to products containing lower levels of sugar, they generally have high margins in absolute terms for manufacturers. Consequently, manufacturers can use the revenue generated from the sale of such products to heavily invest in their marketing and advertising—and to thus drive further demand. A cyclical pattern then emerges, in which products with strong consumer demand are offered prime spots and more shelf space in stores, thereby increasing their prominence and maximising their sales while minimising the labour costs for replenishment.

#### *Out-of-store Marketing and Advertising*

Marketing and advertising are also heavily geared towards unhealthy foods and drinks beyond the point of purchase. Channels include broadcasting media such as TV, cinema and radio advertising; printed media such as newspapers and magazines; non-broadcast/digital media such as advertising through social networks (Facebook, Instagram); product packaging, with the prominent use of licenced or cartoon characters; and even large ‘carry boxes’ of chocolates, biscuits and confectionery made available to kindergartens, schools and sports clubs for children to sell (with adult supervision) as a fundraising opportunity.<sup>85</sup>

Food companies spend huge amounts of money on marketing. Although it is difficult to obtain exact figures, annual reports of large transnational food and beverage companies reveal that the financial resources available to them are substantial. For example, Coca-Cola Amatil Australia outlined a planned \$80 million marketing package for 2018 to investors.<sup>86</sup> Although 90 per cent of Coca-Cola’s marketing funds ‘feature or hero’ varieties of Coca-Cola with no or low amounts of sugar, it is important to note that the persuasive effect of advertising activities in driving purchase and consumption extend beyond the product or brand being featured, to the broader category.<sup>87, 88</sup> In brief, the promotion of sugar-free or reduced-sugar soft drink varieties encourages the purchase of other full-sugar soft drinks. Bombarding society with advertising for unhealthy products also contributes to the normalisation of sugared drinks in diets.

More than twice as much advertising is devoted to unhealthy products than to healthy products, according to a recent study of an Australian free-to-air TV network.<sup>89</sup> The study showed that children aged five to eight years old would typically be exposed to more than 800 advertisements and to four hours of unhealthy product advertising from TV alone. Recent auditing of advertisements on bus shelters near kindergartens and schools in Perth also identified that a third of advertisements promoted unhealthy products or behaviours (unhealthy food or drink products, gambling or alcohol). Less than one per cent of advertisements were for a healthy product.<sup>90</sup>

Sponsorship of sports events is also heavily weighted towards unhealthy products. Sports sponsorship in Australia is valued at \$956 million, of which the Australian Rules Football League is the largest recipient; \$188 million is spent on the sport’s sponsorship annually, much of it derived from manufacturers of unhealthy products.<sup>91</sup> A recent study discovered that all 18 clubs surveyed had at least one sponsor that promoted unhealthy products and that in more than a quarter of cases, such sponsorship of unhealthy products appeared on players’ uniforms.<sup>92</sup> Research with Australian children aged five to 12 years old revealed that just over three-quarters of these children could correctly match at least one sporting team with their sponsoring brand:<sup>93</sup>

Kids go to sporting events and watch sport on TV, but it’s not just about kids; it’s about everyone. Even I find that I struggle with sporting events and athletes promoting junk food and fast food. Athletes, who people look up to for being healthy, are being ambassadors for junk foods. Those kinds of things are not helpful.

**Research Participant—Retail Representative**



#### 2.2.4 Changes to Portfolio Mix, Product Formulation and Portion Sizes

Increasing consumers' awareness of the health effects of sugar is a key incentive for the food industry to take action.<sup>94</sup> One outcome for this involves businesses acting to reduce their exposure to the risk of a drop in sales by adjusting their product portfolio mix—such as by developing new products with lower levels of sugar or decreasing sugar levels in existing products. In this way, food manufacturers, retailers and even sugar manufacturers can maintain a market for their products and potentially capitalise on consumer trends.

One notable example of how sugar manufacturers have responded to consumer concerns regarding their products has been the development of a raw sugar with a low glycaemic index called Nucane, which has been positioned in marketing materials as the 'good sugar'.<sup>95</sup> Further downstream, against a backdrop of significant declines in the purchase of sugary drinks, both Coca-Cola Amatil and PepsiCo have pledged to reduce the sugar levels supplied by their Australian portfolios by 20 per cent by 2025, based on 2016 sales-weighted figures.<sup>96</sup> Notably, Coca-Cola's latest annual report suggested an increase in raw sugar usage from 280,887 metric tonnes in 2016 to 288,982 metric tonnes 2017 across Australia, New Zealand, Fiji, Indonesia and Papua New Guinea. This suggests that declining the consumption of sugar through their products in Australia may be tempered by increasing their sales in other markets.<sup>97</sup>

Manufacturers have also sought to grow their market share by acquiring other smaller brands that exhibit lower levels of sugar in their products—such as Coca-Cola Amatil's recent purchase of Adelaide-based kombucha brand, MOJO, which contains between 6.0 to 9.4 grams of sugar per 330 millilitres compared to almost 40 grams of sugar in a 375 millilitre can of Coke.<sup>98, 99</sup> In this way, increasing the availability of products with lower levels of sugar may support consumers in making less sugared choices, either consciously or subconsciously:

When we are developing products, we're trying to make them healthier and to shape consumers preferences by getting them used to lower salt and lower sugar. But then, at the end of our product development process, products have to pass through the consumer taste panel. So, if we go too far, we still need to be guided by their preferences, and if they say it's not tasty enough, sometimes we must adjust what was done. Or, it just goes on the shelf and it doesn't sell and then it gets deleted. So, we're sort of trying to go slowly on that journey; the whole food industry has to balance trying to push consumers to healthier options while also trying to deliver what they want on taste.

#### **Research Participant—Retailer Private Label Representative**

Research conducted in 1995 and 2011–2012 that compared Australian dietary surveys found that portion sizes (the amount of food or drink that an individual consumes at one eating occasion) reported for some product categories—including cake, ice cream and cereal—had significantly increased over that time period by 66, 39 and 17 per cent, respectively. However, other sugary product categories such as chocolate, biscuits and sugary drinks remained unchanged.<sup>100</sup> Further, although portion sizes for some sugary products such as sweet biscuits, chocolate and sugary drinks were similar to the ADG serving size (providing 600 kilojoules as a standard serving), others such as cakes, buns and muffins exceeded the ADG serving size by 114–155 per cent—even ice cream exceeded the ADG serving size by nine to 41 per cent.<sup>101</sup> This suggests that at least for some sugary products, portion sizes have increased over time and may be excessive compared to dietary guidelines.

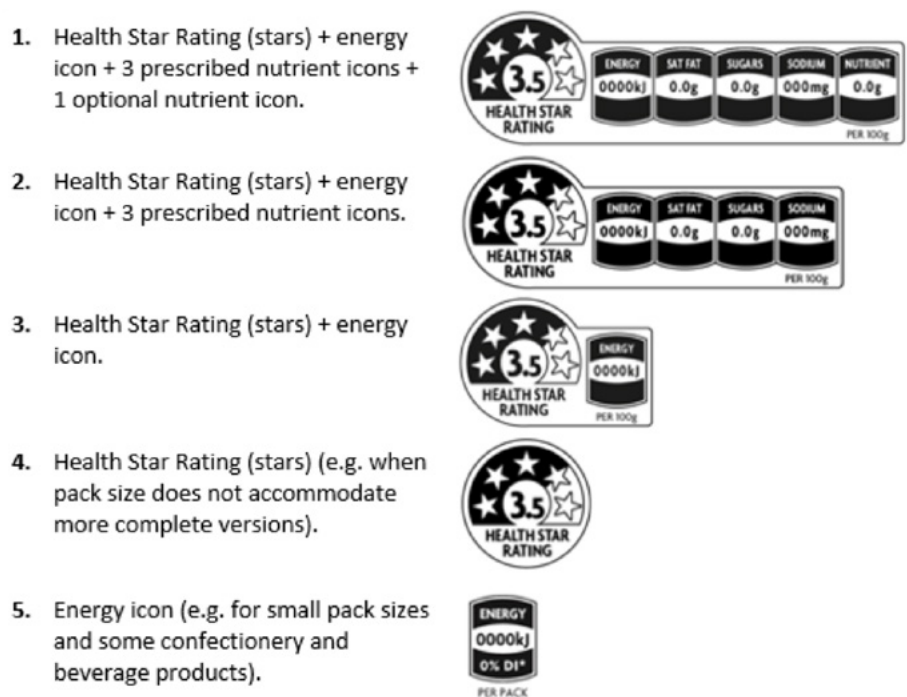
People consistently consume more when they are offered larger portions of food or drink or larger package sizes, and they do not compensate for larger amounts by consuming less at subsequent meals or over time.<sup>102</sup> No longitudinal studies have been conducted on the change in pack sizes over time in Australia—most likely due to a lack of historical data. However, the widespread and inexpensive availability of large cups of sugary drinks in fast food or convenience store outlets is impossible to ignore. Food labelling that indicates appropriate portion sizes likely only minimally affects behaviour in this environment.<sup>103</sup>

#### 2.2.5 Government Intervention to Reduce Sugar Consumption

All levels of governments in Australia have acknowledged sugar consumption and are taking action to reduce the trend.<sup>104</sup> Initiatives primarily comprise education campaigns and the provision of information to consumers via food labels, with a key focus on reducing the consumption of sugary drinks.<sup>105, 106</sup> Other interventions include potential reformulation targets and efforts to reduce portion sizes as part of the Healthy Food Partnership—educational campaigns, materials and settings-based activities that impose restrictions on sugary products.<sup>107</sup> One example of this is the 'New South Wales Health School Canteens program', which restricts sugary drinks;

however, it does permit discretionary foods (including those that are high in sugar levels) to comprise up to a quarter of the menu, provided that their Health Star Rating (HSR) is over 3.5.<sup>108</sup> Another example is the Australian Capital Territory Government's recent move to ban advertising of unhealthy products on public transport buses.<sup>109</sup> Australia's voluntary front-of-pack nutrition labelling scheme, the HSR, is another prominent example of a government intervention. The HSR scheme scores products according to their nutritional profile, awarding ratings that range from 0.5 to 5 stars (see Figure 13). The HSR is calculated by the offsetting of nutrients or ingredients; it is thus possible for a product that is high in sugar levels to be 'balanced' by low amounts of other risk nutrients or high amounts of beneficial ingredients.

