



Functional and Luxury Foods Research Project

Functional and Luxury Foods
opportunities for
South Australia in Asia

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THE PROJECT

Project organisation

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Phase 1

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Subcontractors: ESSEC Business School (Paris and Singapore), Frost & Sullivan (Australia) Pty Ltd, Food Innovation Centre of Mondelez Australia Pty Ltd.

Introduction

Project report documents

This reference report does not include original content or analysis; rather, it consolidates material drawn from progress reports submitted by VTT Technical Research Centre of Finland throughout the research phase of the Functional and Luxury Foods Project (February to December 2015). This reference report presents VTT's research findings for both the functional and luxury domains.

Notes for the use of this Reference Report

1. In order to preserve the context of the research processes undertaken, the sections describing the process used by the researchers to build the preliminary roadmaps and outline future pathways have been included with the results of those processes.
2. This report should be used in conjunction with the following documents:
 - Literature Review for the Functional and Luxury Food Project (VTT Technical Research Centre of Finland Ltd, October 2015)
 - Final Report for the Functional and Luxury Foods Project (VTT Technical Research Centre of Finland Ltd, 2015)

Objectives and study design

The primary objective of this project was to provide the South Australian Government and the South Australian food industry with a roadmap outlining where food value chains may potentially be transformed to higher value add, i.e. functional and luxury foods and beverages, with an emphasis on domestic and Asian markets.

The study was undertaken in three separate phases. Phase 1 examined the market opportunities, Phase 2 investigated industrial strengths and value chains, and Phase 3 comprised a preliminary set of roadmaps for high value add food chains.

The objective of Phase 1 of the project was to complete a value chain analysis and examine the actors in the value chain, both locally and internationally, to describe the challenges and issues related to the current state of the South Australian food and beverage manufacturing industry and identify arising opportunities of interest to local manufacturers and producers.

The objective of Phase 2 was to complete a preliminary market assessment focusing on markets in 8 countries in Asia, and to undertake an assessment of current technology and technological innovation in order to identify preliminary opportunities for the South Australian functional foods and luxury industries.

In Phase 3, the objective was to outline in more detail the proposed pathways along which the South Australian food industry could move towards higher value adding, with a particular focus on Asian markets. This included detailing key assumptions for these proposed pathways and suggesting actions to be taken by the South Australian Government, the South Australian food and beverage industry and relevant stakeholders.

The proposed pathways identified in Phase 3 were refined to determine a total of six detailed pathways in the Final Report, submitted at the end of 2015. For details on the final six pathways, refer to VTT's Final Report.)

Development of recommendations

Detailed recommendations arising from the research were developed as part of the final reporting process. These recommendations are documented in VTT's Final Report for the Functional and Luxury Foods Project (available on the PIRSA website in July 2016).

Definitions

Business size

For the purposes of this study, VTT has defined "micro businesses" as those with fewer than 10 employees; and "small businesses" as those with fewer than 50 employees.

Absorptive capacity

Absorptive capacity is the ability of a company to recognise the value of new, external information, assimilate it, and apply it to commercial ends to adapt new technologies (Cohen & Levithal, 1990).

Functional foods

There is no universally agreed definition of functional foods. Commonly used definitions are related to health promoting and benefitting products, and 'free-from' products. In this study VTT uses a definition that refers to any food which has the additional function of promoting health and/or preventing diseases by the addition of new ingredients or the removal of harmful components (Bech-Larsen & Grunert, 2003).

Luxury foods

The term 'luxury food' is also subject to interpretation. As noted in the Literature Review document associated with this study, it is common to use the terms 'premium' and 'luxury' interchangeably as representing any products at the prestige end of a brand scale.

However, for the purposes of this project, VTT defines luxury foods as categories of food that are scarce and rare to source, are painstakingly prepared with care, of consistently high quality, often endorsed by the high-end clientele and restaurants in different geographies, follow cultural cues, purchasing power parity, tastes, habits and historical evolution of people of a particular country that are linked to wellness, indulgence, ethnicity and high perceived value (Som & Blanckaert, 2015).

