



Victoria's Nutraceutical Industry

A Roadmap to unlock
future growth opportunities
for Victoria

2020



CSIRO

We are Australia's national science agency, solving our greatest challenges through innovative science and technology.

Uniquely positioned to tackle such challenges, CSIRO is home to over 5,500 of the world's brightest minds networked across a comprehensive research portfolio. We collaborate closely with industry, government and the extended research community to drive innovation that leaves a lasting legacy for our nation. Our research improves the health and wellbeing of our communities; transforms our industries to successfully compete in a global marketplace; and accelerates international understanding of our diverse natural environments to sustain them for generations to come.

Swisse

Swisse is a global wellness brand with a mission to make billions around the world healthier and happier. Starting as a small Australian wellness company with that same dream in 1969, for 50 years now Swisse has been on an ongoing quest to find the finest natural ingredients from all over the world, to formulate products that help people live their best life every day.

Sampano

Sampano aims to establish a coordinated local nutraceutical value chain, enabling all the different parts of the industry to connect and flourish. We provide opportunities for growers and processors to participate in the local value chain and provide information and support to create direct access to Australian and export markets.

This Report

This is a CSIRO Futures report, informed by industry consultation. The project was co-funded by CSIRO and Swisse in collaboration with Sampano, as a priority activity in line with the Victorian Government's Future Industries Initiative. We are grateful for the time and input of the many external stakeholders who contributed to this project through interviews and by providing feedback.

Acknowledgements

CSIRO acknowledges the Traditional Owners of the lands that we live and work on across Australia and pays its respect to Elders past and present. CSIRO recognises that Aboriginal and Torres Strait Islander peoples have made, and will continue to make, extraordinary contributions to Australian life including in cultural, economic and scientific domains.

Copyright

© Commonwealth Scientific and Industrial Research Organisation 2020. To the extent permitted by law, all rights are reserved and no part of this publication covered by copyright may be reproduced or copied in any form or by any means except with the written permission of CSIRO.

Important disclaimer

CSIRO advises that the information contained in this publication comprises general statements based on consultations and desktop research. Nothing in this document is intended as medical advice nor a health claim. The reader is advised and needs to be aware that such information may be incomplete or unable to be used in any specific situation. No reliance or actions must therefore be made on that information without seeking prior expert professional, scientific and technical advice. To the extent permitted by law, CSIRO (including its employees and consultants) excludes all liability to any person for any consequences, including but not limited to all losses, damages, costs, expenses and any other compensation, arising directly or indirectly from using this publication (in part or in whole) and any information or material contained in it.

CSIRO is committed to providing web accessible content wherever possible. If you are having difficulties with accessing this document, please contact csiroenquiries@csiro.au.

Foreword

Nutraceuticals are a significant and growing opportunity for Victoria.

Our strong agricultural and manufacturing sectors, combined with world-leading health and medical research expertise, can support the development of a nutraceuticals industry that will create new jobs across the state and support skills and capability development.

It can help primary producers diversify and take advantage of new opportunities.

The impacts of building this sector will not just be economic – evidence-based nutraceuticals, including healthier fortified and functional foods, will support the health and wellness of not only people in Victoria, but across the world.

The CSIRO Victorian Nutraceuticals Industry Roadmap provides a blueprint for establishing Victoria as a global hub for nutraceutical ingredients, research and product development.

Building Victoria's contribution to global nutraceutical value chains will require deep collaboration across the industry, with organisations working together to grow Victoria's advantage and fill supply chain gaps.

Together with growers, processors, manufacturers, food companies, vitamin companies, regulators, and researchers, we can grow Victoria's evidence-based nutraceutical industry to become a national leader.

I look forward to close collaboration with the industry and seeing Victoria realise the opportunities outlined in this report.

The Hon. Martin Pakula MP

Minister for Jobs, Innovation and Trade
Minister for Sport, Tourism and Major Events
Minister for Racing





Contents

Foreword	i
1 Victoria’s nutraceuticals industry: a growing opportunity	1
1.1 Global trends shaping industry	6
2 Opportunities for growth	11
2.1 Support the health and wellness of future global consumers.....	13
2.2 Unlock the Victorian supply chain for nutraceuticals	18
3 Why Victoria?.....	23
4 Enabling growth	27
4.1 Enablers for the growth of Victoria’s nutraceuticals industry.....	28
4.2 Future research priorities.....	30
5 Appendix.....	33
A.1 Project methodology	33
A.2 Opportunity sizing methodology	34



1 Victoria's nutraceuticals industry: a growing opportunity

Vision for the future: A global hub for nutraceutical ingredients, research and product development. Victoria's nutraceutical industry draws on the state's unique strengths to contribute to global nutraceutical supply chains, delivering significant economic and social value to Victoria.

What are nutraceuticals?

There are varying definitions of 'nutraceuticals' around the world. This report uses the term to mean products consumed for specific medicinal, health, wellness and/or additional nutritional benefits (usually food-derived). This includes:

- vitamins, supplements and minerals (VSM);
- fortified foods (enriched with nutrients); and
- functional foods and beverages (contain ingredients offering health benefits).¹

Nutraceuticals often result from the convergence of food and pharmaceutical technologies.²



Victorian industry is well placed to build on its competitive advantages to contribute to a growing global nutraceutical industry, capturing a possible \$4B in value by 2030.³ It can do this by building local supply chains to provide safe, sustainable, effective and ethically sourced nutraceuticals that complement the balanced diets and lifestyles for enhanced health benefits of global consumers.

Growing global demand for nutraceuticals alongside increasing momentum from stakeholders across the Victorian supply chain are two factors driving growth opportunities within the local nutraceutical industry. By seizing the opportunities available (described in this report), Victorian industry can steer innovation in the sector and become a hub for nutraceutical ingredients, research and product development, including robust scientific validation. Building and supporting Victorian supply chains, the state can capture economic value and create foods and products that have the potential to play a role in maintaining wellbeing and enhancing health.

In a healthy general population, fresh food and a balanced diet is the optimal way to receive nutrition. However, an ageing population together with an increasing chronic disease burden⁴ drives greater consumer health awareness and creates demand for nutraceuticals.⁵ This growing chronic burden puts pressure on both health and food systems to deliver increased health promotion and illness prevention measures.⁶ With increasing consumer demand for healthier foods, beverages and evidence-based nutraceuticals, there is opportunity for both innovation and stronger R&D to support the growth of the industry.

1 This excludes naturally healthy foods and beverages. Vitamins, supplements and minerals are sometimes referred to as complementary medicines.
2 KPMG (2015). *Nutraceuticals: The future of intelligent food*.
3 CSIRO economic analysis – 2030 annual domestic and export opportunity for VSM + FF. See *Appendix for underlying assumptions, sources and further details*.
4 World Health Organization (2019). *Global Health Observatory (GHO) data*, [Online] Available from: https://www.who.int/gho/mortality_burden_disease/en/ Accessed: 11/07/2019; Technavio (2019). *Global Nutraceuticals Market*.
5 BCC Research (2018). *Nutraceuticals: Global Markets to 2023*, pp.28; Technavio (2019). *Global Nutraceuticals Market*; Frost & Sullivan (2014). *Strategic Analysis of ANZ Nutraceuticals Market*.
6 AIHW (2018). *Australia's health 2018*; VicHealth (n.d.) *Supporting healthy eating – Local government action guide no. 7*. [Online] Available from: https://www.vichealth.vic.gov.au/-/media/Indicators/Overview-sheets/10/VH_LG_Guides_Health-Eating_web.pdf?la=en&hash=52BF1B610FEEB1439DACE0E274F6847267F31C49 Accessed 30/07/2019

With a growing consumer focus on preventative care⁷ together with a national ambition to transition the health system to one that monitors and manages health risk more proactively and places greater emphasis on optimal wellbeing,⁸ momentum for innovation across numerous Australian industries is growing. This includes medical technologies (e.g. improved screening), pharmaceuticals (e.g. vaccine development), and the food and nutrition sector (scientifically validated vitamins supplements and minerals (VSM) and fortified and functional (FF) foods). Fortified and functional foods, for example, can help improve consumer's intake of nutrients and contribute towards improved public health.⁹ Neural tube defects fell by 14% following mandatory folic acid fortification of bread in Australia.¹⁰

The Victorian industry is well-placed to leverage its competitive advantages and growing momentum across the state to build local supply chains and grow its contribution to the global nutraceutical industry. These competitive advantages include the state's significant horticultural production, infrastructure and expertise, its ability to leverage Australia's global reputation for clean and green food systems, and a world-class manufacturing and regulatory framework for complementary medicines (such as vitamins, minerals and supplements). However, Victoria's industry will not realise opportunities for economic growth, new jobs and societal benefit without appropriate action. Lack of collaboration is a challenge, and a concentrated effort is needed from across the supply chain. This report outlines several enabling actions that aim to help build an evidence-based and innovative nutraceutical industry in Victoria.

This report

This report draws on consultation with industry stakeholders from across the supply chain alongside CSIRO's research expertise.

The report aims to help senior decision makers across industry and government identify growth opportunities that Victoria can pursue to reach the vision for the future. These opportunities outline areas for investment, including supply chain gaps that present potential new revenue streams for Victoria's primary production industry and new product innovation prospects that

are driven by global industry trends. While the report focuses on Victoria and its competitive advantages, the nutraceutical value chain often crosses state (and national) borders, with many of the growth opportunities applicable Australia wide. The report highlights several enabling actions and R&D priorities (Section 4) that aim to promote growth of an evidence-based industry and drive Victoria towards being a global hub for nutraceutical ingredients, research and product development. Appendix A.1 contains detail on the methodology and Figure 3 provides a summary of the report.

Is it a food or a medicine?

Nutraceutical products have different regulatory obligations based on whether the product is classified as a food or a therapeutic good. To effectively capture the opportunities in this Roadmap, businesses are encouraged to clearly define which regulatory path they will need to follow early in the product development process. The TGA has a Food-Medicine Interface Guidance Tool on their website that helps distinguish therapeutic goods from foods.

- Products classed as therapeutic goods (including medicines) are regulated by the Therapeutic Goods Administration (TGA) at a federal level. If a nutraceutical product is deemed to be a therapeutic good (usually referred to as a complementary medicine), it must be included in the Australian Register of Therapeutic Goods (ARTG) which comes with certain legislative obligations around safety, quality, efficacy and presentation of the product. Importantly, evidence to support indications made for the medicine must be held by the company (sponsor).
- Foods (including many that make health claims) are predominantly regulated by state and territory food regulatory bodies to meet the Australia New Zealand Food Standards Code.

For more information, visit: www.tga.gov.au/community-qa/food-and-medicine-regulation

⁷ BCC Research (2018). *Nutraceuticals: Global Markets to 2023*, pp.23.

⁸ CSIRO Futures (2018). *Future of Health*, CSIRO

⁹ World Health Organization and Food and Agriculture Organization of the United Nations (2006). *Guidelines on food fortification with micronutrients*.

¹⁰ AIHW (2016). *Monitoring the health impacts of mandatory folic acid and iodine fortification 2016*.

Victorian industry snapshot

33%

of Australia’s vitamin and supplement manufacturing establishments are in Victoria¹¹

\$15B

of agricultural commodities produced in Victoria in 2017-18 (25% of Australian production)¹²

6%

annual growth in Australian VSM and FF retail sales between 2013 and 2018¹³

The Victorian nutraceuticals industry is well positioned to:



Complement holistic models for health and wellbeing, both domestically and globally, in potential areas such as healthy ageing, brain and gut health.



Contribute to Victoria’s position as the food, health and wellness hub, through competitive advantages across the supply chain – from primary production to R&D.



Capture a \$4B opportunity by 2030 across domestic and export markets if enabling actions are implemented and industry’s competitive advantages supported.