**Figure 13. Health Star Rating System Full Graphic**



The HSR system is promoted as being an enabler of reducing sugar consumption either through reformulation or by directing consumer choice. However, the extent to which the HSR system facilitates this and its significance in terms of overall dietary consumption of sugar is unclear. One study from New Zealand that investigated the impact of the HSR system on sugar reformulation revealed a mean 4.6 per cent reduction after the HSR was applied, which was an absolute change of only -0.3 grams per 100 grams.<sup>110</sup> Another study from Australia demonstrated a decrease in sugar levels in breakfast cereals of 1.6 grams per 100 grams of the three categories studied—cereal-based products, fruit-based products and dairy products.<sup>111</sup>

The HSR system has been criticised for taking a reductionist approach and for reinforcing the industrialised food system by awarding stars to nutrient-poor processed foods, albeit at the lower end of the rating scale.<sup>112, 113</sup>

## 2.3 Influencers on Sugar Production

### 2.3.1 Global Sugar Consumption

Although the consumption of sugar per capita in Australia appears to be decreasing, the overall demand for sugar at a total population level has been sustained—primarily due to population growth. The demand for sugar production has also been supported by population and income growths in developing economies, as well as by an accompanying transition to more Westernised dietary patterns:

At the moment, no, there's no real impact there. People talk health, but they really don't care. They just want the product; they want their Mars Bar, or whatever else. But when you have people like Coke saying they're going to reduce their sugar usage and companies saying they're going to look at different products with a smaller amount of sugar, at the end of the day, you've got to be prepared for the customers not requiring supply. But there is still a lot of expansion, as far as other countries are concerned.

**Research Participant—Australian Sugarcane Farmer and Miller Representative**



The growth potential for the Australian sugar industry rests on demand expressed in overseas markets. For example, according to the latest data, South Korea—Australia’s main export market—has an annual per capita sugar consumption of 21.8 kilograms, which is significantly lower than that in developed countries such as Australia.<sup>114</sup> Whether developing economies will achieve the ‘peak sugar’ of advanced economies remains to be observed, with analysts predicting that although global sugar consumption will increase in the future, it will be tempered by growing concerns regarding the health effects of high sugar intakes.<sup>115</sup>

### **2.3.2 World Sugar Price and Pricing Pressure**

The world sugar market is one of the most volatile of all the primary commodity markets. It typically follows a pattern of short, sharp peaks followed by extended troughs that can be briefly explained as follows:

Though high world prices have led to large increases in production, low world prices have not led to large contractions. When world prices fall due to surges in production, protective policies are activated to support the expanded industries and new fixed investments around the world. This protection of expanded production causes world prices to remain depressed for some years. After a time, consumption again exceeds production, and stocks fall to a level where a large weather-induced drop in production can again lead to a sharp increase in world price.

**Brent Borrell, Economist and Professor Ronald Duncan, Australian National University<sup>116</sup>**

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The Intercontinental Exchange (ICE) No. 11 is typically used as the world’s market price for sugar (US c/lb) and represents the physical delivery of lots of 112,000 lb of raw cane sugar onboard the receiver’s vessel at a port within the country of origin.<sup>117</sup> ICE No. 11 was predicted to reach a 17-year low in the period 2018–19, with supply outstripping demand.<sup>118</sup> The Australian sugar industry is notably exposed to these low prices, due to most of production being exported onto the world market and a lack of government-guaranteed pricing mechanisms that come into force when the price is low (see Section 3.3.3):

At the end of the day, it always comes back to sugar price; that’s the key in all of it. You’re exposed on the world market and the ICE 11 is at its lowest price that it’s been for a long, long time, so there’s nobody in the world at the moment that would be sustainable at these prices. It’s that simple. There’s also an excess of production in there that’s got to get through; you’ll see some recovery, but that will probably happen in about 18 months’ time. So, you’ve got to survive these sorts of downturns, and to do that, you’ve got to have throughput; if you don’t have throughput, then you can’t cover your fixed costs.

**Research Participant—Australian Sugarcane Farmer and Miller Representative**

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The pool of money that is available is the crop. The minute we start falling down on our throughput, then the fixed costs that are attached to the sugar mill have to be propped up by a cane price that would normally go to the grower. It’s a bit of a dog chasing its tail.

**Research Participant—Fourth-Generation Sugarcane Farmer**

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Nevertheless, the Australian sugar industry has survived downturns before—and with the fixed costs that it has to service, production is generally maintained even at times of low returns:

Growers who are in the industry want to be in the industry; they want to be cane farmers, but they do need a certain amount of money to stay in business. Will they pull out if they don’t get it? Most won’t; they’ll stay put. But there’s certainly pressure there for some people, particularly with the age of growers, which is a big concern for all agricultural industries. If they can’t get the family to take over the farm and the industry is down where it is, they will get out. But we’re not seeing a lot of that at the moment; they’re pretty resilient, growers—you can throw a lot at them and they’ll still come out the other side.

**Research Participant—Australian Sugarcane Farmer and Miller Representative**

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Sugar is a homogenous product, with little to differentiate one producer from another, so the main way that operators compete is through price. In addition to a low world market price, operators are also increasingly exposed to pricing pressures from the escalating costs of inputs such as energy or water (47 per cent of sugarcane land is irrigated).<sup>119</sup> They are also pressured from further downstream in the supply chain from industrial buyers such as beverage or confectionery manufacturers, or retailers.

Low returns can affect sugar producers in several ways: they can lead to rationalisation, with smaller farms being bought by larger operators who can benefit from greater economies of scale; they can result in farmers exiting the industry altogether and/or moving to potentially more lucrative crops, such as macadamias; and they can constrain farmers' capacity to invest in more environmentally sustainable practices, or processors in investing in new technologies or diversification.<sup>120</sup> ABARES predicts that returns to growers are expected to remain low over the medium term.<sup>121</sup>

### ***2.3.3 Government Intervention and Assistance***

The World Bank recognises sugar as being one of the most policy-distorted commodities of all.<sup>122, 123</sup> For example, producers in Japan and the US may receive more than double the world market price through taxpayer-funded, government-guaranteed prices, import controls and production quotas.<sup>124</sup> The generous raft of global protectionism buoys the production of sugar, incentivising producers to maintain or increase production by insulating them from the otherwise volatile dynamics of the world market (see Section 3.3.2). However, although the Australian sugar industry reaped the benefits of similar protectionism from its inception, the industry is now noticeably unique among its competitors, with the last remnants of its routine direct support dismantled through the Australian government's \$334 million sugar industry reform program in 2004.<sup>125, 126</sup>

Possible reform of the global sugar market to remove protectionist policies is purported to be greatly beneficial to the Australian sugar industry—with modelling to show the effect of a massive production relocation away from protected markets such as the EU, Japan, Mexico and the US and towards other markets such as Brazil, Australia, Cuba, Indonesia, Malaysia and Turkey. These markets would all significantly expand production, though these models tend to neglect equity in the distribution of those benefits and the social effects on the agricultural sectors overseas.<sup>127</sup>

Viewed in this way, the Australian sugar industry is not privy to beneficial government protectionism that might provide an incentive to continue the production of more sugar. However, that is not to say that the Australian sugar industry has no support from the state. The government acknowledges the sugar industry as being one of Australia's 'largest and most important rural industries' and 'an integral part of the rural and regional communities along the east coast'—and thus receives various forms of assistance.<sup>128</sup>

A key area to which government funding is directed is Sugar Research Australia, which is funded through a compulsory sugar levy. It also receives a dollar-for-dollar matched funding from the federal government of up to 0.5 per cent of the industry's gross value of products, in addition to grants from the Queensland Government. It is estimated that the government spent \$92.9 million on research and development in the sugar industry between 1997 and 2015.<sup>129</sup>

Other support includes introducing a mandatory code of conduct in 2017 to support growers dealing with the mills and, importantly, facilitating trade agreements—such as reducing the Indonesian tariff on Australian raw sugar imports and eliminating the Korean import tariff altogether.<sup>130</sup> Also of note is the charity status that is granted to industry-owned Queensland Sugar Limited (Queensland's main provider of marketing and terminal services), which confers considerable tax concessions and an aspect of industry assistance that has been criticised by the government's own pro-neoliberal Productivity Commission.<sup>131</sup>

Further government assistance to support the financial viability of industry operations exists along the value chain. For the sake of brevity, these are not discussed here. However, by way of example, Norco Co-operative, which manufactures ice cream, received a \$15 million grant to upgrade its manufacturing facility in Queensland through the federally funded Regional Growth Fund.<sup>132</sup>



### 2.3.4 Competition from Sugar Substitutes

As concerns regarding sugar's health effects have persisted and the range of alternative sweeteners has grown and become more cost competitive, food and beverage manufacturers have turned to these alternatives to create products with lower sugar levels or sugar-free products, without compromising on sweetness. A review of a random selection of 5,744 packaged food products available in the Australian FoodSwitch database found non-nutritive sweeteners were even more pervasive than white sugar (in terms of product count); they were present in 69 per cent of products surveyed compared to white sugar, which was present in 61 per cent of products.<sup>133</sup> The proportion of products containing sweeteners suggests that they are not only being used in products with lower sugar levels or in sugar-free products.

The use of sugar substitutes is not without challenges. Consumer perception is mixed in regard to the preference or acceptance of alternatives to sugar. This is likely spurred by mixed media reporting their health effects:

We sort of get to a point with some products where we do as much as we can and then it starts affecting taste and you have to look at what other things you can put in. We know from our customer research [that] there's a lot of people that believe—I think around half of our customers say they think that artificial sweeteners are just as bad as the sugar they are replacing. So, we must find that balance between taking as much [sugar] out as we can, not putting in artificial things to replace it and still producing an acceptable product.