In South Australia, it is appropriate to use a broad interpretation of the high-end food market, including categories such as premium, super-premium and luxury. It is also important not to have too strict definitions and borders for such food groups since, ultimately, the goal of the industry and the Government is to see all those categories grow, and in some cases products that are not defined as luxury may have the ability to be so in the future.

The Internet of Things

The Internet of Things refers to the seamless dataflow between networks and devices, as defined by the Internet of Things Council (<http://www.theinternetofthings.eu/what-is-the-internet-of-things>, accessed June 2016). VTT describes The Internet of Things as the ability to connect remote or mobile machines to networks through advanced wireless connectivity and low-cost sensors.

Megatrends

Megatrends are large, social, economic, political, environmental or technological changes and macro-economic forces of development that impact business, economy, society, cultures and personal lives.

Prosumerism

Prosumerism refers to the phenomenon that today's consumer is no longer a 'passive market' but instead can become involved in the design and manufacture of products, so the products could be made to individual specification.

Value adding

Value adding refers to the enhancements to products or services offered by a business prior to being made available to customers. Value adding is used to make a product more desirable for the consumer such as adding things to it, packaging it in different form, as well as capturing a premium or luxury price for a product. It is also related to competitiveness by differentiating a product from a competitor's products, or adding services around the product.

Methodology

Phase 1: Value chain analysis

With a focus on functional and luxury foods and export activities (especially to Asia), the first phase of the project comprised a value chain analysis and industry mapping process to gain an understanding of the current South Australian food and beverage industry.

As a part of this first Phase, 65 South Australian food companies were interviewed. VTT assured the companies of confidentiality, and references to individual enterprises or persons were excluded in all project reporting. Due to a lack of other inputs, companies for interview were recommended by the Department of Primary Industries and Regions SA (PIRSA), and were chosen based on their potential activities and interests in luxury and functional foods, and in Asian exports.

The framework for analysing the current companies used three layers to describe the key functions of each company in the context of industry drivers. The first layer comprised the core functions that gather the most elemental issues for a company: raw materials and resources, key products and customers, skills and human capital and finances. The second layer in the framework referred to the transformation functions that assess the capacity of the company to transform and renew. The third layer of the framework considered context functions, and consisted of drivers in the operational environment at the local, national and global levels.

Interviews were semi-structured and lasted approximately 60-90 minutes. The process provided information related to the competitiveness of the South Australian food industry in Australian and Asian markets. The interviewees answered open-ended questions concerning:

- raw materials and resources
- key products and customers
- skills and human capital
- innovation and renewal
- value chains, networking and collaboration
- business management and future strategies
- technological capabilities
- industrial, cultural, environmental, financial, regulatory, and research and development drivers

Information related to the financial status of the companies was not systemically surveyed.

The interview data was processed utilising a value chain analysis approach and looking at the companies' capabilities and motivations.

The VTT researchers also used two established business analysis tools, SWOT (Strengths/Weaknesses/ Opportunities and Threats) and PESTLE (Political/Economic/ Socio-cultural/Technological/Legal/ Environmental) to assess the current state of South Australia's functional and luxury foods industries, and the challenges related to Asian markets.

This methodology was complemented by an innovation ecosystem approach that stresses the flow of ideas, technology and people among enterprises and institutions as the key to an innovative process. In this context, innovation is not only related to the actual food innovation; rather, the emphasis is also on utilising the innovation ecosystem approach within the value chain thinking.

The South Australian Government has called for the development of a world-class framework for innovation¹; the approaches of innovation research are utilised throughout this analysis.

Phase 2: Preliminary market and technology assessment

Phase 2 of the project comprised a preliminary market assessment, concentrating on markets in Asia (a more detailed analysis followed later in the project), a technology assessment looking at interesting new food technologies and innovations, and early drafts of strategic roadmaps for South Australian luxury and functional food industries.