Figure 1: Industry snapshot

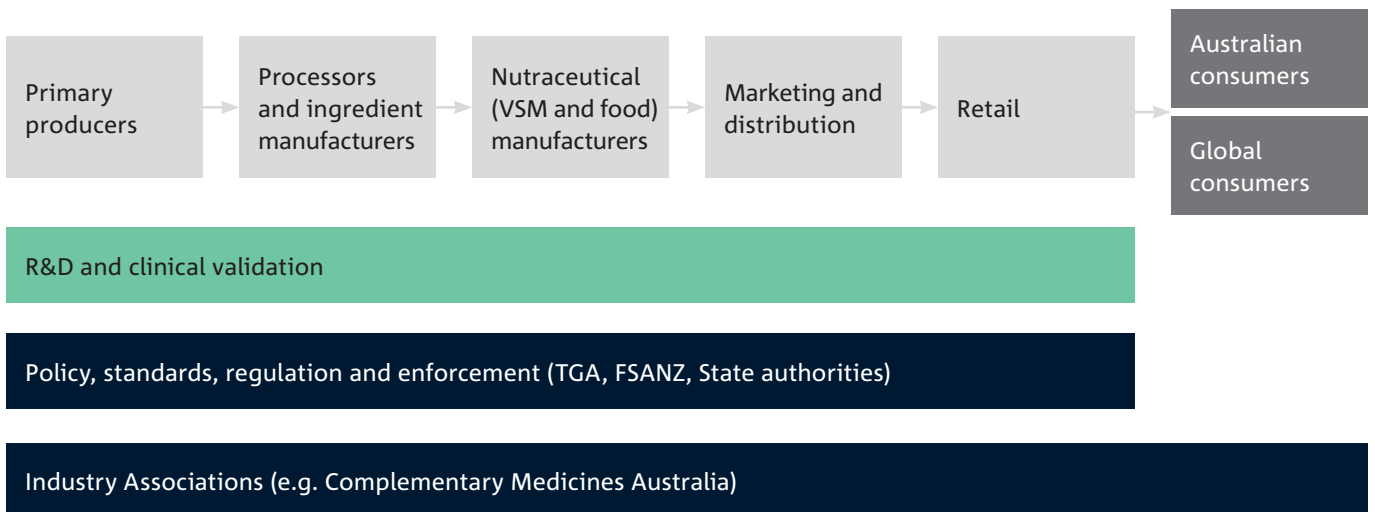


Figure 2: A Nutraceutical industry supply chain

¹¹ Richardson, A. (2017). *Vitamin and Supplement Manufacturing in Australia*. IBISWorld.

¹² ABS (2018). 7503.0 - Value of Agricultural Commodities Produced, Australia, 2017-18; Data cube All commodities by Australia, state/territory and SA4 regions (Table 3). Aquaculture and fisheries data based on 2016-17 data (ABARES (2018). *Australian Fisheries and Aquaculture Statistics 2017*).

¹³ Euromonitor International (2019). *Consumer Health and Health and Wellness Statistics*.

Victorian Nutraceuticals Roadmap Summary

Global trends

Future consumers

Demographics and lifestyles are changing and demand for natural, sustainable and convenient products is growing

Holistic care

Evidence-based nutraceuticals may complement a holistic model of care for health and wellbeing

Growth opportunities



Support the health and wellness of future global consumers

- **Healthy ageing:** Innovation to support healthy ageing (e.g. heart, bone and eye health, etc.)
- **Brain health:** Research and evidence-based products for memory, attention, sleep quality, mood, etc.
- **Gut health:** Evidence-based solutions to help consumers achieve optimal digestive wellness.
- **Pre-conception and early life:** Innovation and personalisation to support pre-conception, pregnancy and early life wellbeing.
- **Health by stealth:** Convenient and accessible solutions to meet dietary, lifestyle and/or cultural needs.
- **Personalised and precision nutrition:** Tailor and maximise nutritional benefits to unique needs of each consumer at different stages of life.



Unlock the nutraceuticals supply chain for Victoria

- **Victorian grown ingredients:** Help meet global demand for Australian made products and native ingredients
- **Waste conversion:** Utilise ingredients more efficiently and meet consumer demand for sustainable products and supply chains
- **Research and development hub:** Make Victoria the global destination for nutrition R&D and clinical testing

Victoria's advantage

Food and health clusters: Victoria is a desired destination for nutraceuticals, agri-food and health industries

Clean and green brand: Australia's reputation for high quality products supports global demand for Victorian nutraceuticals

Enabling actions

1 Support local upstream development

2 Establish pathways to commercialisation and trade at scale / profit

Figure 3: Victorian Nutraceuticals Roadmap Summary

Information, safety and effectiveness

Consumers are better informed; transparency of information is critical to supporting the long-term viability of the nutraceuticals industry

Global supply chains

International markets present significant growth opportunities and competition

Ripe for innovation:

Strong demand for nutraceutical innovation; priority areas include new ingredients, delivery mechanisms, sustainability and traceability

Challenges

- Complementary medicines often do not have enough evidence to support claims
- More well-constructed research projects are required
- Improve consumer education and awareness
- Greater industry access to timely and trusted information
- Access to growing export markets

Opportunity size by 2030

- Help capture \$1.8B in domestic and export demand for VSM
- Contribute to \$2.5B in domestic and export demand for F&F
- +3.5K direct jobs if economic value is captured locally

Outcomes

Complement health and wellness systems with Australian-made, evidence-based nutraceuticals

Support growth and jobs across Victoria's agri-food and health industries

Challenges

- Lack of collaboration and communication across the supply chain
- Cost pressures and access to infrastructure
- More research is required to support the nutraceuticals industry
- Product counterfeiting and fake nutraceuticals

Opportunity size by 2030

- \$600M growth opportunity for Victorian ingredients by 2030
- \$400M in investment towards R&D and clinical trials

World class capability: Victoria has world leaders in R&D and clinical trials, and is well placed to develop new innovations and build the evidence base

Effective policy and regulation: A trusted and fit-for-purpose system will maintain strong safety and quality standards, protect Australia's brand and encourage research to drive innovation and evidence

3 Build R&D and clinical trials activity

4 Continuous improvement to ensure regulation is fit-for-purpose

5 Improve consumer education and information

1.1 Global trends shaping industry

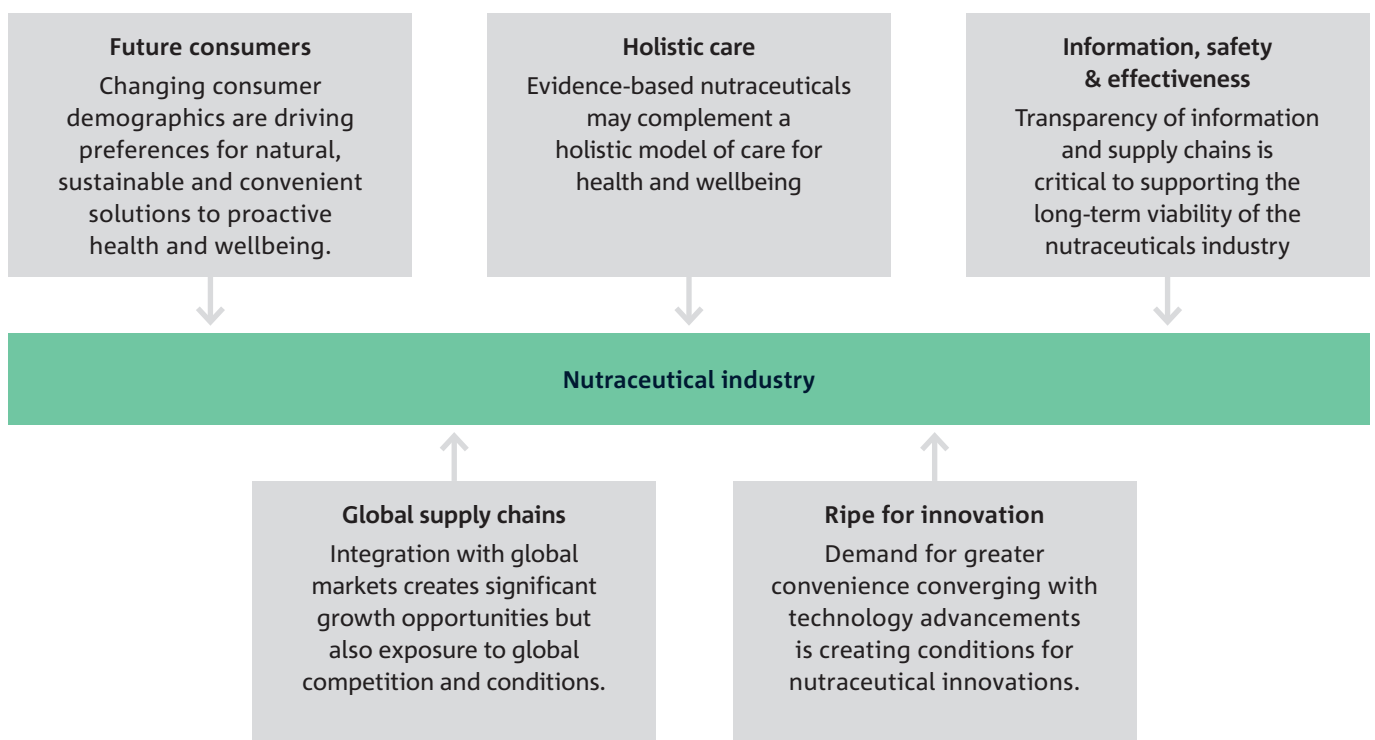


Figure 4: Global trends

Various societal and industry trends will shape and drive the growth of the global nutraceuticals industry over the next five to ten years. Understanding and considering these trends is important when making strategic decisions within the nutraceutical industry.

Future consumers

Changing consumer demographics are driving preferences for natural, sustainable and convenient solutions to proactive health and wellbeing.

Health and wellness solutions are transforming from predominantly treatment focused towards proactive lifestyle improvement.¹⁴ Changing demographics and societal norms, such as evolving family roles, preferences for work-life balance, ageing populations, a rising number of health conscious consumers and a growing chronic disease burden are creating demand for convenient but effective nutritional options with accessible and personalised distribution channels (e.g. online retail).¹⁵ Consumers also demonstrate a growing preference for organic and natural ingredients¹⁶ as they are perceived to be less harmful than manufactured ingredients.^{17,18} Likewise, there is increased preference for eco-friendly and ethically sourced products as awareness of social and environmental issues improve. A 2015 survey found that about 39% of global consumers are willing to pay a premium for naturally sourced ingredients, while 33% are willing to pay a premium for ingredients that are sourced sustainably.¹⁹

Holistic care

Evidence-based nutraceuticals may complement a holistic model of care for health and wellbeing

Healthcare systems are shifting from illness treatment to holistic wellbeing management; from one-size-fits-all to bespoke health solutions; and from extending life to improving quality of life.²⁰ As populations age and grow, the incidence of chronic disease, mental health conditions and other health and wellbeing issues increase. Today, around half of all Australian adults live with a chronic condition,²¹ with a recent survey finding that almost a third of Australians who use complementary medicines are using them to manage symptoms of a chronic disease or condition.²²

A shift to more holistic models of care is driven by a continual rise in health expenditure. In Australia, the health expenditure proportion to gross domestic product (GDP) has risen from 8.75% in 2006-07 to 10.28% in 2016-17 (+1.53%),²³ while average real annual health expenditure per person has risen at 2.7% per annum during the same period.²⁴ To complement holistic models of care, nutraceutical products and distribution channels may expand to meet the diverse wellbeing and lifestyle needs of different consumer groups. This is in addition to a balanced and nutritious diet, and alongside growth in industries such as naturally healthy or organic foods and beverages.

14 Euromonitor Passport (2017). *Vitamins and dietary supplements (VDS): trends and prospects 2017*.

15 BCC Research (2018). *Nutraceuticals: Global Markets to 2023*, pp.28; Technavio (2019). *Global Nutraceuticals Market*; Frost & Sullivan (2014). *Strategic Analysis of ANZ Nutraceuticals Market*.

16 Román, S., Manuel Sánchez-Siles, L., Siegrist, M., (2017). *The importance of food naturalness for consumers: Results of a systematic review*, Trends in Food Science & Technology, 67, pp. 44-57.