**Research Participant— Retailer Private Label Representative**

Technical issues can limit or prohibit these alternatives' use in certain applications. Some intense sweeteners leave a bitter aftertaste, or others such as polyols cause digestive discomfort when taken in larger amounts, which precludes their use in beverages. Data on the split between sugar and alternative sweeteners is difficult to obtain, but in 2013, it was reported that sugar from sugarcane or sugarbeet accounted for more than 80 per cent of the global sweetener market.<sup>134</sup>



## Part 3. Impacts of the Sugar System on Planetary Health and Associated Costs

### Key Points

- Agriculture is a significant user of Australia’s water supplies, and sugarcane uses more water than any other crop. Additionally, the run-off of polluted water raises planetary health concerns—particularly those related to the Queensland sugar industry, which is situated next to the ecologically sensitive Great Barrier Reef coral ecosystem. Sugarcane farms are the source of more than half the annual anthropogenic load of inorganic nitrogen that flows into the Reef catchment area. Excess nitrogen disturbs natural systems and promotes outbreaks of crown-of-thorns starfish, which feed on the coral.
- Through the ‘Reef plan’, the federal and state governments have committed \$34.5 million up until the period 2021–22 to help sugarcane farmers adopt more environmentally sustainable practices. However, progress has been slow, and even if standards are achieved, there are concerns that action will not sufficiently improve water quality.
- Although sugar as a nutrient has been a beneficial part of ancestral diets for millennia, the way sugar is consumed in modern diets is responsible for several adverse health effects—including the promotion of excess energy consumption, the displacement of nutritious foods and tooth decay. Sugar in liquid form is particularly problematic, due to the ease with which large amounts can be consumed. There is a scientific consensus that the consumption of sugary drinks has contributed to the obesity epidemic.
- The health effects associated with sugar consumption place both a significant burden on individuals and on their quality and length of life, as well as on society in terms of the multi-billion dollars of health care costs and productivity losses.

### 3.1 Environmental Effects of Sugarcane Farming on the Great Barrier Reef

Beyond the immeasurable ecological value of the Great Barrier Reef is its immense economic and social value, conservatively estimated to be worth \$56 billion; it supported 64,000 jobs and contributed \$6.4 billion to the Australian economy in the period 2015–16.<sup>135</sup> However, despite the significance of the Reef and the efforts to protect it, its condition has deteriorated in recent decades because it is forced to endure persistent and direct threats from human-made hazards. This is in addition to the natural pressures that it has had to withstand for millennia. Foremost among human activities is climate change, but beyond that, poor water quality from land-based pollution (exacerbated by extreme weather events) is an ongoing and major issue that threatens approximately 25 per cent of the global Reef area:<sup>136, 137, 138</sup>

In terms of environmental sustainability, I suspect [that] the Australian sugar industry is up there at the top globally in terms of its performance. A lot of that is borne out of the fact that Australia has a significant level of environmental legislation that is more onerous than other countries, in terms of expectations that are set on not just producers, but also the community at large. A lot of that within Queensland revolves around this water quality issue—water use and the like. The Reef is there, fortunately, or unfortunately for the sugarcane industry, and we have a \$6 billion a year Reef tourism industry [that] employs close to 65,000 people annually, and, so, generates a level of return [that] is far more than what agriculture, or sugarcane, returns. So, in that context, governments and community stakeholders are obviously really keen to ensure [that] the economic asset that is the Great Barrier Reef continues to be in good health and is able to continue to return the dollars for the regions, the state and the nation.

**Research Participant—Sugarcane Farming Sustainability Consultant**



### 3.1.1 Intensive Water and Agrochemical Use

Australia is the driest inhabited continent in the world and, in the coming years, it will face major challenges with water security due to fluctuating weather patterns and a rising demand for water.<sup>139</sup> The agricultural sector is a significant user of water in Australia, accounting for 12.5 per cent of the water extracted from the environment to support the economy in the period 2015–16.<sup>140</sup> Sugarcane uses more water than any other crop in Australia, including rice, accounting for over a quarter of all irrigated water (973 gigalitres and 26 per cent of irrigated water—or 11 per cent of total agricultural water use).<sup>141</sup> In Queensland, over 40 per cent of the sugarcane crop (representing 60 per cent of production) is irrigated, though rates can vary from season to season.<sup>142</sup>

Sugarcane is also a significant user of agrochemicals, including herbicides and pesticides. Eleven times more herbicides than pesticides are typically used on sugarcane farms and fertiliser use is also notably high.<sup>143</sup> When nitrogen (N) is deficient, the whole sugarcane is affected with stunted growth and low yields.<sup>144</sup> The application rates of N fertiliser increased from very low levels at the time of Federation to approximately 60 kilograms per hectare in the 1940s, to 160–180 kilograms per hectare in the 1970s and up to 200 kilograms per hectare by the 1990s.<sup>145</sup> Nitrogen usage has reduced since the 1990s, partly as a means of minimising costly input use; however, N fertiliser rates still average approximately 150–200 kilograms per hectare—a level at which leaching is commonplace.<sup>146</sup>

### 3.1.2 Runoff of Pollutants and Sediments into the Great Barrier Reef Catchment Area

The Great Barrier Reef maintains an interconnected and complex relationship with its neighbouring environment, the wider Great Barrier Reef Catchment Area (GBRCA), covering 423,144 square kilometres and including 25 per cent of the land area of coastal Queensland and 35 river basins.<sup>147, 148, 149</sup> The inshore areas within the GBRCA, most of which are used for agricultural production, are a runoff source of major pollutants, including suspended sediment, dissolved inorganic N and photosystem II herbicides (herbicides designed to inhibit photosynthesis in plants). Key land uses in the GBRCA include beef grazing (75 per cent of the total area), forestry (five per cent), sugarcane (one per cent), horticulture (0.15 per cent), grain and cotton (2.7 per cent) and nature conservation (13 per cent).<sup>150, 151</sup>

The mean annual sediment has increased more than five-fold since initial European settlement (1850) and at least 30 tonnes of herbicides are exported through the GBRCA annually, with most of them originating from sugarcane and grain cropping.<sup>152</sup> In terms of sugarcane specifically, according to recent estimates from Sugar Research Australia, the industry is a significant contributor to the average annual anthropogenic load of inorganic N (56 per cent), particulate N (18 per cent), particulate phosphorus (18 per cent) and suspended solids (six per cent) entering the GBRCA.<sup>153</sup> Therefore, in all cases—but notably in the burden of runoff from fertiliser—sugarcane contributes disproportionately and accounts for more than half of N loads, despite occupying only one per cent of the nearby land.

A 2017 scientific consensus statement concluded that the greatest effects of poor water quality in the GBRCA include:

- i) nutrients, which are an additional stress factor for many coral species, promoting crown-of-thorns starfish population outbreaks, with destructive effects on mid-shelf and offshore coral reefs, and nutrients that promote macroalgal growth
- ii) fine sediments, which reduce the light available to seagrass ecosystems and inshore coral reefs
- iii) pesticides, which pose a toxicity risk to freshwater ecosystems and some inshore and coastal habitats.<sup>154</sup>

### 3.1.3 Economic Burden of the Environmental Management of Sugarcane Production

To address the issue of water quality in the GBRCA, the bilateral ‘Reef plan’—a joint initiative of the Queensland and Australian Governments—commenced in 2003 and has undergone several iterations in 2009 and 2013. A government investment of \$900 million has been committed to improve the quality of water flowing into the Reef for the period 2013–2024.<sup>155</sup> It is difficult to separate the calculations to derive a total figure in terms of the proportion of funding directed to sugarcane, but government investment for specific activities related to helping sugarcane farmers adopt more environmentally sustainable practices amounts to \$34.5 million from 2017–2022.<sup>156</sup>

In the latest version of the ‘Reef plan’—the Reef 2050 Water Quality Improvement Plan 2017–2022—the following commitments are particularly relevant for sugarcane: reducing the anthropogenic inorganic N loads by 60 per cent and reducing total suspended sediment by up to 25 per cent by 2025.<sup>157</sup> Unfortunately, recent reviews of the





efforts to improve water quality have concluded that progress towards these targets has been slow, with targets unlikely to be met in the aspired time frames. Even more distressing, efforts are insufficient to adequately address the issue, even if fully applied:<sup>158, 159</sup>

So, over the last probably nine years, we've seen, particularly in Queensland ... an active focus on the impact of agriculture in relation to water runoff and water footprint, and to some degree, carbon footprint, and those industries are trying to lower levels of pollution contamination. I know within the Great Barrier Reef region, which probably constitutes about 90 per cent of Australia's sugar production area, we've seen investment of public funds in excess of \$2 million to improve farming practices. And what we've seen over that time frame is a level of improvement—there's no doubt about that. But that level of improvement has pretty much stagnated over the last couple of years, which indicates that—and all the reports are indicating that—the current levels of industry-accepted practices that the industry is comfortable taking on effectively aren't transformative enough; they aren't innovative enough to basically go to the next level of efficiencies and effectiveness.

**Research Participant—Sugarcane Farming Sustainability Consultant**

### Box 3. Sustainability Standards for Sugarcane Production

According to the International Trade Centre, there are over 60 voluntary sustainability standards for sugarcane that differ in their focus areas and requirements.<sup>160</sup> The two key standards that are used in Australia are Bonsucro and Smartcane Best Management Practices (BMP). Bonsucro is a non-profit organisation established in 2008 that is presently used in 13 countries, with 80 mills certified and 4.9 million tonnes of certified sugar produced (57 million tonnes of certified sugarcane).<sup>161</sup> The sugar industry in New South Wales was the first in the world to be certified to the Bonsucro standard:

We were one of the first in the world to get certification for Bonsucro. We were looking for a system that effectively supported what we were doing and the way we operated. We've got a very clear, strategic business plan about establishing our sustainability at all levels, and that was in place already. What I wanted to see was if there was some way of certifying the systems that we've got in place, so that we could prove to the community and customers that we were doing the right thing as far as our sustainability was concerned. And so, now, we're the only industry in the world that's 100 per cent certified from the grower, through the milling, through the refining and out to the customers. So, we've been the leader from that point of view and we're all pretty proud of where we've got to. It just clears everybody's mind as to what we're doing here. We'd like everybody just to follow the same path, but we'll see.