For the purpose of this research project, the market analysis determined the attractiveness of a market and presented its evolving opportunities. The market assessment covered markets for specific foods in specific countries determined in the Literature Review. The information was gathered through primary interviews with relevant stakeholders in the luxury food value chains in these countries, including food importers and distributors, food retailers, restaurant and hotel executive chefs and food journalists.

The market analyses undertaken for both luxury food and functional food identified and covered the markets in **China (including Hong Kong), India, Indonesia, Japan, Korea, Malaysia and Singapore**. Details about market drivers, trends and restraints, and estimates of market size and growth (until 2020) in both luxury and functional domains have been included. These comprehensive market analyses were undertaken by Frost & Sullivan (Australia) Pty Ltd. Due to their size, these reports have not been physically included in the body of this Reference Report.

The technology assessment consisted of a future-oriented study of new and interesting food technologies and their implications. Information for this assessment was gathered through a desktop study and through interviews with VTT's food technology experts. The assessment describes commercially-ready or near commercially-ready technologies and capabilities that can move the food industry towards higher value added business activities.

The Technology Readiness Level (TRL) method was used for evaluating the maturity of technology for operational deployment. The selected technologies represent techniques that show growth potential and open up new possibilities in the future (NOTE: the selection is not all-inclusive because there is no need to assess all well-established traditional food technologies). This assessment concentrated on technologies that have direct links to food and beverages.

However, behavioural science, psychology, behavioural economics and neuroscience also contribute in advancing both luxury and functional food.

This phase of the project also included a roadmapping component. The roadmapping process is a collaborative and iterative process that is achieved through data analysis and expert workshops. NOTE: to provide context, the full explanation of the roadmapping process is explained in conjunction with the description of the preliminary roadmaps (refer 'Roadmaps for the South Australian Food Industry' section in this report).

VTT's roadmapping methodology included collaborative workshops comprising South Australian customer experts as well as VTT experts. The preliminary roadmaps developed during Phase 2 of the project included roadmaps for luxury and functional food, which were then tested in a workshop

¹ See for example the Minister for Science and Information Economy report related to the Commercialisation of Publicly Funded Research in SA, 2014.

together with various experts. Industry views were collected by interview, with the workshop further enriching industry input.

Business-related knowledge providers include companies from food, beverage, wine and food ingredient industries, the packaging industry, and from specialised knowledge-intensive service providers. In addition, information from industry organisations, government representatives, researchers from universities and research institutes as well as technology organisations was also collected as part of this project phase.

Phase 3: Development of future pathways

For Phase 3 of the project, five 'future pathways' were developed. The term 'future pathways' was used to conceptualise a series of suggested activities that the South Australian food industry, together with South Australian government and other stakeholders, could take in order to transform the industry towards higher value add businesses. To ensure preservation of the context of this component of the study, more detail on the development of pathways group work is described in the 'Pathways for Future Growth' section of this report.

These five pathways respond to business opportunities identified in the earlier phases of the project in the domains of functional foods and luxury foods (including wine and beverages) in Asian and Australian markets. The pathways are logical combinations of steps which aim towards a set vision.

An industry workshop was organised in September 2015 in Adelaide to discuss the suggested future pathways and elaborate visions and associated steps to be taken towards the targets in the short, medium and long term. The workshop also aimed at creating joint commitment towards reaching the industry visions and momentum for realising the policy goals.

Participants in the workshop were presented with five suggested pathways. Each group was requested to discuss the selected pathway and, if needed, to refocus it. They were also asked to devise a long-term vision for the pathway, and to consider how the pathway might transform the food and wine industry. Finally, participants were asked to identify steps to be taken to realise their long-term vision and to organise those steps on a timeline, including identifying local actors that could undertake activities along the timeline, and support the overall long-term vision for the pathway.

The complete set of pathways has been designed to provide a comprehensive outline of actions which, in total, have the potential to move the South Australian food industry towards growth and a higher level of value generation through product differentiation and entry to new markets. The final pathways and steps leading to realisation were presented in the Final Report.