17 Jain, P. K., & Pundir, R. (2013). *Nutraceuticals: Recent developments and future prospectives*. In *Recent Trends in Biotechnology and Therapeutic Applications of Medicinal Plants* (pp. 213-224). Springer Netherlands.

18 In Australia, the Therapeutic Goods Administration has released guidance on ensuring 'natural' claims are not misleading. Ingredients must be only minimally processed from the form found in nature AND must not have been transformed to an extent that the ingredient is a different chemical substance. Source: TGA [Online] Available from: <https://www.tga.gov.au/therapeutic-goods-advertising-ensuring-natural-claims-are-not-misleading>.

19 Nielsen (2015). *We Are What We Eat – Health Eating Trends Around the World*.

20 CSIRO Futures (2018). *Future of Health*, CSIRO

21 AIHW (2018). *Australia's health 2018*, pp. 8.

22 YouGov Galaxy (2019). *Consumer Sentiment Study prepared for Complementary Medicines Australia* – unpublished.

23 AIHW (2018). *Health Expenditure Database, Health Expenditure Australia 2016-17* (Table 2.2).

24 AIHW (2018). *Health Expenditure Database, Health Expenditure Australia 2016-17* (Table 2.12).



Information, safety and effectiveness

Transparency of information and supply chains is critical to supporting the long-term viability of the nutraceuticals industry

Increasingly connected and informed consumers will challenge the nutraceutical industry, demanding transparency in supply chains, more robust scientific evidence behind health claims, and associated societal acceptance of these operations, known as a ‘social licence to operate’. Despite the increasing availability of information, there is still a lack of easily accessible and trusted nutraceutical consumer information,²⁵ which together with the vast diversity of nutraceutical options sees consumers largely depending on recommendations of friends, family, social media and quality of packaging.

As the global market for nutraceuticals grows, so too does the risk of adulteration, counterfeits, and undeclared or misleading labels. Internationally, considerations for regulators will continue to be safety, quality and efficacy of nutraceuticals while supporting a maturing sector. Furthermore, nutraceutical research is complex, where different studies of the same product can sometimes lead to conflicting results.²⁶ This emphasises the need for continued investment, both to demonstrate effectiveness and build trust.

²⁵ NHMRC (2014). *Talking with your patients about Complementary Medicine – a Resource for Clinicians*.

²⁶ Harvard School of Public Health (2019). *Supplement Studies: Sorting Out the Confusion*. The Nutrition Source.

Global supply chains

Integration with global markets creates significant growth opportunities but also exposure to global competition and conditions.

Nutraceuticals are reliant on global supply chains, particularly Australia's industry, which relies on inputs from various countries and heavily exports to global markets. Access to global markets creates opportunities to service the needs of different consumers, but also creates exposure to volatility and complexity that comes with the global political-economic climate, which can impact global supply and demand of nutraceuticals over the medium term. One complexity to be navigated is the differing regulation of nutraceuticals across geographies.

While most countries have adequate access to carbohydrates and proteins, many countries still face micronutrient inadequacies, and over the long term, ongoing environmental risks may threaten global nutrition security. Long term environmental modelling suggests that micronutrient availability across regions could fall even further with the onset of climate change and biosecurity complications.²⁷ While the Asia-Pacific region presents opportunities for the nutraceutical industry, particularly China and India where demand is growing in line with increasing affluence,²⁸ intensifying competition with large multinational corporations is also anticipated. Consumers differ in profiles, preferences and willingness to pay across regions and success in each market segment requires deep consumer understanding with tailored solutions.

Ripe for innovation

Demand for greater convenience converging with technology advancements is creating conditions for nutraceutical innovations.

Challenges around undernutrition, nutritional insecurity and diseases of overnutrition are pushing the need for nutrition research, which has potential for prevention, management and treatment of human disease.²⁹ Over the past two decades, there has been a surge in global nutraceutical R&D. Annual peer-reviewed publications in nutraceuticals have grown at 14% per annum between 2010 and 2018.^{30,31} Continued advancements in extraction methods, analysis techniques, formulation methods and sustainable supply chains are expected over the next decade. Furthermore, new product development will aim to continue satisfying the consumer with new modes of delivery, new ingredients and new products with proven therapeutic benefits, including foods with benefits beyond their normal nutrition. Research is also expected to focus on enabling more personalised and precision nutritional solutions.³²

27 Nelson, G., Bogard, J., Lividini, K., Arsenault, J., Riley, M., Sulser, T., Rosegrant, M. (2018). *Income Growth and Climate Change Effects on Global Nutrition Security to Mid-century*, Nature Sustainability, 1(12), 773-781. doi:10.1038/s41893-018-0192-z

28 EY (2017). *Health supplements and nutraceuticals—Emerging high growth sector in India*.

29 National Committee for Nutrition (2019). *Nourishing Australia: a decadal plan for the science of nutrition*, Australian Academy of Science.

30 Elsevier (2019). *Scopus Database*.

31 Da Costa, J. (2017). *A current look at nutraceuticals – Key concepts and future prospects*. Trends in Food Science & Technology, 62, 68-78.

32 National Committee for Nutrition (2019). *Nourishing Australia: a decadal plan for the science of nutrition*, Australian Academy of Science.



2 Opportunities for growth

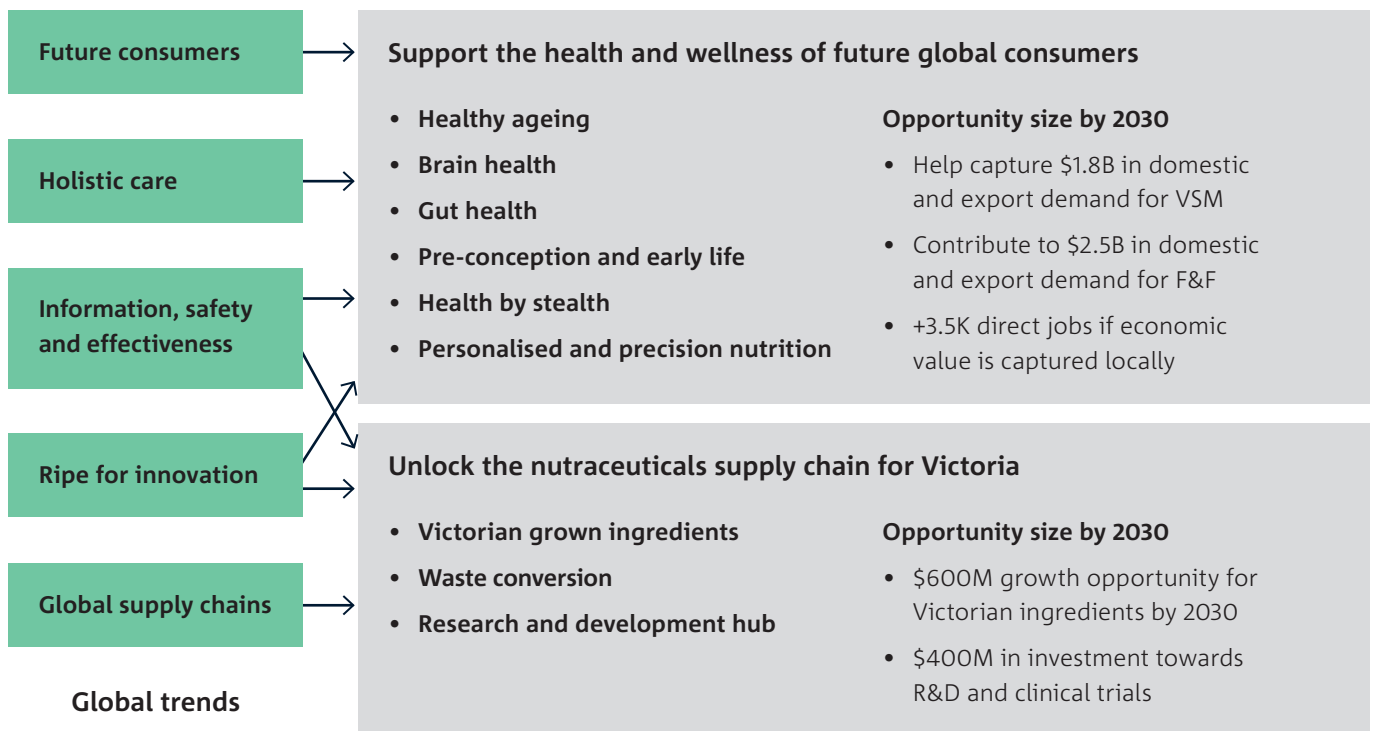


Figure 5: Opportunities for growth

The global nutraceutical market presents a significant domestic and international economic opportunity for Victoria. The opportunity for Victorian industry in VSM is expected to reach \$1.8B by 2030 (\$1.2B in 2018), and \$2.5B by 2030 for fortified/functional (FF) foods (\$1.7B in 2018).³³ This could translate to an additional 3,500 direct jobs by 2030 if economic value and production can be captured locally.³⁴ However, it is important to understand that these are estimates of what Victoria could reasonably capture under current industry, economic and demographic trends, but not necessarily under business-as-usual operations. That is, realisation of opportunities requires Victorian industry to pursue

opportunities for growth (some of which are discussed in this section) and adopt enabling actions that can support the conditions for growth (discussed in Section 4).

Industry consultations to inform this report led to the identification of several opportunities focused on consumer sub-groups, where the nutraceuticals industry is potentially well placed to support through product innovation, research and development. These include healthy ageing, where an ageing population with an increasing incidence of chronic disease has and is expected to continue to drive increased demand for nutraceuticals.³⁵

³³ This refers to the current and expected opportunity for Victorian industry if it can capture up to a third of market share in Australian domestic retail sales and exports under current industry growth trends. Source: CSIRO economic analysis – Please see Appendix for underlying assumptions, sources and further details.

³⁴ Ibid.

³⁵ Frost & Sullivan (2014). *Strategic Analysis of ANZ Nutraceuticals Market*; BCC Research (2018). *Nutraceuticals: Global Markets to 2023*, pp.28.



Greater understanding of mental health will encourage nutritional practices to promote brain health and emotional wellbeing;³⁶ and as research on determinants of gut health progresses, opportunities to help consumers improve digestive and overall wellbeing will develop.³⁷ Similarly, continued research on the influence of nutrition during the period from pre-conception to early childhood drives opportunities for improved nutritional solutions.³⁸ More generally, consumers are increasingly seeking accessible, convenient and personalised nutritional solutions to meet dietary, lifestyle and cultural needs.³⁹

While recognising that healthy food and diet is the optimal way to receive nutrition in a healthy general population, these segments reflect the opportunity for evidence-based nutraceuticals to support an increasingly integrated model of care and changing nutritional needs due to global changes in consumer demographics and preferences.

These opportunities are discussed further in Section 2.1.

Consultations also identified substantial opportunities to capture untapped value from Victoria's supply chain. There is strong demand for local ingredients due to Australia's reputation for 'clean and green', high quality nutraceuticals and inputs. This represents an attractive growth and diversification opportunity for Victorian agriculture and native ingredients that could reach \$600M by 2030 (\$130M in 2018).⁴⁰ Furthermore, rising demand for greater innovation, traceability, sustainability and efficacy in nutraceuticals could see Victorian investment in R&D and clinical trials grow to \$400M by 2030 (\$270M in 2018).⁴¹ Sustainability and conversion of under-utilised biomass (food waste) will be a growing priority for industry, particularly as consumers seek environmentally friendly products, and as industry seeks opportunities to improve utilisation of by-products.

These opportunities are discussed further in Section 2.2.

36 Owen, L., & Corfe, B. (2017). *The role of diet and nutrition on mental health and wellbeing*. The Proceedings of the Nutrition Society, 76(4), 425-426. doi:<http://dx.doi.org/10.1017/S0029665117001057>

37 Euromonitor Passport (2019). *Opportunities in gut health: dairy and beyond*.

38 Sourced from consultations with industry

39 BCC Research (2018). *Nutraceuticals: Global Markets to 2023*, pp.28; Rogers, K., Cosgrove, A., (2018). *Eight forces that will shape the future consumer*, EY.