**Research Participant—Australian Sugarcane Farmer and Sugar Producer Representative**

The Bonsucro production standard covers various elements of sugar production and aims to drive improvements against sustainability metrics. For example, water use by Australian sugarcane producers dropped by 48 per cent in the period 2015–16 compared to the levels in the period 2014–15 (though weather conditions may also play a role here), and Australian mills are net exporters of water.<sup>162</sup> Since its inception, Bonsucro has become an increasingly expected standard:

So, more recently, now we have a lot of the big customers saying [that] unless you're Bonsucro certified or certified in a way that's pretty similar to Bonsucro, they won't take supply from you. And some of the big guys are saying [that] by 2020, if you haven't got certification by then, you're not going to be in the tender process. So, that's probably stepped the whole thing up a bit more, but there's nobody paying any sort of premium for Bonsucro certification. You can trade in the certificates, but you know, one or two dollars for that is just not going to make any real difference. The industrial customers and retailers just don't want to pay a premium for it and that's an issue at the end of the day. They should be, but they're not, and they won't because it's all about profit and the bottom line; it doesn't matter what you do. The buyer is paid to get the lowest price—that's what his job is, and they'll have bonuses and all sorts of things that hang on what result they get there.

**Research Participant—Australian Sugarcane Farmer and Sugar Producer Representative**



Smartcane BMP is an initiative of the Queensland sugar industry with funding from the Queensland Government that includes three essential modules for accreditation on the topics of soil health and nutrient management, irrigation and drainage management and weed, pest and disease management. Other modules include managing people and the environment to align with Bonsucro requirements. Accreditation through Smartcane BMP is voluntary and has been somewhat protracted; however, a promising new behaviour change program—Project Cane Changer, also supported financially by the Queensland Government—has accelerated adoption in targeted areas.<sup>163</sup> Similar to other voluntary initiatives in the food industry (e.g., the HSR; see Section 2.2.5), piecemeal uptake creates an inherent challenge in the scale of influence that these initiatives may have.

## 3.2 Nutrition, Health Effects and Related Economic Burden of Sugar Consumption

The following section considers how sugar has shifted from being a beneficial component of ancestral foodways to a harmful component of contemporary diets—when, from a purely biochemical perspective, the sugar as a nutrient has not changed. On the subject of sugar, the discussion is inherently reductionist in scope, as opposed to considering dietary patterns more broadly. However, this narrow focus offers a helpful approach for illustrating much deeper, complex and consequently less well-understood or underappreciated connections between dietary patterns and health. It is argued here that sugar has become an issue because the way in which it is consumed is different and mismatched to the body's evolved capacity to effectively manage it.

### 3.2.1 *Energy Balance, Diet Quality and Health Effects*

#### *Energy Balance*

Whether the consumption of sugar substantially influences the health of an individual or not depends on the amount and frequency with which it is consumed, the individual's nutritional needs and diet, and his or her 'metabolic capacity' to effectively manage the metabolic load of the sugar. At a basic biochemical level, all sugar—regardless of food or drink source or chemical structure—provides the same amount of energy, with every gram of sugar converting to 17 kilojoules, or 4 calories. Excess sugar consumption can promote positive energy balance by providing more energy than is expended. This increases the risk of developing several weight-linked conditions, including cardiovascular disease, type 2 diabetes (T2DM) and some cancers. Consequently, it has been argued that if people simply balanced their consumption of sugar with additional energy expenditure, the 'problem' of sugar could be resolved. However, the situation is far more complex.

#### *Diet Quality*

Aside from the fact that balancing energy intake in such a way is far from simple in the current food system, recent studies have demonstrated that habitual human energy expenditure is fixed.<sup>164</sup> In short, people with vastly different physical activity levels can expend similar amounts of energy and they cannot simply 'exercise off' their indulgences. Moreover, according to the modelling underpinning the ADG, there is little to no space in the diets of most Australians for unhealthy products, including those high in sugar, without the compromising of nutrient intakes.<sup>165</sup> Studies that have assessed the relationship between the consumption of sugar and dietary quality using Australian national survey data have shown that significant inverse trends exist between intakes of free sugar and most micronutrients; they have shown that, especially with high intakes of free sugars (20 to 25 per cent of energy), the consumption of core foods is impinged and the capacity of such diets to achieve micronutrient requirements is notably compromised.<sup>166, 167, 168, 169</sup>

#### *Health Effects of Ultra-Processed Foods*

Using a more holistic perspective—and looking beyond the energy provision and lack of beneficial nutrients in sugar—the effects of sugar consumption on health depend on several factors pertaining to the way in which it is consumed: the food source, including level of processing and format (e.g., an orange versus orange juice versus a sugary drink); the habitual dietary pattern; wider lifestyle factors, such as level of physical activity; and individual physiology. In recognising the limitations of linking specific nutrients to health effects and instead giving due consideration to these wider issues, researchers have recently developed a classification system to more clearly conceptualise the extent of 'industrialisation' as related to the food source. The NOVA system (not an acronym) categorises foods into four groups based on a continuum related to the level of processing: 1) unprocessed or minimally processed foods, 2) processed culinary ingredients, 3) processed foods and 4) ultra-processed foods.<sup>170</sup>

Ultra-processed foods (UPF) are now ubiquitous in the Australian food supply. For example, of the 4,143 new packaged products released into the Australian retail market in 2015, more than three-quarters (82 per cent) would be defined as UPF.<sup>171</sup> Moreover, in a sample of more than 200 high-market share UPF (breakfast cereals, beverages, condiments, confectionery and snacks), sugar was present in almost all cases (95 per cent) and found to be a characterising component. This signifies that UPF are the main vehicles for transporting sugar to the diets of the population.<sup>172</sup>

There are multiple mechanisms through which UPF may contribute to adverse health effects that are masked by standard nutritional models of sugar content, beyond the addition of energy and/or displacement of nutrients. Examples include how these products may induce a heightened glycaemic response, how they have a lower satiety potential and how they may modulate changes to the gut microbiota that promote inflammatory disease or that form hazardous compounds through processing, such as acrylamide.<sup>173</sup> For example, in the case of sugary drinks, easily consuming a large amount of sugar over a short period of time is effortless. Even more so, the satiety response from drinking sugary beverages (i.e., the drink's ability to induce sensations of fullness) is less than if the same amount of sugar was consumed in a solid format.<sup>174</sup> In this way, the body does not automatically compensate for the overriding of intuitive appetite mechanisms by subsequently consuming less sugar and/or food at later meal occasions or throughout the day.<sup>175, 176</sup> Indeed, high-quality prospective studies have discovered that changes in the consumption of sugary drinks are directly related to changes in energy intake and bodyweight; consequently, most health authorities agree that the overconsumption of sugars in liquid form has contributed to the obesity epidemic.<sup>177</sup>

#### Overweight and Obesity

To be sensitive of this more holistic perspective on sugar, and due to the difficulties in ascribing a specific disease burden to isolated nutrients or foods (though this has been somewhat attempted for sugar drinks; see Section 3.2.2), the remainder of this section is devoted to the issues of overweight and obesity in general. In terms of the population level of overweight and obesity, Australia has higher rates than the OECD average; in fact, it ranks fifth among OECD countries. It is behind the US, Mexico, New Zealand and Hungary and just ahead of the UK and Canada (see Figure 14).<sup>178, 179</sup> The most recent data show that, in adults, rates have increased from 56.3 per cent in 1995 to 62.8 per cent in the period 2011–12, and then by 63.4 per cent in the period 2014–15 (i.e., 11.2 million people, 6.3 million overweight and 4.9 million obese).<sup>180</sup> In children aged five and older, rates have increased from 20.9 per cent in 1995 to 25.7 per cent in 2011–12, and then to 27.4 per cent in 2014–15 (1.2 million children). Though the rate of increase has decreased in recent years, the rates have levelled out at a considerably high percentage (see Figures 15 and 16).<sup>181</sup>

**Figure 14. Obesity Prevalence in People 15 years-old and over, Australia and OECD, 2015<sup>182</sup>**

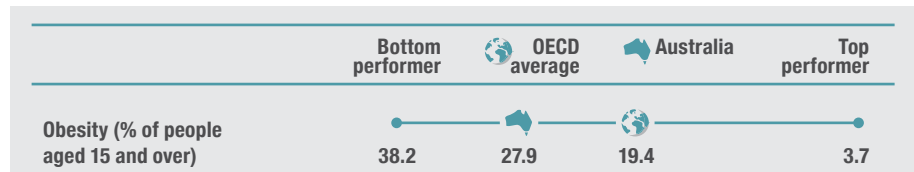


Figure 15. Proportion of Adults with Overweight and Obesity in Australia, by Age and Sex, 2014–15<sup>183</sup>