Survey Participants

Approximately 120 South Australian companies with functional and luxury foods potential were considered for this research project. Most of these companies are food and beverage manufacturers, but the interview list for Phase 1 also included selected packaging companies, service companies and industry associations of relevance to the food industry. (Note: Food South Australia was not interviewed in the first round of interviews.)

The final list of companies that agreed to be interviewed in Phase 1 represented each of the food sectors in South Australia, and included actors from all relevant food and beverage categories (see Table 1).

Out of the 65 actors that were ultimately interviewed, 53 are food, wine and beverage companies (Table 1). Note that, essentially at present in the South Australian food industry, functional food is effectively a sub-category of healthy food (see Definitions above, and Industry Analysis), and for this reason in Table 1 these companies are shown as having a ‘health promoting focus’ instead of, more specifically, a functional food focus).

Table 1. Companies interviewed for survey by type.

NOTE: The ‘other focus’ column in this table refers to additional informants that were identified as interesting stakeholders within the food industry – their representation in the interview material is indicative and not comprehensive.

Industry area and focus	Luxury and premium focus	Health promoting focus	Other focus	Interviewed
DAIRY INCLUDING CHEESE	4 companies	3 companies	1 association	6 companies
GRAINS INCLUDING BEER	9 companies	6 companies	-	8 companies
HORTICULTURE	12 companies	8 companies	1 cosmetics company	12 companies
MEAT (RED, WHITE & SMALLGOODS)	10 companies	3 companies	-	5 companies
SEAFOOD	16 companies	-	-	5 companies
WINE INCLUDING SPIRITS	12 companies	-	1 association	7 companies
OTHER FOOD MANUFACTURING AND SUPPORTING ACTORS	14 companies (e.g. cakes, pastries, chocolate, sauces)	6 companies	1 luxury importer, 2 business service companies	16 companies
PACKAGING	N/A	N/A	9 packaging industry companies	6 companies

Industry Environment

Phase 1 of the study examined value chains in the food industry and in South Australia specifically. This phase of the research also included a PESTLE analysis and SWOT analysis of the South Australian food industry ecosystem. These findings, together with responses from the food businesses surveyed in the study, were used to compile a picture of the current state of the industry and the opportunities for development of the functional and luxury food domains. The results are shown here for both market segments together, as many of the factors under consideration, such as automation and technology, are relevant to both.

The South Australian food industry

In accessing IBIS World reports, Estrada-Flores (2015) highlights that there are 1,499 South Australian food, wine and beverage manufacturing companies in South Australia².

VTT estimates that of these, less than 10% have a current focus on functional or luxury foods and beverages.

The majority of South Australian food manufacturers and producers – and similarly more than 90% of interviewed actors in Phase 1 – are micro and small to medium sized enterprises, often owner-operated and family owned.

Primary Industries and Regions SA (PIRSA) has already conducted several value chain studies within the local key industries, such as lamb (2013), citrus (2011b), tuna (2012a), potatoes (2012b), and wine (2014; Fearne, 2009). The approach and methodology used for VTT's study builds on these pieces of work with a focus on functional and luxury foods and Asian export markets.

PIRSA's earlier studies examined a wide range of issues related to South Australian food value chains, such as changes in farming conditions, markets and productivity, a number of consumer trends that impact and influence how households are buying their food, and different scenarios for value adding (see e.g. the SA Lamb Value Chain, PIRSA 2013a). PIRSA has also systemically facilitated awareness-raising and adoption of the concepts and practises of value chain management within South Australia (PIRSA, 2011c).

The South Australian food and wine industry is a significant contributor to the State's economy, contributing around \$10.2 billion in revenue and employing almost one in five, or 18% of the state's employed workforce (Food and Wine ScoreCard, 2013–14, PIRSA, 2014b). Government development agencies and South Australia's key industry organisation, Food South Australia, have produced a number of reports assessing the status and future potential of the South Australian food industry. The main messages from these reports are that the industry is growing fast, and it is widely acknowledged as an important value creator in the South Australian economy (e.g. Estrada-Flores, 2015; Estrada-Flores & Bethell, 2014).