40 Estimates are based on the scenario that import replacements with Victorian ingredients grows from 10% in 2018 to 30% by 2030. Source: CSIRO economic analysis. Please see Appendix for underlying assumptions, sources and further details.

41 CSIRO economic analysis – Please see Appendix for underlying assumptions, sources and further details.

2.1 Support the health and wellness of future global consumers



Identified below are example opportunity areas for industry to support the changing nutritional needs of current and future global consumers through foods and VSM products.

Healthy ageing

There are opportunities to support the health and wellness of a growing and ageing global population. The global population aged 60 years and older is projected to grow by 56% between 2015 and 2030 (this increases to 66% for Asia).⁴² As ageing is associated with decreased immunity⁴³ and higher risk of chronic disease, malnutrition, undernutrition and related health conditions,⁴⁴ demand for nutraceuticals (including functional foods) to promote heart, gut, eye, mobility, joint/bone and skin health may increase.

Consultation with industry outlined that innovation in primary ingredients and novel combinations for targeted VSM products, alongside new delivery mechanisms will aim to better serve the specific needs of an ageing population. Research into smaller efficacious doses and modes of delivery beyond that of conventional tablets may support the preferences of these consumers. Different delivery modes are particularly important for consumers with swallowing difficulties (dysphagia), a condition more common in the elderly.⁴⁵ Delivery mechanisms such as effervescent, sublingual, gummy and liquid doses alongside other product innovations may open new markets and support better health outcomes. To support these innovations, scientific evidence of health claims, particularly among people over 65 years of age, is required.

Brain health

Demand for safe and effective nutraceuticals to support brain health and emotional wellbeing is expected to grow, driven by an ageing population and improving awareness and understanding of mental health.⁴⁶ Areas of focus may include products for memory, attention, sleep quality, stress, anxiety and mood. While there is converging evidence from controlled trials that nutritional interventions can improve mood and cognitive function in both clinical and healthy populations,⁴⁷ it is important that consumers understand that nutraceuticals are supplements and not substitutes for healthy diets, physical activity, medical care and/or therapy where needed. Policy, regulation, research and education will have important roles in supporting growth in the brain health market and more broadly.

Gut health

Over 50% of Australians experience unpleasant gut symptoms, with obesity increasing the likelihood of experiencing these problems.⁴⁸ The gut is vital for keeping other body systems functioning optimally, with a growing body of research linking gut health with conditions such as cancer, obesity, metabolic and auto-immune diseases.⁴⁹ As awareness on the topic increases, demand for products specifically aimed at helping improve digestive functions is growing.⁵⁰

42 United Nations, Department of Economic and Social Affairs, Population Division (2015). *World Population Ageing 2015*.

43 Gupta, C., & Prakash, D. (2015). *Nutraceuticals for geriatrics*. *Journal of Traditional and Complementary Medicine*, 5(1), 5-14. doi:<https://doi.org/10.1016/j.jtcme.2014.10.004>

44 This includes cataracts, back and neck pain, osteoarthritis, chronic obstructive pulmonary disease and diabetes. Source: World Health Organisation (2018). *Ageing and Health Fact Sheet*.

45 Sura, L., Madhavan, A., Carnaby, G., & Crary, M. A. (2012). *Dysphagia in the elderly: Management and nutritional considerations*, *Clinical Interventions in Aging*, 7, 287-298. doi:<http://dx.doi.org/10.2147/CIA.S23404>

46 BCC Research (2018). *Nutraceuticals: Global Markets to 2023*, pp.118.

47 Scholey, A. (2018). *Nutrients for neurocognition in health and disease: Measures, methodologies and mechanisms*. *The Proceedings of the Nutrition Society*, 77(1), 73-83. doi:<http://dx.doi.org/10.1017/S0029665117004025>; Soldevila-Domenech, N., Boronat, A., Langohr, K., & de la Torre, R. (2019). *N-of-1 Clinical Trials in Nutritional Interventions Directed at Improving Cognitive Function*, *Frontiers in Nutrition*, 6(110). doi:[10.3389/fnut.2019.00110](https://doi.org/10.3389/fnut.2019.00110).

48 Belobrajdic, D., Brownlee, I., Hendrie, G., Rebuli, M., Bird, T. (2018). *Gut health and weight loss: An overview of the scientific evidence of the benefits of dietary fibre during weight loss*. CSIRO.

49 Conlon, M., Bird, A. (2015). *The Impact of Diet and Lifestyle on Gut Microbiota and Human Health*, *Nutrients* 7:17-44.

50 Frost & Sullivan (2019). *Global Analysis of Major Food Ingredient Manufacturers, 2018*.

Strong evidence supports the role of high fibre, whole foods in gut health (e.g. wholegrains, fruit, vegetables, legumes with prebiotic fibres),⁵¹ with emerging evidence suggesting that polyphenols also exert prebiotic effects.⁵² Probiotics have proven beneficial for only a few health problems, with limited evidence for improving *general* gut health.⁵³ This may be due to methodological differences between studies and differences in host cohorts,⁵⁴ or because in many probiotic products, only a very small percentage of bacteria actually reach the lower bowel, which is necessary in order for them to influence the gastrointestinal microbiota. As research into the role of the gut and the gut microbiome in health, there are opportunities for industry to help consumers achieve optimal digestive wellness through the development of novel nutraceuticals.⁵⁵

Pre-conception and early life

The health and nutrition of both men and women before conception is vitally important for pregnancy outcomes, with pre-conception health being a key determinant of both pregnancy success and the long-term health of the next generation.⁵⁶ Maternal pre-conception and pregnancy nutrition and the child's nutrition in the first two years of life (the first 1000 days) are crucial factors in a child's development and long-term risk of non-communicable diseases.^{57,58}

Nutrition interventions for pre-conception, pregnancy and early life have the potential to improve the life-long health of a child. For example, the Australian Government Department of Health's Pregnancy Care Guidelines advises pregnant women to take daily iodine supplements, and that folic acid is taken from 12 weeks before conception and throughout the first 12 weeks of pregnancy, as this reduces the risk of having a baby with a neural tube defect.⁵⁹ Women at high risk of iron deficiency are also often advised to supplement iron during pregnancy in order to avoid maternal anaemia and potential negative effects on the child, including low birth weight.^{60,61} This is important, given that 38% of Australian women of reproductive age (aged 19-50) have iron intakes less than the estimated average requirement.⁶²

As Australian women continue to give birth later in life,⁶³ nutritional intervention both through advocacy of healthy dietary behaviours and evidence-based nutraceuticals are important. Research in this segment will continue to build evidence for nutritional guidelines; for example, there is emerging evidence of benefits associated with supplementing omega-3 fatty acids during pregnancy,⁶⁴ which requires continued investigation. Research is also needed to investigate which groups of women may benefit from multiple micronutrient supplementation⁶⁵, and deliver innovation in supplement delivery and personalisation to support wellbeing at different stages of pregnancy and child development.

51 Belobrajdic, D., Brownlee, I., Hendrie, G., Rebuli, M., Bird, T. (2018). *Gut health and weight loss: An overview of the scientific evidence of the benefits of dietary fibre during weight loss*. CSIRO.

52 Sanders, M. E., Merenstein, D. J., Reid, G., Gibson, G. R., & Rastall, R. A. (2019). *Probiotics and prebiotics in intestinal health and disease: from biology to the clinic*, *Nature Reviews Gastroenterology & Hepatology*. doi:10.1038/s41575-019-0173-3; Conlon, M., Bird, A. (2015). *The Impact of Diet and Lifestyle on Gut Microbiota and Human Health*, *Nutrients* 7:17-44.

53 Belobrajdic, D., Brownlee, I., Hendrie, G., Rebuli, M., Bird, T. (2018). *Gut health and weight loss: An overview of the scientific evidence of the benefits of dietary fibre during weight loss*. CSIRO.

54 Conlon, M., Bird, A. (2015). *The Impact of Diet and Lifestyle on Gut Microbiota and Human Health*, *Nutrients* 7:17-44.

55 Euromonitor Passport (2019). *Opportunities in gut health: dairy and beyond*.

56 Stephenson, J. et al. (2018). *Before the beginning: nutrition and lifestyle in the preconception period and its importance for future health*. *The Lancet*, Volume 391, Issue 10132, 1830 – 1841; Barker, M. et al. (2018). *Intervention strategies to improve nutrition and health behaviours before conception*. *The Lancet*, Volume 391, Issue 10132, 1853-1864.

57 Schwarzenberg, S.J., Georgieff, M.K. (2018). *Advocacy for Improving Nutrition in the First 1000 Days to Support Childhood Development and Adult Health*, *Pediatrics* 141 (2) DOI: 10.1542/peds.2017-3716.

58 Hanson M.A. et al (2015). *The International Federation of Gynecology and Obstetrics (FIGO) recommendations on adolescent, preconception, and maternal nutrition: "Think Nutrition First"*. *International Journal of Gynecology and Obstetrics* 131 S4 (2015) S213–S253.

59 Department of Health (2018). *Clinical Practice Guidelines: Pregnancy Care*, pp 77, Australian Government Department of Health.

60 World Health Organization (2013). *Essential Nutrition Actions: improving maternal, newborn, infant and young child health and nutrition*.

61 Department of Health (2018). *Clinical Practice Guidelines: Pregnancy Care*, Australian Government Department of Health.

62 AIWH (2018). *Nutrition across the life stages*. Cat. no. PHE 227.

63 AIHW (2019). *Australia's mothers and babies 2017—in brief*. Perinatal statistics series no. 35. Cat. no. PER 100.

64 Department of Health (2018). *Clinical Practice Guidelines: Pregnancy Care*, pp 78, Australian Government Department of Health.

65 Department of Health (2018). *Clinical Practice Guidelines: Pregnancy Care*, pp 78, Australian Government Department of Health.



Health by stealth

Consumers increasingly seek accessible, convenient and effective solutions to meet their dietary, lifestyle and/or cultural needs.⁶⁶ Demand for greater convenience is driving the opportunity to create new and novel products that assist in maintaining healthy and balanced diets. This includes packaged fortified and functional foods, alongside subtle reformulations of foods to feature health promoting ingredients.⁶⁷ These innovations contribute to the so called 'health by stealth' opportunity as they aim to lift the nutritional value of everyday foods and reduce the effort (and cost) of healthy eating.

For example, consumers with busy, on-the-go lifestyles are increasingly seeking functional foods and supplements that are simultaneously accessible, tasty, nutritious and convenient. Similarly, people with vegetarian and vegan diets have to plan carefully to ensure they achieve adequate intakes of protein, specific minerals (including iron, calcium and zinc), vitamin B12, vitamin D⁶⁸ and omega-3 fatty acids.

Across these consumer groups, healthy fortified and functional foods and evidence-based supplements may help maintain a healthy diet and meet all essential nutrients.

More generally, changing consumer preferences and global competition are likely to incentivise innovation in fortified and functional food product development and delivery mechanisms across these facets. For example, innovation in protein delivery alongside rising demand for ethically and sustainably sourced foods is driving demand for alternative plant-based proteins.⁶⁹ Changing diets are driving innovation in wheat flour substitutes, such as pulses for pasta and bakery products, and innovation in delivery mechanisms will see bioactives from plant material provided as consumable liquid shots or powders. Demand for convenience also means that ease of access to a product's evidence base and nutrition guidelines will be increasingly important to support consumer decision making.

⁶⁶ Euromonitor Passport (2019). *Top consumer trends impacting health and nutrition*.

⁶⁷ KPMG (2018). *Foods for Health*.

⁶⁸ Department of Health & Human Services (2018). *Vegetarian and Vegan Eating*, Victoria State Government, [Online] Available from: <https://www.betterhealth.vic.gov.au/health/healthyliving/vegetarian-and-vegan-eating> Accessed: 28/06/2019

⁶⁹ FIAL (2019). *Protein Market: Size of the prize analysis for Australia*.