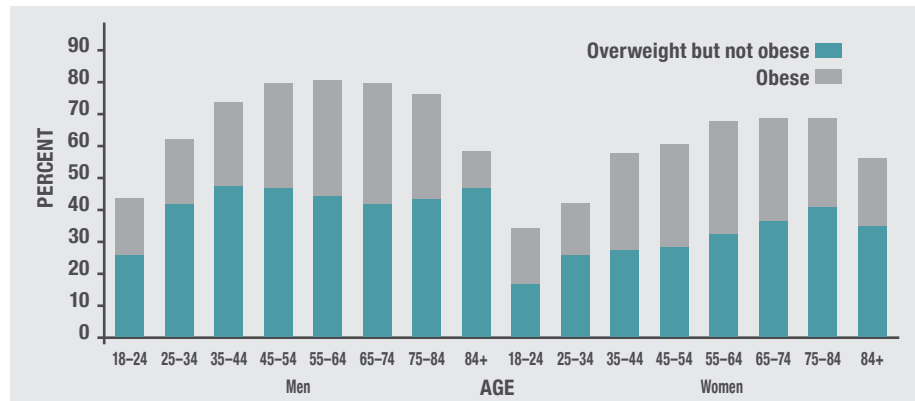
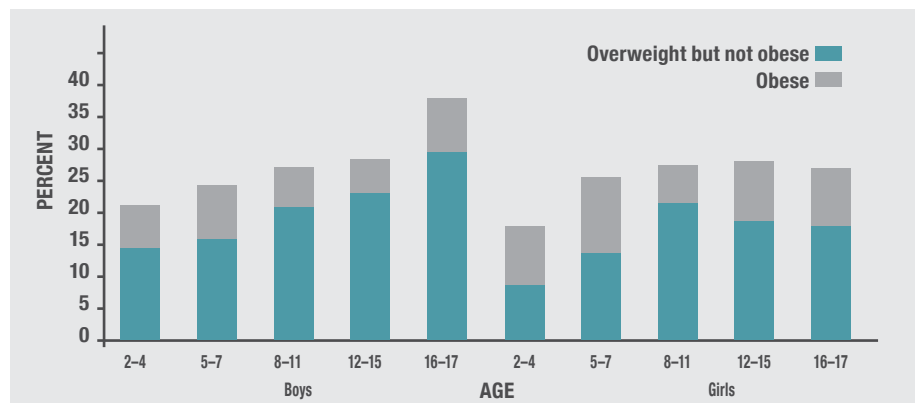


Figure 16. Proportion of Children and Young People with Overweight or Obesity, Aged 2–17 in Australia, by Age and Sex, 2014–15<sup>184</sup>



Obesity and being overweight disproportionately affect some groups. For example, rates exceed 80 per cent in certain regional areas: Southern Highlands and Shoalhaven (88.7 per cent), Riverina (84.8 per cent), the sugarcane region of Mackay (83.4 per cent) and Murray (80.4 per cent). In contrast, rates remain below 50 per cent in other areas: in inner city Melbourne (47.3 per cent), Sydney (45 per cent) and Perth (42 per cent).<sup>185</sup> Aboriginal and Torres Strait Islander peoples are also 1.2 times more likely to be overweight and 1.6 times more likely to be obese than non-Indigenous populations.<sup>186</sup>

### Dental Health

The effect of sugar consumption on dental health is well established, with prospective cohort studies that tracked children and adolescents across time consistently revealing that higher intakes of sugars and sugary products (both foods and beverages) are associated with a greater risk of developing tooth decay.<sup>187</sup> Conversely, dental caries do not occur when sugars are absent from the diet.<sup>188</sup> Tooth decay develops when lactic acid in the mouth, which is produced when sugars—particularly sucrose (and starches)—are fermented by oral bacteria, dissolves the enamel and dentine over time. With enough time, saliva is efficient at re-mineralising and repairing the teeth. However, if sugary products are consumed regularly throughout the day, the opportunity for this repair process to activate is diminished and teeth decay ensues.

Severe tooth decay can contribute to several conditions: pain specifically in the tooth or more widely in the face, jaw or temples, infection, tooth loss, inflammation of the gums (gingivitis), difficulty sleeping or eating (and thus the avoidance of certain foods) and absenteeism at school or work.<sup>189</sup> Decay in permanent teeth is the world’s most common non-communicable disease, affecting 2.3 billion people in 2015.<sup>190</sup> In Australia, two in five children (42 per cent) aged 5–10 years have decay in their primary (milk/baby) teeth and almost one in four children (24 per cent) aged 6–14 years have decay in their permanent teeth.<sup>191, 192</sup>

### 3.2.2 Economic Burden of Sugar-Related Ill Health

The burden of disease, or a risk factor of disease such as being overweight or obese, is usually quantified in terms of disability-adjusted life years (DALYs). This measure is a combined estimate of the number of years of life lost due to premature death along with the number of years lived with ill health or with disability (YLD). In brief,



one DALY represents one year of healthy life lost. No modelling has been completed to determine the specific burden attributed to sugar consumption in Australia; however, estimates for sugary drinks conclude that they were associated with 0.3 per cent of the overall disease burden in 2011, amounting to 12,411 DALYs (this is likely to be a conservative figure based only on overweight, obesity and T2DM).<sup>193, 194</sup>

In 2011, more broadly, there were 4.5 million years of healthy life lost in total, with one-third (31 per cent) of these attributed to modifiable risk factors.<sup>195</sup> Dental caries accounted for 36,615 YLD in 2011, or 1.6 per cent of total YLD (noting that few people die directly from dental caries).<sup>196</sup> Overweight and obesity accounted for an even greater share at seven per cent of the total burden of disease, or the equivalent of 312,505 DALYs, due to the increased risk of at least 22 linked diseases.<sup>197, 198, 199</sup> On an individual level, compared to people with a healthy BMI (between 18.5 and 24.0 for young and middle-aged adults), people with a BMI between 30 and 34.99 have their life expectancy cut by two to four years, and people with a BMI greater than 40 have their life expectancy cut by eight to 10 years.<sup>200</sup>

Beyond the burden of ill health on individuals is the wider cost to society in terms of treating them directly through the health system—as well as indirect costs in term of the effects on the workforce:

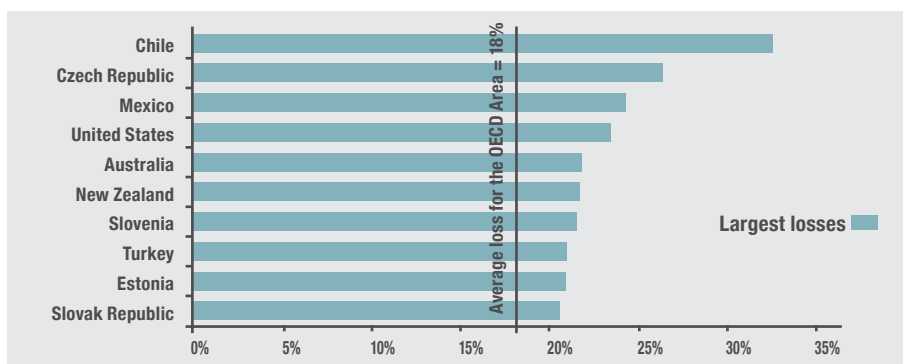
There's a relatively small number of really significant challenges in the health sector, particularly the high cost of health care, the ageing in the population and the proliferation of chronic disease. By far, the costliest expense in the health sector relates to chronic disease and, particularly as overweight and obesity become more prevalent, these costs are going to escalate as time goes on. So, I think the economic arguments about how on earth are we going to sustain a health care system in this context must be an overriding factor in the debate about how we prevent chronic disease or delay the onset of chronic disease through the life course.

**Research Participant—Health Promotion Advocate**

In the period 2015–16, Australians in the government, individuals and non-government funders such as private health insurers collectively spent \$170 billion on health care.<sup>201</sup> When expressed as a proportion of GDP, this was 9.6 per cent of GDP in 2016—higher than the OECD average of nine per cent in the same year.<sup>202</sup> The amount spent on health care per person has also increased well ahead of population growth in recent years, with a per capita increase from the period 2006–07 to 2015–16 of 22 per cent, to \$7,096.<sup>203</sup> For obesity alone, in the period 2014–15, Medicare was billed over \$25 million for almost 125,000 weight loss-related procedures, and a further \$37.1 million was paid by patients and health insurers.<sup>204</sup> In total, it is estimated that obesity cost Australians \$8.6 billion in the period 2011–12, but this estimate came from indirect costs such as productivity losses (\$4.8 billion), then from direct costs to the health system (\$3.8 billion) and, if no further action was taken, obesity would cost \$87.7 billion over a 10-year period up until the period 2024–25.<sup>205</sup>

Morgan Stanley noted that investors should be concerned about the implications of obesity and diet-related diseases from indirect costs for long-term growth.<sup>206</sup> Their modelling demonstrated that a reduced workforce and decreased productivity (from premature deaths, exit from the labour force and/or poorer performance at work) can significantly affect economic growth. For example, in Australia, the prediction of an average annual GDP growth is 3.2 per cent, but when corrected for productivity losses due to excessive sugar consumption, growth drops to 2.7 per cent.<sup>207</sup> Based on a GDP of \$10,798 billion in the period 2015–16, this drag on economic growth equates to \$1,687 billion a year spent (see Figure 17).<sup>208, 209</sup>

**Figure 17. Estimated Economic Output Loss Due to 'Diabesity' by 2035<sup>210</sup>**



## Part 4. A Sustainable Sugar System Transition for Planetary Health

### KEY POINTS

- Widespread adverse socio-ecological effects are inevitable within a system that prioritises the short-term maximisation of profits and the perpetual growth of market share. There are enormous stakes, both financially and ideologically, that are wagered against change.
- Narrowly seeking to address sugar-related issues may deliver some reprieve; however, this act may not extend far enough to deliver impactful change at the scale or pace required. Even more so, as the system adapts and responds, the focus on sugar alone may inadvertently further entrench issues of the broader food system.
- Studies of system transitions suggest that rather than linear and incremental improvements to the current model, new food regimes are born from the innovation and eventual constellation of alternative ways of food provisioning. This alternative framing presents multiple avenues for policy developers and researchers to explore.