CASE STUDY

Fortified coffee and tea

The ubiquity of coffee and tea in Australian leisure and work makes these beverages an attractive candidate for fortification with healthy ingredients (e.g. turmeric lattes).⁷⁰ CSIRO, within a Hort Innovation project, recently experimented with adding broccoli powder to lattes, which is high in protein, fibre and health-promoting bioactive phytochemicals⁷¹; and cauliflower, making one latte the equivalent of a daily serve of vegetables.⁷² Four Sigmatic, a US company, is exploring producing fortified coffee through the use of mushrooms.⁷³



Personalised and precision nutrition

Personalised and precision nutrition are different levels of nutritional solution tailoring along a scale. Personalised nutrition involves static tailored advice, whereas precision nutrition generally builds on this to provide nutritional solutions to the unique, precise, real-time nutritional needs of an individual based on their genotype, phenotype and lifestyle.⁷⁴ For example, an individual's physiological response to food-derived nutrients, through blood glucose readings or microbiome analysis, could potentially inform the type and dosage of nutraceuticals that would best support their everyday health and wellbeing.^{75,76}

As an area of emerging opportunity, more R&D in personalised and precision nutrition will be a priority. Key questions include: understanding the relationship between food structures and in-body interactions and gene-diet interactions; defining the minimum set of measurements/biomarkers that predict individual response to personalised nutrition⁷⁷; identification and development of food structures that can deliver customised nutrition needs; development of next generation food technologies to manufacture personalised food materials; and advancements in sensor technologies to measure personalised food-body interactions to inform food design. Commercial viability in the longer term will require a well-integrated supply chain or business model since the trade-off between cost, time and benefit for consumers (e.g. from data collection to consumption) will be a critical determinant of future uptake. Given Victorian industry's strength in primary production, nutraceuticals, R&D and clinical trials, the state has an opportunity to be at the forefront of innovation in personalised nutrition, both in the immediate and longer term.

70 Euromonitor Passport (2019). *Fortified/Functional Beverages in the US*.

71 CSIRO (2018). *Broccoli lattes could be a thing* – News Release Statement, [Online] Available from: <https://www.csiro.au/en/News/News-releases/2018/Broccoli-lattes-could-be-a-thing> Accessed: 28/06/2019

72 Brann, M. (2019). *Cauliflower coffee causing a stir at horticultural conference in Melbourne*, [Online] Available from: <https://www.abc.net.au/news/rural/2019-06-27/cauliflower-coffee-causing-a-stir-at-hort-connections/11248318> Accessed: 2/07/2019

73 Four Sigmatic (n.d.) [Online] Available from: <https://us.foursigmatic.com/> Accessed: 28/06/2019

74 KPMG (2018). *Foods for Health*.

75 CSIRO Futures (2017). *Food and Agribusiness Roadmap*, pp 18, CSIRO.

76 Verma, M., Hontecillas, R., Tubau-Juni, N., Abedi, V., & Bassaganya-Riera, J. (2018). *Challenges in Personalized Nutrition and Health*. *Frontiers in nutrition*, 5, 117. doi:10.3389/fnut.2018.00117

77 Ordovas, J., Ferguson, L., Tai, E., Mathers, J. (2018). *Personalised nutrition and health*, *BMJ* 2018; 361, <https://doi.org/10.1136/bmj.k2173>

Challenges to address

Developing products tailored to support the health and wellness of future global consumers presents a significant opportunity for Victoria's nutraceutical industry, however, consultation with industry outlined several key challenges that must be considered, as identified below. **The enabling actions outlined in Section 4 aim to address these challenges.**

- **Complementary medicines often do not have enough evidence to support claims**, with the TGA's 2017-18 Annual Performance Statistics outlining that there were 129 verified compliance breaches from 243 (53%) completed post-market listed medicine⁷⁸ compliance reviews.⁷⁹ These compliance breaches include: issues with the information provided to the TGA, manufacturing, quality and/or formulation, labelling, advertising, etc. In 50 of the 243 (21%) completed reviews, evidence held by the sponsor did not support the claims relating to the medicine.⁸⁰
- **More well-constructed research projects** are required to provide a stronger evidence base with a clear link to the options for health claims, alongside validating new delivery mechanisms and dosage forms, and investigating the bioavailability of nutrients contained in various supplements and methods to improve bioavailability where necessary.
- **Consumer education and awareness** needs to improve. Despite the availability of information today, there is still a lack of easily accessible and trusted consumer information about nutraceuticals.⁸¹ Making sense of evidence-based and non-evidence-based information can be a challenge for consumers. More work is required to improve health literacy standards to help consumers understand their health and nutrition requirements, and learn when nutraceuticals can complement a healthy diet, physical exercise and other measures for wellbeing.
- **Access to timely and trusted information** is needed to help industry respond to trends and changes in consumer preferences and operating conditions (e.g. regulatory and compliance requirements). Smaller manufacturers and primary producers may have less access to market research. This can affect the quality and speed-to-market of Victorian innovation in nutraceuticals.
- **Access to growing export markets** can be difficult, especially in India where a free-trade agreement does not yet exist and trade tariffs are restrictive (between 30% to 150% depending on the product⁸²).

78 Listed medicines are usually considered to be relatively benign, so the regulations allow for sponsors to 'self assess' their products in some situations. The majority of listed medicines are self-selected by consumers and used for self-treatment. They are all unscheduled medicines with well-known low-risk ingredients, usually with a long history of use, such as vitamin and mineral products or sunscreens. These are assessed by the TGA for quality and safety but not efficacy. Source: <https://www.tga.gov.au/listed-medicines>

79 Therapeutic Goods Administration (2018). *Therapeutic Goods Administration Annual Performance Statistics Report July 2017 to June 2018*, pp 32.

80 Therapeutic Goods Administration (2018). *Therapeutic Goods Administration Annual Performance Statistics Report July 2017 to June 2018*, pp 34.

81 NHMRC (2014). *Talking with your patients about Complementary Medicine – a Resource for Clinicians*.

82 Complementary Medicines Australia (2019). *Complementary Medicines Australia 2019-20 Pre-Budget Submission*.

2.2 Unlock the Victorian supply chain for nutraceuticals



Identified below are example opportunity areas for the nutraceutical industry to unlock more value from the Victorian supply chain.

Victorian grown ingredients

Australian agribusiness' strong reputation for 'clean and green'⁸³ has strengthened international demand for Australian agricultural produce and, increasingly, Australian nutraceuticals products and ingredients. With Victoria's significant agriculture industry, responsible for a quarter of the gross value of the Australian industry (the largest of any state), there is an attractive growth and diversification opportunity for Victorian primary producers into nutraceuticals, and for current Australian manufacturers to source more ingredients from Victorian producers. For example, tomatoes contain lycopene (a carotenoid),⁸⁴ with Victoria producing approximately 36% of Australia's tomatoes.⁸⁵

Some of Victoria's key agricultural outputs include dairy, livestock, wool, wheat, barley, canola, grapes, almonds, apples, fresh tomatoes and mushrooms (Figure 6).⁸⁶ Importantly, growing directly for the nutraceutical industry can open up opportunities to better use marginal land that has limited value for conventional agriculture.

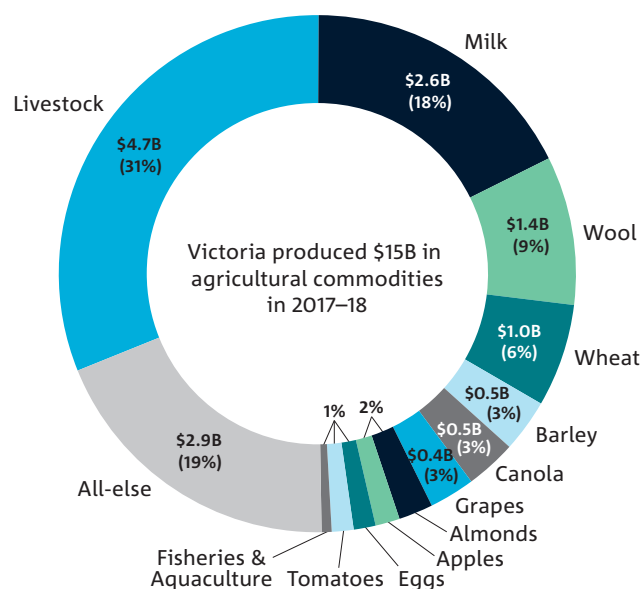


Figure 6: Victorian agriculture by gross value of production in 2017-18

There are also significant opportunities to explore and incorporate Australian native and botanical ingredients into health and wellness solutions. For example, quandongs, ribberries, and wattle seeds are native ingredients to Victoria and have been evaluated to contain health-enhancing compounds.⁸⁷ The state also has a high level of seaweed (macroalgae) diversity.⁸⁸ Ingredients such as these may provide a unique source of differentiation and diversification in health and wellness solutions to broader Australian and global markets. However, further R&D will be required to grow the evidence base and opportunities for such ingredients.

83 CSIRO Futures (2017). *Food and Agribusiness Roadmap*, CSIRO.

84 Alamgir, A. N. M. (2018). *Phytoconstituents—Active and Inert Constituents, Metabolic Pathways, Chemistry and Application of Phytoconstituents, Primary Metabolic Products, and Bioactive Compounds of Primary Metabolic Origin*, Therapeutic Use of Medicinal Plants and their Extracts: Volume 2: Phytochemistry and Bioactive Compounds (pp. 25-164). Cham: Springer International Publishing.

85 By gross value. Tomatoes (Processing and Fresh Market). Source: ABS (2018). *7503.0 - Value of Agricultural Commodities Produced, Australia, 2017-18*; Data cube All commodities by Australia, state/territory and SA4 regions (Table 1 and 3).

86 ABS (2018). *7503.0 - Value of Agricultural Commodities Produced, Australia, 2017-18*; Data cube All commodities by Australia, state/territory and SA4 regions (Table 3). Aquaculture and fisheries data based on 2016-17 data (ABARES (2018). Australian Fisheries and Aquaculture Statistics 2017).

87 Rural Industries Research and Development Corporation (2009). *Health Benefits of Australian Native Foods – An evaluation of health-enhancing compounds*, [Online] Available from: <https://www.agrifutures.com.au/wp-content/uploads/publications/09-133.pdf>

88 Department of the Environment (2015). *South-east marine region profile*, Australian Government.

While Victoria has a strong agriculture industry, Australian manufacturers import speciality fruit and vegetable ingredients because there is currently little manufacturing capability in Australia.⁸⁹ Industry has strongly expressed its interest in better integrating local primary production into the nutraceutical supply chain, which would require improved processing and manufacturing capability. This interest extends from farmers through to retailers, with potentially over 50 nutraceutical ingredients that could be sourced locally, based on currently grown crops.⁹⁰ While increased integration of Victorian ingredients can help meet growing demand for Australian-made products, industry consultation emphasised that investment in traceability technologies will be important to help consumers understand where their products have come from and where they were manufactured, helping protect Australian-made products from counterfeiting.

Waste conversion

Aside from households, primary production food waste (harvest ready produce that is ploughed into the ground) and food manufacturing wastes are the largest sources of food waste nationally. In Victoria, primary production waste amounts to an estimated 461,900 tonnes annually (20% of Australian total food waste), with over 57% generated by vegetables, particularly tomatoes. Victorian food manufacturing wastes are the largest in Australia, amounting to approximately 663,940 tonnes, with over 60% from the dairy products industry.⁹¹ A CSIRO report mapping pre-retail fruit and vegetable loss found Shepparton, Ballarat and Melbourne South East and Victoria's North West to be the key regions producing losses.⁹² Repurposing this waste represents significant opportunity to develop locally produced ingredients for the nutraceutical industry.

Waste conversion provides an avenue for industry to manage supply chain risk due to climate change, resource scarcity and other environmental risks; and improve diversification, utilisation and recovery of primary production waste and related by-products. There are opportunities to extract bioactives, food fractions enriched with bioactives and other compounds with nutritional value from food waste for applications in nutraceuticals. This opportunity includes large primary production markets such as dairy and grapes, as well as smaller markets such as carrots and abalone. Opportunities in conversion of food lost to the supply chain can help industry to 'close-the-loop' in production, lift agricultural productivity, diversify revenue streams and reduce the estimated \$2.8B cost per year to Australian farmers because of agricultural food losses.⁹³ Investment in waste conversion will likely be in R&D and proof-of-concept projects in the near term. Commercialisation should gain greater traction when viable technologies and processes with economies of scale become more accessible.

CASE STUDY

Extracting nutrients from abalone waste to improve sustainability

Southern Ocean Mariculture, an abalone farm in Port Fairy, is collaborating with Southern Canning (an abalone processor), CSIRO, and the Fisheries Research Development Corporation to pilot the development of nutraceutical products from extracts of abalone processing waste. The trial has progressed through the laboratory phase and is moving to the pilot commercial phase soon. Southern Canning is looking to set up a processing facility once commercialisation trials are complete and have an ongoing collaboration with Southern Ocean Mariculture and the CSIRO. In addition to potential environmental benefits, this investment could help to generate additional export revenue for Victorian abalone production and is estimated to create an additional 15 jobs.⁹⁴

89 CSIRO (n.d.). *Towards a next generation food manufacturing hub for Gippsland*, [Online] Available from: http://www.eastgippslandfoodcluster.com.au/images/18-00607_AF_BROCHURE_GippslandFoodHub12pp_FA_WEB.pdf Accessed: 28/06/2019

90 Sampano (2019). *A Roadmap for Building the Value Chain for the Nutraceutical Industry in Australia*.

91 Arcadis (2019). *National food waste baseline – Final assessment report*.

92 CSIRO (2019). *Mapping of Australian fruit and vegetable losses pre-retail*.

93 Department of Environment and Energy (2017). *National Food Waste Strategy – Halving Australia's Food Waste by 2030*.

94 Victorian State Government (2018). *Media Release – Creating a New Super Food from Abalone Production*. [Online] Available from: <https://www.premier.vic.gov.au/creating-a-new-super-food-from-abalone-production/> Accessed: 28/06/2019



Research and development hub

Victoria has an opportunity to build its reputation as a hub for health and wellness R&D and commercialisation, by servicing local and global demand for nutraceutical R&D and clinical trials. This is driven by growing global demand across many facets including: new product delivery systems, increased traceability and provenance, and more sustainable and personalised nutrition solutions. Increasing regulatory scrutiny and consumer demand for greater evidence to support nutraceutical product claims further drives the opportunity to become an R&D hub.

Servicing this opportunity involves leveraging and growing Victoria's existing capability, reputation and infrastructure across its food, agriculture, health and pharmaceutical industries. Research priorities, for example, might include understanding and validating the nutritional benefits of novel and native ingredients for new products; development and validation of new delivery mechanisms to make consumption of vitamins easier for consumers; and development and implementation of digital and/or chemical signatures in Australian-made nutraceuticals to combat the risk of adulteration and counterfeiting in export markets (see section 4.2 for more research priorities). Australia is well regarded globally for clinical trial activity and provides a good market for testing of innovative products.⁹⁵ Leveraging Australia's reputation, concentrated effort to build Victorian R&D and clinical trials activity, in collaboration with research organisations in other states, could strengthen Victoria's existing capability and support the state's reputation as a global health and wellness leader.

⁹⁵ Australian Trade and Investment Commission (n.d.). *Invest in Australia Clinical Trials factsheet*.

Challenges to address

While the opportunities presented here are potentially beneficial for the future of Victoria's nutraceutical supply chain, there are several challenges that must be considered. Key challenges for this opportunity are identified below, with **several enabling actions outlined in Section 4 that aim to address these challenges.**

- **Lack of collaboration and communication across the supply chain** from primary producers through to nutraceutical manufacturers. These communication channels are vitally important to establishing candidate ingredients, expected demand, and product specifications, to help establish the business case for greater integration of the Victorian industry. Greater support to help smaller manufacturers and primary producers to understand and navigate compliance can improve integration and participation in the nutraceuticals supply chain.
- **Cost pressures and access to infrastructure** can create barriers to growth, particularly for small-to-medium enterprises in nutraceuticals. The high cost of ingredients, labour, transportation, logistics and energy creates challenges to the viability of local nutraceutical manufacturers; and insufficient access to infrastructure and capital also discourages local producers and processors from venturing into nutraceuticals. Manufacturers of complementary medicines are regulated under the TGA and must abide by Good Manufacturing Practice for medicinal products, which makes it a high cost industry to remain competitive in.
- **Product counterfeiting and fake nutraceuticals** can lead to product recalls, increased regulatory scrutiny and reduced consumer confidence and trust. More work is required to improve supply chain integrity, traceability and provenance of nutraceuticals.
- **Research is required to support the nutraceuticals supply chain**, including building the evidence base for VSM products and fortified/functional foods; identifying new ingredients, production methods and delivery mechanisms; developing and deploying food provenance and traceability; and pursuing new innovations (e.g. waste conversion). Innovation is critical to Victorian industry's long-term competitive advantage but cost pressures, time-to-market, compliance, intellectual property rights, and infrastructure barriers may discourage investment in R&D and clinical trials.



3 Why Victoria?

Food and health clusters

Victoria's clusters can bring scale, network effects and innovation to the supply chain

Victoria is an attractive destination for a thriving evidence-based nutraceuticals industry, with more than 30% of Australia's vitamin and supplement establishments based in the state, which is similar to New South Wales.⁹⁶ Victoria is home to one of the world's largest life science clusters, with numerous medical technology, biotechnology and pharmaceutical companies (92% of Australia's public pharma companies are based in Victoria⁹⁷). Victoria also accounts for 25% or \$15B of Australian agricultural production by gross value,⁹⁸ and produces approximately 79% of Australian exports in dairy, 45% in horticulture and 38% in prepared foods.⁹⁹

The clustering of food, health and research industries in Victoria should facilitate increased economies of scale, network effects, innovation and lower barriers to entry across the state's nutraceuticals supply chain. These are important advantages to long term viability as the small size and dispersion of the Australian market exacerbates the risk of fragmentation in the Victorian supply chain. Effective integration of Victorian primary production may help industry to meet global demand for high quality Australian-made nutraceuticals. Food and Fibre Gippsland (formerly the East Gippsland Food Cluster) has initiated preliminary investigations into the viability of establishing a high-tech processing hub in Gippsland and the benefits this could deliver to the region.¹⁰⁰

Clean and green brand

Australian-made is a key advantage but competition and counterfeits create reputational risk

Australian-made and grown products have a strong reputation in key export markets; the nutraceutical industry leverages this reputation and is generally perceived by Asian consumers as 'clean and green' with solid quality systems.¹⁰¹ As a significant contributor to Australian food and fibre exports, Victoria's diverse agriculture and food manufacturing sector has been an important source of this advantage. As such, Victorian industry is well placed to support and grow this brand through the supply of high-quality nutraceuticals and ingredients to market.

Protecting and growing Australia's high-quality nutraceuticals brand will be critical to the industry's long-term viability. International competitors are likely to pursue similar brand strategies, while greater counterfeiting of Australian nutraceuticals¹⁰² poses reputational risk to Australian producers. Maintaining strong safety and quality standards, and continued innovation in product development and food provenance is paramount.

World class capability

Victoria's capability in R&D and clinical testing can strengthen the evidence base and innovation

Victoria's reputation, capability and infrastructure makes it an attractive global destination for nutraceutical R&D and clinical trials. It supports nine universities, 10 teaching hospitals, 13 medical and 14 agricultural research centres and more biotechnology companies than other Australian states.¹⁰³

96 Richardson, A. (2017). *Vitamin and Supplement Manufacturing in Australia*. IBISWorld.

97 Measured by ASX market capitalisation. Source: Department of Economic Development, Jobs, Transport and Resources (2017). *State of the Sector – Medical Technologies and Pharmaceuticals 2017*, Victorian Government.

98 ABARES (2019). *About my region – Victoria*, [Online] Available from: <http://www.agriculture.gov.au/abares/research-topics/aboutmyregion/vic#agricultural-sector> Accessed: 28/06/2019

99 Agriculture Victoria (2018). *Victorian Food and Fibre Export Performance Report 2017-18*.

100 CSIRO (n.d.). *Towards a next generation food manufacturing hub for Gippsland*, [Online] Available from: http://www.eastgippslandfoodcluster.com.au/images/18-00607_AF_BROCHURE_GippslandFoodHub12pp_FA_WEB.pdf Accessed: 28/06/2019

101 Complementary Medicines Australia (2016). *Exporting to Asia: Australian Complementary Medicines*.

102 Zhou, C., Mo, X. (2018). *Chinese police seize fake Penfolds, Swisse, Blackmores in multi-million-dollar counterfeiting crackdown*, ABC News, [Online] Available from: <https://www.abc.net.au/news/2018-05-07/chinese-police-crack-down-on-fake-australian-products/9720578> Accessed: 18/07/2019

103 Invest Victoria (2015). *Skilled, Innovative and Diverse Workforce and Universities – Melbourne, Victoria* (factsheet), [Online] Available from: http://www.invest.vic.gov.au/_data/assets/pdf_file/0013/18013/Skilled-Workforce-and-Universities.pdf Accessed: 28/06/2019.

Victoria attracts about 30% of Australia's innovative food R&D¹⁰⁴ and is home to CSIRO's Food Innovation Centre. Further, it attracts 40% of the National Health and Medical Research Council's (NHMRC) funding.¹⁰⁵ Victoria is also a popular destination for clinical trials, boosted by the quality of its medical research infrastructure and workforce, attractive R&D tax incentives, international clinical data standards and practices, and an ethnically and demographically diverse population.¹⁰⁶ Victoria's reputation for clinical trials is being actively strengthened through initiatives like the Victorian Clinical Trials Gateway (VCT Gateway) – a digital portal for accessing clinical trial partners in Victoria.

This R&D and clinical trials capability will help strengthen the nutraceutical evidence base, guide product development and deliver new innovations to consumers and industry. However, industry consultations emphasised that workforce shortages in STEM, alongside lower investment rates in R&D will need to be managed to support this capability and competitive advantage going forward.

Continued exploration into food loss and waste repurposing, novel ingredients for supplements and functional foods, and new delivery mechanisms with improved bioavailability will all utilise and extend Victoria's existing expertise and infrastructure. With clear evidence of safety and efficacy required, Victoria can drive further growth in its clinical trials industry for testing of nutraceuticals.

Effective policy and regulation

Australia's policy and regulatory environment should promote safety, quality and innovation

Recent reforms such as the Therapeutic Goods Administration's (TGA) new 'assessed listed medicines' pathway for complementary medicines are expected to increase transparency for consumers, provide additional flexibility for manufacturers, drive clinical trial activity and support innovation.¹⁰⁷ Further activities are also underway to strengthen the effectiveness and currency of regulation of over-the-counter products.¹⁰⁸

The advantages afforded to Australian industry by the TGA are complemented in Victoria by strong policy and support for SMEs, together with identification of the food and fibre and medical technologies and pharmaceuticals sectors as priority 'future industries'. The Victorian Government is also developing a circular economy policy that will support minimisation of food waste,¹⁰⁹ alongside the agriculture strategy that aims to create an innovation system to drive the application of new ideas to improve agriculture and value-added products.¹¹⁰ Continuous improvement in policy development and regulation should foster more timely and higher quality production cycles for the sector.

104 Invest Victoria (2018). *Agriculture and Food Processing*, [Online] Available from: <http://www.invest.vic.gov.au/opportunities/food-and-fibre/advanced-food-manufacturing-and-processing> Accessed: 28/06/2019

105 Victorian Government (2016). *Healthier Lives, Stronger Economy – Victoria's Health and Medical Research Strategy, 2016-2020*.