### 4.1 The Tyranny of Sweet Profits

From a public health perspective, it is positive news that sugar consumption has declined in recent times; however, based on the present declining trajectory, 40 years will pass before recommended intakes are realised.<sup>211</sup> This sugar system analysis has posited that the external issues or externalities associated with sugar production and consumption are inevitable within a system of food provision that seeks short-term profit maximisation and perpetual growth as its primary goal. As such, the externalities of the system that have been labelled as examples of market failures are not failures at all; socialising the full costs of the system is exactly how private entities may generate the highest amount of profit, in the shortest amount of time. The system is operating exactly as it has been designed to.<sup>212</sup> The corollary to this argument might be that capitalism is not a suitable model for a system of food provision—and, indeed, a persuasive case for this point has certainly been made elsewhere.<sup>213</sup>

In any case, there are extensive financial stakes wagered against meaningful change. Australia, as with many other advanced economies (and increasingly developing economies), is as wedded to its sweet tooth now as it was 150 years ago, when those pioneering farmers established an industry that became the mainstay of the Queensland economy. Like in the past, sugar now remains a valuable fuel in the economic engine of nations. Shifting sugar intakes significantly downwards would prompt major effects on global sugar markets.

Modelling that quantified the effects of achieving WHO-10 by 2025 found that, on balance at a global level, sugar demand would be 10 per cent lower compared to a no-action baseline—with sugar consumption increasing by 17 million tonnes, compared to 38 million tonnes (noting that the system would continue to grow over this period, as it is geared to do).<sup>214</sup> Unsurprisingly, given that exports comprise the bulk of Australia's sugar production, Australia is anticipated to lose export market share in this scenario.

With financial stakes wagered so high, it is difficult—if not impossible—to predict how change can be achieved without considerable market intervention; a profit-maximising system will not voluntarily commit, or even resist, measures that would position businesses at a competitive disadvantage and impact bottom line. Additionally, similar to almost all OECD countries, the dominant political rhetoric used in Australia not just in relation to food, but in more broader contexts, is neoliberal; it asserts that the 'government's role in regulating the economy should be kept to a minimum'.<sup>215</sup> Moreover, enacting interventions requires regulation impact statements that clearly demonstrate that the benefits outweigh the costs to business—an unattainable requirement, when issues are systemically mediated and isolated interventions do not deliver proportionate change.<sup>216</sup>



Finally, it is also important to recognise how a narrow focus on the subject of sugar can have the unintended consequence of entrenching other burdens into planetary health. The ways in which this can occur may be manifold. As a brief example, sugar reduction programs can simply replace sugar with another ingredient that is no better nutritionally, and they may also reinforce the industrialised food system by providing an opportunity for businesses to profit from the sale of additional products containing lower levels of sugar rather than replacing the variants containing higher sugar levels.<sup>217</sup>

The example illustrated in Table 12 demonstrates this by comparing two confectionery products that are currently available on the Australian market—one of which is the standard product and the other a lower-sugar counterpart—and that make the claim of having '25 per cent less sugar'. However, by closely inspecting the labels, the energy content of the two products is identical, with the sugar being replaced with maltodextrin (a highly refined carbohydrate). It is doubtful that this 'mal-substitution' of ingredients in the reformulated product represents a genuinely healthier option for consumers, particularly in light of the mounting evidence against refined carbohydrates.<sup>218</sup>

**Table 12. Comparison of a Standard and Sugar-Reduced Confectionery Product<sup>219</sup>**

Product	Sugar (g per 100g)	Energy (kJ per 100g)	Ingredients
<b>Standard Snakes</b>	46.8	1400	Glucose syrup (from wheat and corn), cane sugar, water, thickener (acid modified wheat starch), gelatine, food acid (citric), natural flavours, fruit juice concentrate, natural food colours (grape skin extract, anthocyanins, black carrot, spirulina, paprika oleoresin, turmeric), glazing agents (vegetable oil, carnauba wax)
<b>Sugar-Reduced Snakes</b>	31.5	1400	Glucose syrup (from wheat and corn), cane sugar, water, thickener (acid modified wheat starch), resistant maltodextrin, gelatine, food acid (citric), fruit juice concentrate, natural flavours, natural food colours (grape skin extract, anthocyanins, black carrot, spirulina, paprika oleoresin, turmeric), glazing agents (vegetable oil, carnauba wax)

#### 4.2 Reframing Sugar as a Systemic Issue

Although this analysis deeply explored how issues for planetary health manifest from the wider system, there is evidently still a way to go to enact such integrative thinking. With sugar consumption as an example, many of the industry stakeholders interviewed for this report framed excessive sugar consumption as a matter of personal responsibility; they believed that people's autonomy in their decision-making should be respected and, therefore, the state has a duty to not interfere.<sup>220</sup> Aligned with such neoliberal, 'autonomy first' rhetoric, the appropriate and proportionate policy response hinges on arming individuals with more knowledge or meaningful information regarding food and drinks and allowing them to shift their choices, should they desire so.

In an industrial model of provision in which people are significantly detached from the food before it arrives on their plate (if there is even a plate!), it is evident that people require a reasonable level of food and health literacy and that they should be equipped with the necessary information to make educated choices. However, this knowledge-centred approach to guiding system change assumes a high degree of rational decision-making. In short, this approach relies on the belief that when equipped with all the necessary information regarding food and health, people will be free to make choices that are consistent with their own best interests and long-term health. Within this personal responsibility paradigm, it is accepted that when people know better and still make choices that are inconsistent with their desire for long-term good health or environmental sustainability, it becomes their fault—people are free to do as they please. However, humans are not rational actors who carefully weigh the advantages and disadvantages of purchasing and consuming foods or drinks before doing so.<sup>221</sup> Most food and drink choices are made automatically, below a level of conscious awareness, and are strongly influenced by the choice architecture and wider environment in which food and drink options are presented.<sup>222</sup>

As the sugar system analysis demonstrated, the food choice environment is entirely geared to a default position that encourages the over-consumption of sugar, which is aligned with the core principle of the system to generate the greatest amount of profit in the shortest amount of time. Even more so, people are vulnerable to this environment because they, to some extent, subconsciously place more value on a smaller and sooner reward (e.g., the pleasure of consuming a sugary drink) than they do on a larger and later reward (e.g., long-term good health), even though they consciously value the choices in the opposite way—a concept known as time discounting.<sup>223</sup> People also heavily rely on the industrial system of food provision due to contemporary lifestyles.



Building on the research that has revealed the limitations of a knowledge-centred approach to generating changes in dietary patterns—such as educational campaigns and informational labelling—it is now more commonplace for policy researchers, developers and advocates to call for ‘changing the food system’ to drive changes in dietary patterns. However, the food system runs much deeper than the immediate food choice environment, which, as is the case with sugar, only manifests as an issue due the system and the structure underpinning it. Attempting to change the food choice environment but not the system behind it falls prey to the same logic of changing individual behaviour. All system agents operate within a bounded rationality—it is less about businesses not wanting to or knowing how to change and more about the notion that they are constrained by what they can do by the very system in which they operate.

### 4.3 Rethinking Sustainable System Transitions

You never change things by fighting the existing reality. To change something, build a new model that makes the existing model obsolete.

**R Buckminster Fuller, Systems Theorist<sup>224</sup>**

This analysis has demonstrated that issues related to the production and consumption of sugar are systemic in origin. It acknowledges that this is important in three ways; first, it pulls the issue away from sugar being the problem to be solved, which can inadvertently form the basis of unintended consequences and further entrench the issues. Sugar is just a symptom of an ailing food system—treating it will not tackle the underlying pathology. Second, it ensures that blame is not attributed to individuals or groups of producers, consumers or other system actors.

A systems view recognises that all people and institutions connected to the system conform to a bounded rationality, and it accepts that attributing blame is not helpful in promoting thinking and action. Third, it allows space to explore how to openly conceive a transition pathway. As Friedmann remarked, it can ‘sensitize our capacities to observe elements of an open future’.<sup>225</sup>

Briefly reflecting on how the sugar system has evolved historically can provide a helpful precedent in regard to how food systems transition. Food regimes conceptualise such dynamics. They mark historical periods in which relatively stable relationships exist between actors in the food system: people, states and businesses. Over time, and driven by a growing dissatisfaction with the rules that govern the food regime, tensions mount between different parts of the system and create volatility. It is in this period of instability that the brokering of a new set of system rules occurs, leading to the establishment of a successor food regime:

These transitions then happen over equally long periods of time, about 25 years, and consist of two strands, we can call them. One, are attempts to restore the old order. When things aren’t working, various actors, especially powerful actors, but really anyone, tries to make changes that will help the system work as it did before, when things aren’t predictable anymore that used to be. So, there are efforts to restore the old structures but also new issues, new relationships, new social groups, new movements arise in these periods that create the possibilities for many kinds of combinations into something new, which could be a new food regime.

**Professor Harriet Friedmann, University of Toronto<sup>226</sup>**

The Australian sugar industry was born in the first regime, the so-called Colonial-Diasporic food regime. This was a time when settler states were created and the colonial export market was developed. The first regime continued until the crises of the Great Depression and the World Wars—which generated the conditions for the Mercantile-Industrial food regime, the birth of what became the transnational agrifood corporations and the beginnings of the ascendance of supermarkets. Since the world food crisis of the 1970s, the overriding feature of the Australian food system has been neoliberalism; the resulting Corporate food regime can be summarised as being specialised, standardised and consolidated—epitomised by the supermarket-led organisation of supply chains.

Under a guise of ‘changing the system’, contemporary policy approaches to address the socio-ecological burdens stemming from the food system generally seek to reshape the mainstream way of producing food—be it through voluntary standards that limit the amount, timing and way that fertiliser is applied, by reformulating products to be lower in sugar, through financial or fiscal incentives, or through the reorientation of marketing strategies. Some policies even seek to address the food choice environment in which decisions regarding what to purchase and consume are made. However, although such efforts are admirable and important and can have





some level of effect, they do not change the system in a deep and fundamental sense; the system continues to operate as the regime rules allow.