106 Australian Trade and Investment Commission (2018). *Clinical Trials Capability Report*, Australian Government.

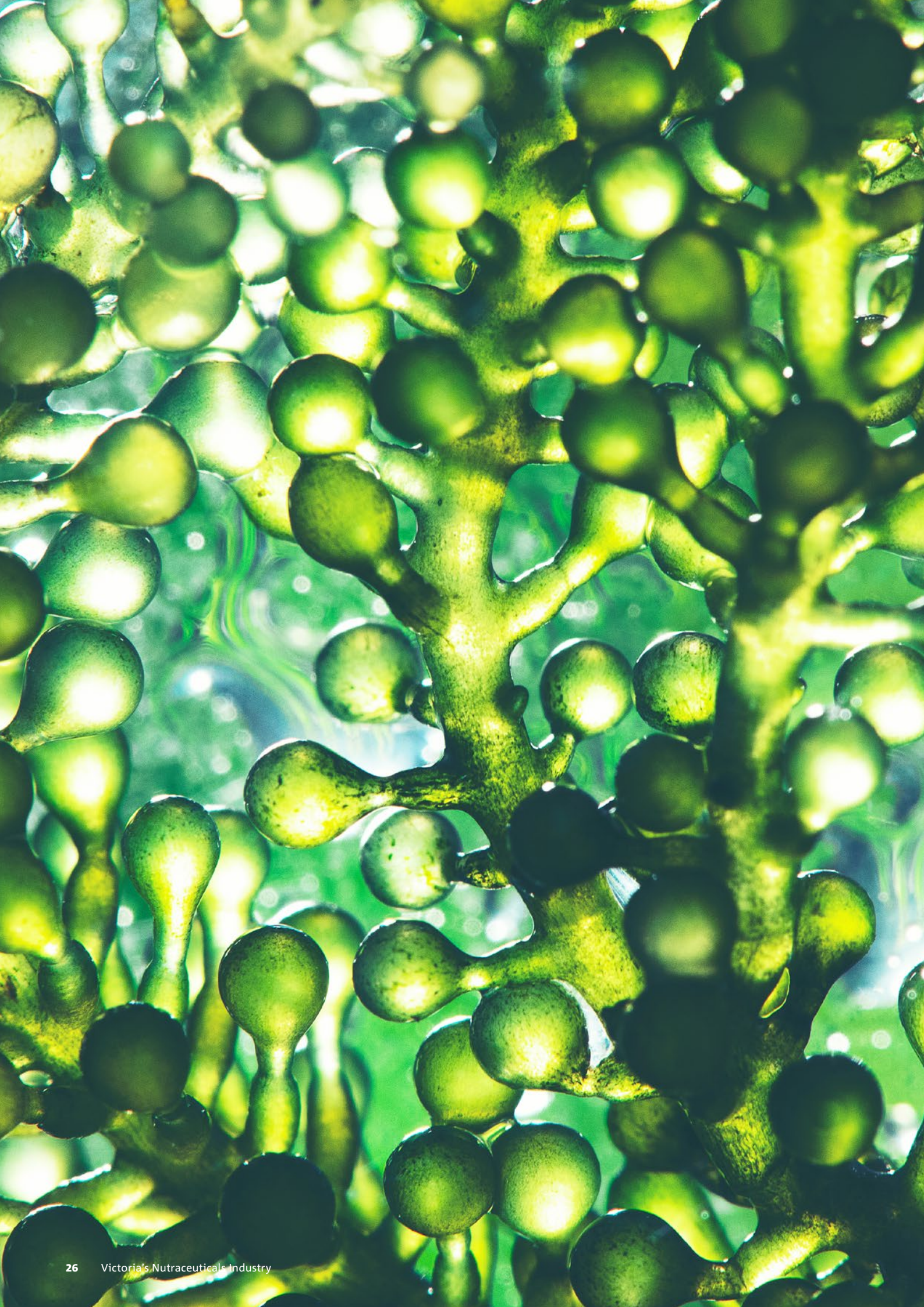
107 Assessed listed medicines can carry intermediate level indications (generally more definitive and may relate to more serious health conditions) only following the successful premarket assessment of quality scientific efficacy evidence by the TGA. Source: TGA (2018). *Assessed Listed Medicines Pathway for Complementary Medicines*; Australian Government Department of Health (2016). *Australian Government Response to the Review of Medicines and Medical Devices Regulation*.

108 Other major reforms from the TGA over the last three years include enhanced post-market monitoring procedures, dedicated regulatory assistance for SMEs, streamlined model for advertising complaints handling, revised evidence guidelines and compliance rating scheme for complementary medicines. Sources: TGA (2018). *The Future Regulation of Low Risk Products*; TGA (2018). *Complementary Medicines Reforms*.

109 Department of Environment, Land, Water and Planning (2019). *A circular economy for Victoria – Creating more value and less waste – Issues Paper July 2019*, Victorian Government

110 Agriculture Victoria (n.d.). *Agriculture Victoria Strategy*.





4 Enabling growth

There is growing momentum across Victoria which will drive opportunity for the state's nutraceuticals industry. This momentum is occurring across food systems, with efforts to reduce wastage and diversify products through innovative value-adding; and the research sector, through novel R&D and increased clinical trials and scientific validation.

Demand drivers are also changing in Victoria's favour. Victorian industry is well-placed to invest in innovation to meet health and wellness demands of the future consumer, building on strengths outlined earlier. However, as noted, each growth opportunity has challenges that must be addressed, requiring focused effort, investment, skills development, and most importantly, collaboration, both within the state, but also nationwide. This chapter outlines enablers required to set the conditions for growth of Victoria's nutraceutical industry. One option to build on industry momentum is convening a taskforce from across industry and government to drive enabling actions.



Figure 7: Enablers for the growth of Victoria's nutraceutical industry

4.1 Enablers for the growth of Victoria's nutraceuticals industry

ENABLER	POTENTIAL ACTIONS	SUGGESTED LEAD(S)	SUPPORTERS
Support local upstream development	1. Information – Collaborate to develop a shared understanding of ingredient specific demand and required specifications, alongside current supply arrangements to assess which ingredients make most strategic sense to source locally, and from which regions.	Marketers + primary producers	Manufacturers
	2. Incentives – Investigate incentives to encourage manufacturers to source more ingredients locally and for primary producers to enter the supply chain. This might include grants to assist in the development of business cases, technoeconomic evaluation and market research; support with establishing partnerships and strengthening supply chains; or subsidised access to infrastructure.	State Government	Research community
	3. Demonstration – Establish small scale demonstrations of food waste conversion into nutraceutical ingredients (both VSM and fortified and functional foods).	Research community	Whole of industry
	4. Hub – Develop investment case for a shared, scalable processing hub to address the challenge faced by upstream industry around access to infrastructure by allowing primary producers to access nutraceutical processing equipment, infrastructure and capability at lower cost.	Whole of industry	State Government
	5. Technology – Incentivise collaborative research projects to help optimise extraction and processing techniques of ingredients from local produce.	State + Commonwealth Government + processors	Research organisations + primary producers
	6. Skills – Invest in upskilling staff, including new processing and extraction capabilities, formulations and pharmaceuticals, and regulatory affairs.	Whole of industry	Commonwealth + State Government
	7. Networking – Convene networking events that bring the whole value chain together (including R&D).	Whole of industry	State Government
Establish pathways to commercialisation and trade at scale and profit	8. Seminars and information – Establish educational seminars, networking events and information packets to help growers, processors and food manufacturers collaborate and navigate the requirements of the nutraceutical industry. This should include seminars on the Australian and global regulatory environments (e.g. TGA requirements), applicable food standards for fortified/functional foods (FSANZ), appropriate intellectual property protections (IP Australia), and other commercially relevant education (market research, export requirements, etc).	Industry associations	State Government + regulators
	9. Clusters – Encourage participants in the nutraceutical upstream supply chain to cluster where feasible, to lower transportation and collaboration costs (especially collaborative access to infrastructure) and increase industry economies of scale.	Whole of industry	State Government
	10. Online portal – Develop a nutraceutical industry knowledge sharing and collaboration platform, including: connections to experts; company listings; information on service delivery labs for bioactive testing and validation; a synthesis of applicable regulations; market research findings; guidance on the food medicine interface; and information on evidence requirements for making therapeutic claims (<i>this might be similar to or leverage FIAL's 'Building Healthier Foods' platform which aims to connect food manufacturers with experts to help with reformulation and development of healthy foods, or the Victorian Government's Food Innovation Network</i>).	Industry associations	Whole of industry
	11. Empowered manufacturers* – Support nutraceutical manufacturers to leverage Australia's brand by providing clarification on country of origin labelling requirements; helping to ensure strong intellectual property protection for innovations, both in Australian and global markets; and progressing trade agreement discussions in key export markets (e.g. India).	Commonwealth Government	Regulators + industry associations

ENABLER	POTENTIAL ACTIONS	SUGGESTED LEAD(S)	SUPPORTERS
Build R&D and clinical trial activity	12. Research priorities* – Improve collaboration and partnerships between industry and the research community to scientifically substantiate nutritional solutions and pursue innovation in product development. Section 4.2 outlines potential research priorities identified during the consultation process.	Whole of industry + research community	State Government
	13. Innovative trials – Continue investigating state-of-the-art methods of scientific validation and clinical trial design for nutraceutical products. This includes developing a better understanding of adaptive study designs, methods for improved ecological validity of trials, use of novel technologies including wearables and electronic health records, improved methods for recruitment, and large cohort studies to build rich evidence to support nutraceutical interventions and preventative health measures.	Research community	Marketers + manufacturers
	14. New products – Identify nutraceutical active ingredient targets and candidates from within research organisations that could be further developed and taken through to scientific validation and/or clinical trials (potential candidates may be already available in pharmaceutical research).	Research community	Marketers + manufacturers
	15. Destination Victoria – Improve information available on doing nutraceutical clinical trials in Victoria. This may be by adding more information onto the VCT Gateway (online portal) about nutraceutical clinical trial partners and capabilities. While building Victoria’s clinical trials activity is the goal, it cannot be done without collaboration with sites across other states.	State Government	Research community
Continuous improvement to ensure regulation is fit-for-purpose*	16. Protections – Ensure adequate protections for nutraceutical innovations, including patents and clinical trials data to incentivise R&D. New ingredient exclusivity available through the TGA is a good step towards this, but needs to be better communicated to industry.	Regulators	Industry associations
	17. Reduce complexities – Explore avenues to minimise regulatory complexities for low risk products and improve regulatory responsiveness to new innovative products, while continuing to ensure high standards in safety, quality and efficacy.	Regulators	Industry associations
	18. Regulatory harmonisation – Encourage Australian regulators to share experiences with international peers in key export markets, especially the rapidly developing Chinese and Indian markets, to help drive export opportunities and reduce regulatory complexity for Australian manufacturers.	Regulators	Industry associations
Improve consumer education and information*	19. Education – Together, the healthcare and education sectors must continue to work towards improving health literacy standards across all age groups and demographics. This includes school-based nutritional education and strong communication/engagement of nutritional recommendations.	Commonwealth Government	State Government + research community
	20. Publicly available data – Develop a consolidated, trusted, evidence-based information platform/portal to improve consumer access and ability to interpret clinical evidence and claims on nutraceutical products. This should consolidate research findings into an easy to access, trusted source of evidence that can deliver personalised information and support directly to consumers.	Commonwealth Government + research community	Marketers
	21. Nutraceutical product information – Provide consumers with trusted information on their products; this includes providing information to help improve the trust of provenance claims on products to reduce fraud and improve the safety, especially for products in export markets alongside improving VSM evidence-based marketing. For Fortified/functional foods, mechanisms to inform consumers about the benefits and improve the way they are uniformly communicated should be investigated.	Marketers	Research community + Commonwealth Government

* Initiative that requires both state and national action and collaboration

4.2 Future research priorities

Primary producers

Processors and ingredient manufacturers

Nutraceutical (VSM and food) manufacturers

Marketing and distribution

Retail

Australian and global consumers



Continued research into identifying and understanding the interactions between nutrients, minerals, vitamins, phytochemicals and other bioactives and their impact on bodily functions and overall health (particularly gut and brain health, healthy ageing and pre-conception and early life); research to inform how VSM products might complement improved health and wellbeing for the individual, but also the broader population; research into understanding how VSM products might reduce the chronic disease burden on the healthcare system



Innovation in provenance and traceability technologies (e.g. isotope analysis, blockchain, image recognition, etc), allowing substantiation of provenance claims and reducing the risk (and cost) of food and nutraceutical fraud



Reformulation techniques for foods to improve health benefits while preserving sensory qualities alongside new fortified and functional foods



Development of food structures that can deliver nutrition to meet customised needs more efficiently and effectively



Market research into the nutritional preferences of the future global consumer, including continued investigation of global societal trends that may create new market niches, disruptive channels to market, and international trade barriers¹¹¹

¹¹¹ FIAL (2019). *Sector Competitiveness Plan*.