Whether these incremental modifications can yield a system that delivers for planetary health at the pace and scale of change that is required is contested. Yet, the alternative to achieving meaningful, widespread and equitable change appears far more radical and unlikely—nothing less than rebuilding the system from the ground up on a foundation of socio-ecological justice.<sup>227</sup> However, if history is taken as a precedent for how regimes shift, then what emerged from the crisis periods were new regimes that were unlike what had preceded them; they had new ways of food that could not be predicted. As systems theorist, Fuller, famously said, ‘There is nothing in a caterpillar that tells you it’s going to be a butterfly’.<sup>228</sup>

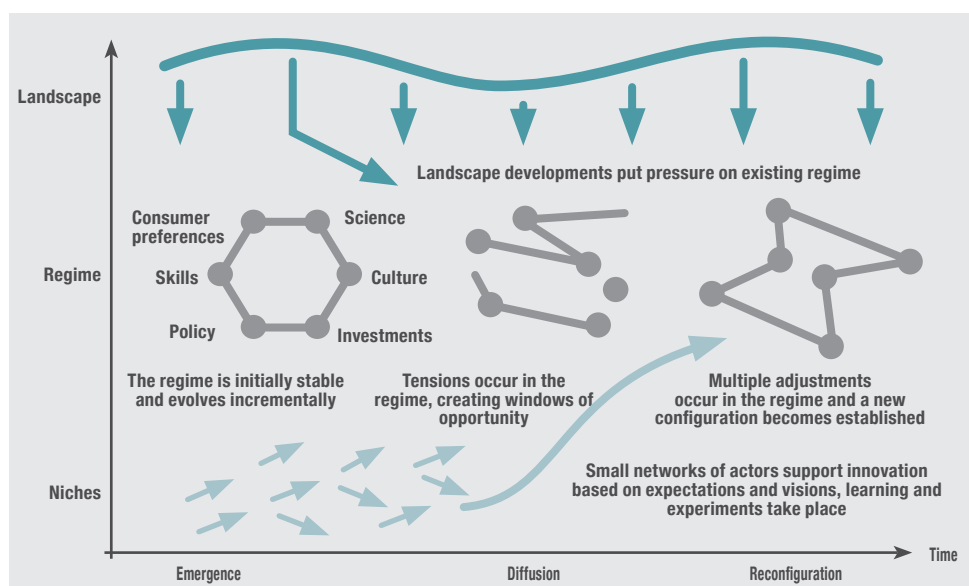
Against a backdrop of the multiple challenges that threaten the ongoing survival of human civilisation, there has been a significant rise in interest regarding transition studies—that is, in investigating how systems transition and how they can be promoted and stewarded in a way that ensures planetary health. In transition studies, the food system, like other sectors such as energy, water and transport is called a socio-technical system; it comprises interconnected elements of actors, institutions (societal and technical norms, regulations, standards of good practice), material artefacts and knowledge. A socio-technical transition (a regime shift) is described as ‘far-reaching changes along different dimensions: technological, material, organisation, institutional, political, economic, and socio-cultural’ that typically occur over considerable time periods and that result in fundamental shifts in the organisation of practices.<sup>229</sup>

The multi-level perspective (MLP) is a conceptual framework used to describe and understand the transition periods. MLP draws attention to the roles of interacting activities across three levels: the niche, regime and landscape (see Figure 18).<sup>230</sup> Applied to food systems, these levels can be outlined as follows:

1. Niche—a protected space outside or on the fringe of the dominant regime within which other ways of food can emerge, such as alternative networks of locally or regionally based shortened supply chains that include buyers groups, farmers markets, box schemes or agroecological and regenerative methods of food production
2. Landscape—change here can be long-term trends such as population demographics or political ideologies or more sudden shocks such as military conflicts
3. Regime—as actors within the mainstream food system increasingly question its sustainability, this can weaken resistance to change and lead to diversification efforts; transitions occur when there are alignments between developments across these three levels.

The transition period can be further divided into three phases, beginning with the emergence of what appears to be radical innovations (compared to the mainstream way of food), which then diffuse more widely until they eventually constellate into alternative rules of food system operation. In this way, MLP proposes that system transitions are non-linear, society-wide processes in which bottom-up innovation and networks play a central role in galvanising change.

**Figure 18. The Multi-level Perspective**



Applying the MLP represents a shift in the framing of how to tackle issues that are generated from the mainstream food system. Implicitly, the focus becomes the system rather than the issue or product (i.e., sugar or sugary products); positioning sugar consumption and production within the recommended limits for planetary health would necessitate a lateral approach to fundamentally restructuring food system practice relations rather than applying incremental changes to the existing model. This would require a rethinking of the goals, types and roles of food policy, as well as a complementary reorganisation of the governance mechanisms to support the rethinking of food policy.

Such a conclusion will inevitably draw resistance from system actors, policymakers and practitioners. However, it must be acknowledged that the current threats to planetary health are unprecedented and that they continue to accumulate. Leading organisations are repeatedly calling for transition pathways that involve a fundamental rethinking of what is now a method of system operation that has been taken for granted, including how food is managed:

The EU's 2050 vision of 'living well, within the limits of our planet' will require 'fundamental transitions in core production-consumption systems ... for food, energy, mobility and housing. Such transitions will necessarily entail 'profound changes in dominant institutions, practices, technologies, policies, lifestyles and thinking.

**European Environment Agency<sup>231</sup>**

Limiting global warming to 1.5°C would require rapid, far-reaching and unprecedented changes in all aspects of society.

**Intergovernmental Panel on Climate Change<sup>232</sup>**

Part of the resistance to deep and truly transformational system change is an inability to acknowledge how systems of food provision could be otherwise:

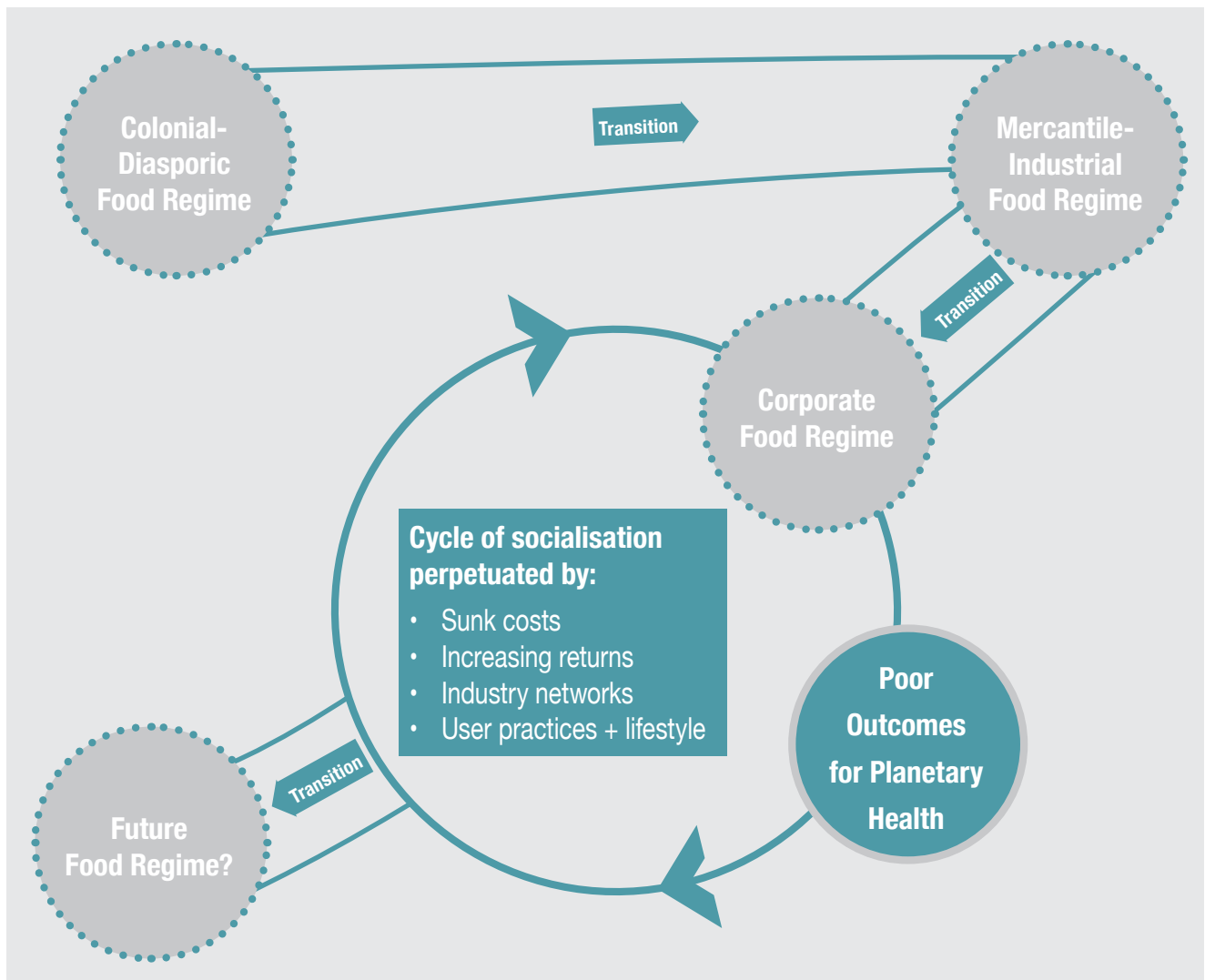
It leads to the folly of assuming that capitalism cannot adapt again. It has done so several times in the past, usually through depression and war. No one in the midst of the last economic crises or wars could have imagined the shape of capital or the inter-state system or the international division of labour that eventually emerged. Even the most apparently powerful people could not predict the shape of earlier food regimes, which unfolded through trial and error ... We cannot predict the future, nor push it into simple trajectories. Climate change does not change this. Such wishful (or fearful) thinking has led to no good in the past.