As highlighted on page 29, continued innovation in product development and strengthening the nutraceutical evidence base is critical to supporting the long-term viability of the industry and ensuring it plays a valid role in supporting global health and wellness. Listed below are research priorities for each opportunity, identified during consultations with industry and mapped to the most relevant sections of the nutraceutical supply chain (*note: these are not specific to Victorian industry*).



Opportunity 1

Support the health and wellness of future global consumers.



Opportunity 2

Unlock the Victorian supply chain for nutraceuticals.



Novel bioactive / ingredient discovery and substantiation, especially investigating food waste streams and Australian natives as sources; standardisation of nutrition analysis and specification of products to improve the comparability and useability of nutrition information and claims



Enhanced processing technologies (including drying, fermentation, extraction, separation, encapsulation, etc.) and equipment to efficiently and safely extract bio-actives from native ingredients, food waste and other sources while ensuring retention of properties through processing, packaging and storage for manufacture of differentiated VSM and fortified/function food products



Innovation in nutraceutical packaging and delivery mechanisms, including mechanisms to reduce size of product while maintaining efficacious dosage



Investigation of the bioavailability of nutrients contained in various nutritional supplements and methods to improve bioavailability where necessary



Innovation in clinical trial methodologies to suit VSM and fortified/function foods, and development of sophisticated methods of substantiating product health claims (e.g. using advanced IT systems and machine logic)



Personalised nutrition research, including building an evidence base for tailoring the contents of multivitamins to specific characteristics of patients; development of smart, structured food materials; sensor technologies that measure food-body interactions with personal information (genetic, phenotype and lifestyle data) to inform food design; and research into solutions to protect consumer data and privacy (pertinent given the level of personal information required for personalised nutrition solutions)



5 Appendix

A.1 Project methodology

Figure 8 highlights the high-level methodology used to formulate this report. Industry interviews were conducted with over 20 diverse industry stakeholders from across the supply chain including primary producers through to retailers and including regulators and researchers. These external consultations were complemented by interviews with experts from CSIRO's Health and Biosecurity and Agriculture and Food Business Units. Together with desktop research, driving industry trends and growth opportunities were identified, as well as enabling actions required to address industry challenges and seize the opportunities. Estimates of the size of the identified opportunities were calculated (Appendix A.2). The project involved review sessions and written feedback from both numerous stakeholders across CSIRO and industry.

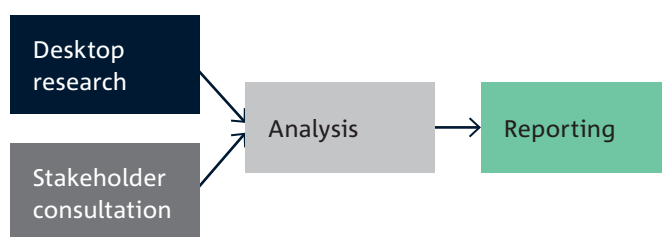


Figure 8: Project methodology

A.2 Opportunity sizing methodology

This report presents estimates on the 2030 opportunity for Victorian industry in nutraceuticals. This section briefly summarises the key results and method used, based on a combination of government, market research and industry data.

Results

Victoria opportunity analysis 2018-2030

OPPORTUNITY		2018	2030
Annual domestic consumption	- VSM	\$482M	\$678M
	- FF	\$1022M	\$1390M
Annual export opportunity (incl. Daigou sales)	- VSM	\$674M	\$1080M
	- FF	\$677M	\$1062M
Employment growth persons (if value is captured locally)		-	+3.5K
Annual gross value of raw ingredients		\$134M	\$588M
Annual R&D expenditure		\$230M	\$332M
Annual clinical trials expenditure		\$37M	\$71M

Methodology

VSM and FF: Annual domestic consumption = A × (1+B) × C

PARAMETERS		VSM	FF
A	Australian consumption of nutraceuticals in 2018 ¹¹²	\$1.5B	\$4.0B
B	Annual real growth in Australian consumption of nutraceuticals ¹¹³	2018-23: 3.3% 2023-30: 2.6%	2018-23: 2.6% 2023-30: 2.6%
C	Victoria's market share of Australian nutraceutical exports ¹¹⁴	33%	25%

¹¹² Sourced from Euromonitor Statistics and IBISWorld. Sales estimates include vitamins, supplements, and fortified / functional foods and beverages. This includes sport nutrition and herbal/traditional related products. Adjustments were made downwards to account for potential exports through Daigou channels.

¹¹³ Growth is forecast at the average of Euromonitor Australian growth estimates and IMF forecasts for Australian real GDP growth between 2018-23. Growth is forecast at Australian real GDP growth from 2024 onward (2.6% p.a.). Source: Euromonitor International (2018). *Vitamins and Dietary Supplements, Herbal & Traditional Products, Sports Nutrition, and Fortified and Functional Foods*; IMF (2019). *World Economic Outlook 2018-2024*.

¹¹⁴ Research suggests around 33% of vitamin and supplement manufacturing establishments are in Victoria. Victoria accounts for 25% of Australian agricultural production and around 27% of food and fibre exports. Source: IBISWorld (2017) *Vitamin and Supplement Manufacturing in Australia*; ABARES (2019). *Victoria – Regional Overview; Agriculture Victoria (2018). Victorian food and Fibre Export Performance Report 2017-18*.

VSM and FF: Annual export opportunity = A x (1+B) x C

PARAMETERS		VSM	FF
A	Australian exports of nutraceuticals in 2018 (incl. Daigou sales) ¹¹⁵	\$2.0B	\$2.7B
B	Annual real growth in global market for nutraceuticals ¹¹⁶	2018-23: 4.4% 2023-30: 3.7%	2018-23: 4.0% 2023-30: 3.7%
C	Victoria's market share of Australian nutraceutical exports	33%	25%

Employment estimates: Employment growth = A / B

PARAMETERS		
A	Growth in VSM and FF opportunity between 2018-30	2030 minus 2018 results
B	Industry sales (or expenditure) to employment ratio ¹¹⁷	\$391K per employee

Raw ingredients: Annual gross value of production = A x (1+B) x C x D

PARAMETERS		
A	Victoria's opportunity in VSM and FF	Analysis above
B	Annual growth in Victoria's addressable opportunity	Analysis above
C	Annual cost of raw ingredients as a percentage of sales ¹¹⁸	35%-55%
D	Change in import replacements over time ¹¹⁹	10% in 2018 to 30% by 2030

¹¹⁵ Triangulated from Euromonitor global consumption data for nutraceuticals, annual reports of ASX-listed nutraceutical companies, and Australia's historical market share of food and agribusiness exports (UNCTAD and DFAT databases). Adjustments from domestic consumption were made to account for exports through Daigou sales as well.

¹¹⁶ Growth is forecast at the average of Euromonitor global industry forecasts and IMF forecasts for world real GDP growth (3.7% p.a.) between 2018-23. Growth from 2024 onward converges to forecast world real GDP growth at 3.7% p.a. Sources: Euromonitor International (2018). *Vitamins and Dietary Supplements, Herbal & Traditional Products, Sports Nutrition, and Fortified and Functional Foods*; IMF (2019). *World Economic Outlook 2018-2024*; Department of Foreign Affairs and Trade (2018). *Australia's Merchandise Exports and Imports*; UNCTAD (2018). *Merchandise Trade Matrix by Export Products and Groups*; ABARES (2012). *Food Demand to 2050: Opportunities for Australian Agriculture*.

¹¹⁷ Based on the 3-year average of sales to employment ratio, weighted by industry value added. Source: ABS (2018). *8155.0 - Australian Industry, 2016-17*.

¹¹⁸ 35% for vitamins, supplements, sports nutrition and traditional products based on the average annual expenditure of raw materials as a percentage of total sales. 55% for fortified and functional foods based on the average annual expenditure of raw materials as a percentage of total sales. Source: Various ASX listed companies in food and agribusiness.

¹¹⁹ Sourced from consultations with industry

Research & development: Annual R&D expenditure = A x (1+B) x C x (1+D)

PARAMETERS		
A	Annual Victorian R&D expenditure in agricultural and health sciences ¹²⁰	\$2.3B
B	Annual growth in R&D expenditure in agricultural and health sciences ¹²¹	2.0%
C	Share of R&D expenditure related to nutraceuticals ¹²²	9.9%
D	Annual change in share of R&D expenditure related to nutraceuticals ¹²³	1.1%

Clinical trials: Annual clinical trials expenditure = A x B x (1+C) x D x (1+E)

PARAMETERS		
A	Annual clinical trials expenditure in Australia ¹²⁴	\$1.1B in 2015
B	Victoria's market share of clinical trial activity ¹²⁵	33%
C	Annual growth in clinical trials expenditure ¹²⁶	7.7% to 2025, 2.6% onwards
D	Share of clinical trials related to nutraceuticals ¹²⁷	8.2%
E	Annual change in share of clinical trials related to nutraceuticals ¹²⁸	0.0%

¹²⁰ Estimates count expenditure under research fields of agricultural and veterinary sciences, and medical and health sciences; and/or business categories of agriculture, food services, food product manufacturing and chemical product manufacturing. Sourced from ABS business, government, non-government and higher education research and experimental development expenditure estimates for Victoria and Australia.

¹²¹ Based on historical growth of R&D expenditure in agricultural and health sciences.

¹²² Based on analysis of research publications in agriculture and life sciences that is affiliated with Australia in Elsevier's Scopus Database in 2017. Search criteria: (SUBJAREA (agri OR bioc OR immu OR neur OR phar)) AND (LIMIT-TO (AFFILCOUNTRY , "Australia")). To determine share of R&D relevant to nutraceuticals, the search criteria term was added: AND (vitamin OR supplement OR nutrition OR nutraceutical OR "fortified food" OR "functional food").

¹²³ Based on the historical annual change in share of nutraceuticals publication, as a proportion of research publications in agriculture and life sciences, between 2011 and 2018. Source: Elsevier (2019). Scopus Database.

¹²⁴ ANZCTR (2017). *The Clinical Trials Landscape in Australia, 2006-15*.

¹²⁵ DJPR (2019). *Medical Technologies, Biotechnology and Pharmaceuticals - Clinical Trials*. Invest Victoria.

¹²⁶ Industry level forecasts between 2015 and 2025. For context, number of clinical trial registrations have grown at 7% per annum between 2006 and 2015. Source: MTPConnect & LEK (2017). *Clinical Trials in Australia: The Economic Profile and Competitive Advantage of the Sector*.

¹²⁷ Based on analysis of clinical trial records by registration year on ANZCTR. Advanced search for the terms 'vitamin OR supplement OR functional food OR fortified food OR nutraceutical' on 14/05/2019.

¹²⁸ Historically, the share of clinical trial records based on search terms relevant to nutraceuticals have remained relatively stable between 2013 and 2018. Source: ANZCTR (2019). *Australian New Zealand Clinical Trials Registry – Advanced Search*.



For further information

Claire Manson

Executive Manager, CSIRO Future Industries
+61 3 9545 2177
claire.manson@csiro.au
csiro.au

Contact us

1300 363 400
+61 3 9545 2176
csiroenquiries@csiro.au
csiro.au