**Professor Harriet Friedmann, University of Toronto<sup>233</sup>**

Applying the Cycle of Socialisation model is beneficial at this point to illustrate how mainstream systems perpetuate despite the inherent contradictions in their rules of play (e.g., burdens on planetary health).<sup>234</sup> Originally developed to explore the social construction of oppression, the Cycle of Food Socialisation illustrates the personal, behavioural and institutionalised systems that perpetuate the dominant model of 'doing food' and create lock-ins that resist transitions. An important concept that perpetuates this cycle is that the way of food to which populations are exposed is socialised and thus taken for granted. In brief, 'it is difficult to see the systemic forces that maintain status quo when you are part of the system' (see Figure 19).<sup>235</sup>



Figure 19. Cycle of Socialisation and Food Regime Transitions



#### 4.4 Implications for Policy and Research

Given that the application of transition studies to food systems is a relatively new approach, the implications for policy are underexplored; there are thus many areas of consideration for further exploration. In regard to policy, the transitions literature does not assert that the state critically steers transitions by pulling policy levers from an outside 'cockpit' perspective.<sup>236</sup> Rather, alignment must occur across all three levels of the MLP for innovative practices to constellate into a successor regime—policy alone cannot broker this.

More so, transitions occur in stages from emergence, diffusion and reconfiguration, so attention should be paid to the role of different policy approaches. This is particularly true in regard to creating the preconditions for acceleration and then driving the acceleration of sustainable food provisioning practices.<sup>237</sup> For example, considering the three policy-orientated frameworks that have been outlined top-down, bottom-up and integrated, Roberts and Geels proposed that interactive network governance is more appropriate during the formative period of transition; while steering through top-down and market approaches are called for during diffusion and reconfiguration (see Table 13).<sup>238</sup>



Table 13. Three styles of policy

	Hierarchies (top-down)	Markets (bottom-up)	Networks (integrated)
Social relationships	Hierarchical, command-and-control relations, with government responsible for steering markets and society.	Policymakers have arms-length (or hands-off) relations with firms and societal actors, which are assumed to be autonomous and relatively independent.	Mutually dependent interactions between policymakers, firms and societal actors.
Government roles	Government sets goals, selects solutions and shapes implementation through laws, regulations, standards and public investments.	Policymakers articulate goals and shape framework conditions (rules of the game, incentives), but let autonomous actors self-organise via markets and choose solutions.	Policymakers moderate, orchestrate and facilitate social interactions, discussions, learning processes and information exchange, aimed at defining problems and exploring solutions.
Scientific disciplines	Classical political science.	Neo-classical economics.	Sociology, innovation studies, neo-institutional theory.
Policy instruments	Formal rules, regulations, laws and standards.	Financial incentives (subsidies, taxes, fiscal incentives)	Network management, sector-level round tables, public-private partnerships, demonstration projects, experiments, scenario workshops, strategic foresight conferences and public debates.

A critical point from transition studies and food regime theory is that crises have been crucial on a landscape level for carrying the transition from one regime to another by creating a ‘focusing event’ for the enactment of policies.

Examples of crises include wars, failures of the economic system, oil shocks and famines. However, these waymarkers are negative by their very nature and raise a pertinent question regarding how policy can support system transitions before a crisis point is reached. Finally, developing a clearer understanding of what constitutes a crisis that forces an action is important. For example, why is a public health or environmental crisis not destabilising enough to generate regime change?



## Conclusion

Human survival on a healthy planet is not a soft liberal pipe dream; it is sound global management and the deepest of religious impulses. No peoples of the world in any era of their history wanted oppression, discomfort or inconsequence. The desire for food, shelter and purpose are universal; therefore, systems that provided citizens with as much of those three physical and psychological necessities must be considered successful, and furthermore, the survival of such systems over time can only have been wrought by the will of the people.

**Bruce Pascoe, Dark Emu<sup>239</sup>**

Using the specific lens of sugar through which to examine the food system, this report has illustrated how some of the general ways for producing and consuming food according to the mainstream, profit-maximising and neoliberal regime that covets endless growth can have widespread, potentially irreversible and certainly transgenerational consequences for planetary health. In doing so, this analysis has been sensitive to the inherent irony that a reductionist frame of reference may have, especially given that these mindsets have partly contributed to the system as it exists today.

The reductionist approach of the past is no longer relevant in a world facing the deleterious consequences of a rapidly changing climate and an ecosystem that has been tipped out of balance, with record levels of malnutrition in all forms. Deep, radical and holistic changes are required, and these must tackle the food system at its core.

Here lies an opportunity for a sweet change—one to rebuild the foodways from which we are made and to reclaim a connection to food, the earth and, ultimately, each other.



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\* Denotes significant and/or accessible works on the themes explored in this report and are recommended as further reading.

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## Nomenclature

### **ABARES**

*Australian Bureau of Agricultural and Resource Economics and Sciences*

### **ABS**

*Australian Bureau of Statistics*

### **ADG**

*Australian Dietary Guidelines*

### **AHS**

*Australian Health Survey*

### **BMI**

*Body Mass Index*

### **bn**

*Billion*

### **DALY**

*Disability-adjusted life years*

### **FAO**

*Food and Agriculture Organization of the United Nations*

### **FSANZ**

*Food Standards Australia and New Zealand*

### **GBRCA**

*Great Barrier Reef catchment area*

### **GDP**

*Gross Domestic Product*

### **GHG**

*Greenhouse gas*

### **GWb**

*Gigawatt hours*

### **Ha**

*Hectare*

### **HSR**

*Health Star Rating*

### **ICE-11**

*Intercontinental Exchange 11 contract for raw sugar trading*

### **IVA**

*Industry Value Added*

### **Km**

*Kilometre*

### **kt**

*Kilotonne (1000 tonnes or 1,000,000 kilograms)*

### **m**

*Metre*

### **Mt**

*Megatonne (1,000,000 tonnes or 1,000,000,000 kilo- grams)*

### **NSW**

*New South Wales*

### **OECD**

*Organisation for Economic Co-operation and Develop- ment*

### **RIRDC**

*Rural Industries Research and Development Corporation*

### **R&D**

*Research and Development*

### **t**

*Tonne (1000 kilograms)*

### **t/ha**

*Tonnes/hectare*

### **tsp**

*Teaspoon*

### **UNESCO**

*United Nations Educational, Scientific and Cultural Orga- nization*

### **UPF**

*Ultra-processed foods*

### **US**

*United States*

### **WHO**

*World Health Organisation*

### **WHO-10**

*World Health Organisation's recommendation that free sugars should comprise less than 10% of energy intake*

### **WTO**

*World Trade Organisation*

### **YLL**

*Years of Life Lost*

### **YLD**

*Years Lived with Disability*

### **yr**

*Year*



## Glossary

### **Added sugars**

*There is no universally accepted definition of added sugars. As most of the discussion in this report relates to Australia, the description of added sugars used aligns with work undertaken by FSANZ to determine amounts consumed through the AHS. In this case, added sugars are sugars that are added to foods and beverages by the manufacturer, cook or consumer that are hexose monosaccharides and disaccharides. This includes dextrose, fructose, sucrose, lactose and products derived from a sugar refinery, such as raw, refined, brown or icing sugar.*

### **Bagasse**

*The fibrous residue after the sugarcane has been crushed through rollers. Consists of fibre, water and a small quantity of sugar. It may be used as fuel in a sugar mill's boiler or a soil-enhancement agent.*

### **Industry Value Added**

*The market value of goods and services produced by the industry minus the cost of goods and services used in production. IVA is also described as the industry's contribution to GDP, or profit plus wages and depreciation.*

### **Food system**

*The entire range of actors and their interlinked value-adding activities involved in the production, aggregation, processing, distribution, consumption and disposal of food and beverage products.*

### **Free sugars**

*The definition of free sugars applied by FSANZ in their work determining intakes aligns with the WHO's definition, which is that free sugars include monosaccharides and disaccharides added to foods and beverages by the manufacturer, cook or consumer and sugars that are naturally present in honey, syrups, fruit juices and fruit juice concentrates.*

### **Neoliberal/Neoliberalism**

*There are several schools of neoliberal thinking. In this report, the terms are used to describe an ideology and policy model that emphasises the value of free market capitalism and of minimising state intervention in the economy.*

### **Nutrition transition**

*The predictable dynamics of dietary shifts and physical activity patterns that occur as communities modernise, urbanise, experience income growth and expand into global trade. It can be split into five predictable patterns:*

- 1. hunter-gatherer, 2. early labour-intensive agriculture with periods of famine, 3. industrialisation of agriculture, income growth and receding famine, 4. energy-dense, nutrient-poor diets and a rise in diet-related diseases and 5. behaviour change.*

### **Planetary health**

*The health of human civilisation and the state of the natural systems on which it depends. This concept recognises that human health and the health of the planet and its ecosystems are inextricably linked.*

### **Social movements**

*These are networks of informal interactions between a plurality of individuals, groups and/or organisations striving towards a common goal relating to human society or social change, or the organised activities of such a group.*

### **Sugarcane**

*A perennial grass of the genus *Saccharum*, native to warm, temperate to tropical regions of Southeast Asia and New Guinea. It is a C4 crop: it cycles carbon dioxide into four-carbon sugar compounds, making it an efficient energy producer. It is grown initially from cuttings (the plant crop), followed by three to five ratoon crops in which the crop can regrow after harvesting, and in some regions, a fallow period.*

### **Raw sugar**

*Raw sugar is produced in a sugar mill, where juice is extracted from the sugarcane stalks to produce a brown crystal that is 96 to 98% sucrose. This is different to the 'raw sugar' that is increasingly found on supermarket shelves.*

### **Refined sugar**

*Produced from raw sugar that has been processed in a refinery to remove molasses and is 100% sucrose.*

### **Ultra-processed foods**

*Industrially produced foods or beverages that include cosmetic or sensory additives such as colours, flavours or sweeteners; or foods undergoing manufacturing processes that have no domestic equivalent, such as extrusion.*



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# Sugar in Australia: A Food System Approach

Competing Issues, Diverse Voices, and  
Rethinking Pathways to a Sustainable Transition