The key food industry types in South Australia are shown below (Estrada-Flores, 2015). Industries naturally differ in size and value; the biggest sectors include wine, meat, poultry and artisanal bakery (which are the largest employers and have the biggest revenues (see Estrada-Flores, 2015)).

² IBIS World for ANZIC industry codes: 1111, 1112, 1113, 1120, 1131, 1133, 1140, 1150, 1161, 1162, 1171, 1172, 1173, 1181, 1182, 1199, 1211, and 1214; mid-2014 reports.

Table 2: Key food industries in South Australia.

Artisanal Bakery:
Businesses in this industry bake and sell bread and other baked products from the same premises. This industry does not include bread and other baked products prebaked in factories.
Beer Manufacturing:
The industry consists of firms that manufacture, keg, bottle and can beer, in a range of varieties such as ale, stout and porter. Beers are packaged for sale to pubs, bars, hotels and wholesale and retail alcoholic beverage distributors.
Biscuit Manufacturing:
The industry consists of establishments that manufacture biscuits (including unleavened bread). The term biscuit refers to any kind of shortened bread that has been leavened with soda or baking powder and is formed into cakes. It bakes hard and can be of many varieties including sweet, savoury or fancy.
Bread Production:
This industry consists of establishments mainly engaged in the production of leavened and unleavened bread from factory based premises. Companies that produce bread dough (both, fresh and frozen), breadcrumbs, or baking bread from home are also included in this industry.
Butter and Dairy Product Manufacturing:
Companies in this industry primarily manufacture dairy products other than cheese, ice cream, milk and milk powder. Industry products include butter, yoghurt, condensed milk, evaporated milk and other dairy products.
Cake and Pastry Manufacturing:
This industry consists of companies engaged in the manufacturing of cakes, pastries and similar bakery products (including frozen products) from either a factory based premises or home. It does not include those companies that produce and sell their products direct to consumers on the same premises, such retail bakeries and supermarket in-store bakeries.
Cereal, Pasta and Baking Mix Manufacturing:
The industry consists of establishments that manufacture prepared cereal breakfast foods, fresh and dried pasta and prepared baking mixes.
Cheese Manufacturing:
This industry includes fresh cheese, ripened cheese, hard and semi-hard cheese, and processed cheese manufacturing.
Chocolate and Confectionery Manufacturing:
Establishments in this industry primarily manufacture confectionery, chocolate or cocoa products, with or without sugar. Chocolate is produced from roasted ground cacao beans that are combined with other ingredients like milk and sugar. Cocoa is a powder produced from cocoa seeds that have been roasted, shelled and ground. Sugar confectionery is produced by boiling, crystallising and moulding sugar or molasses into solid pieces that are usually coloured or flavoured.
Cooking Oil and Margarine Manufacturing:
Companies in this industry manufacture crude vegetable or marine oils, as well as cake or meal. Companies in the industry also refine oil and blend oil and fats to produce food items such as margarine, compound cooking oils or fats, and blended table or salad/olive oils.
Cured Meat and Smallgoods Manufacturing:
This industry includes firms that primarily manufacture bacon, ham (including canned bacon or ham), smallgoods, and other prepared meat products. Smallgoods is a term usually referring to meat products where the meat has been manufactured to form a new product, such as sausages, salamis, pates, and dried, roasted and preserved meat products. Smallgoods are made from pig meat and other meats, such as poultry and beef.
Flour and Grain Mill Product Manufacturing:
Companies in this industry manufacture mill flour or meal intended for human consumption from grains, vegetables or plants. The industry excludes the production of breakfast grains.
Fruit and Vegetable Processing:
This industry consists of companies that bottle, can, preserve, quick-freeze and quick-dry fruit and vegetables (excluding sun-dried products). It includes dehydrated vegetable products, soups, sauces, pickles and mixed meat and vegetable and cereal products. The industry also includes firms that process fruit and vegetables.
Fruit Juice Drink Manufacturing:
Firms in this industry produce and bottle a wide range of still beverages, including fruit juice, fruit drink, cordials, iced tea and flavoured water.
Ice Cream Manufacturing:
This industry consists of establishments that manufacture ice cream, gelato, sorbet or frozen confectionery.
Meat Processing:

The industry consists of businesses mainly engaged in slaughtering livestock (except poultry); boning, freezing, preserving or packing red meat; canning meat (except poultry, bacon, ham or corned meat); manufacturing meals from abattoir by-products (except from products of poultry slaughtering); or rendering lard or tallow. The industry excludes beef feedlot operations.

Milk and Cream Processing:

The industry primarily pasteurises and separates raw milk to produce milk and cream products with varying fat content levels. The industry excludes the manufacture of cultured buttermilk, flavoured milk (whole and skim), sour cream and yoghurt.

Milk Powder Manufacturing:

Businesses in this industry manufacture milk powder, powdered milk-based beverages and baby foods in powder form.

Poultry Processing:

Companies in this industry process live poultry (including chickens, ducks and turkeys) into cuts and value added products. This industry begins where live poultry is purchased for processing (usually aged between five and eight weeks) and includes abattoir operation, dressing, frozen poultry manufacturing, poultry meat manufacturing and poultry packing. The industry ends at the initial point of sale of poultry products.

Seafood Processing:

Businesses in this industry process and manufacture fish or other seafood. This industry also includes businesses that operate vessels that process, but do not catch, fish or other seafood. This industry does not include fishing vessels that both catch and process fish or other seafood. This industry also does not include firms that freeze whole finfish or shell, freeze, or bottle oysters in brine; these are included in the Fish Wholesaling industry.

Snack Food Manufacturing:

Companies in this industry mainly manufacture snack-food products such as potato chips, corn chips, savoury snacks, nuts, pretzels and other similar snacks. The manufacturing process includes buying raw materials such as milled corn, wheat, potatoes, food extracts, flavourings, preservatives and sugar, for processing into finished, consumer snack foods. The finished products are then packaged and marketed to wholesalers and retailers.

Soft Drink Manufacturing:

This industry produces, cans or bottles soft drinks (carbonated and non-carbonated), sparkling mineral water, sport drinks and energy drinks. The industry does not include the production of bottled water, fruit juice or fruit drinks.

Spirit Manufacturing:

This industry purchases ingredients such as grapes, sugar and malt, which are fermented and distilled to produce spirit beverages including vodka, gin, whisky and liqueurs; industry participants also blend spirits. Operators buy glass bottles and paperboard containers to package these products. The spirits are then sold to alcoholic drink wholesalers and retailers. While the industry makes fortified spirits, it does not produce fortified wines.

Tea, Coffee and Other Food Manufacturing (also known as "Other manufacturing"):

This industry segment includes manufacturing of food products not elsewhere classified, including coffee, tea, sauces, dressings, seasonings, flavourings, herbs, spices, yeast, yeast extracts, ice, honey, salt and prepared meals. Manufacturers in this industry procure raw materials and process them into various finished products that are subsequently sold to wholesalers, retailers and related food manufacturers.

Source: Food South Australia. (2015). Competitive Foods Initiative. Food South Australia Industry Intelligence Report, March 2015.

Value Chain Analysis

For the purposes of Phase 1 of this study, the researchers used the value chain approach adopted by the Economic Development Board of South Australia (2015) and the key elements of the value chain map include:

- *The value or supply chain stages* – an overview of the broad linear chain of production
- *The main actors* – mapping the major players in each stage of the value chain
- *Goods produced and services provided* – the outcomes or services provided at each stage of the production chain
- *Processes and activities undertaken* – the major processes and activities required to produce the goods or services
- *Support services across the chain* – activities required across all stages of the value chain, but not produced as a direct result of the chain.

The main actors in the value chain or value network (see e.g. Christensen, 1997) include primary production, food processing and different third parties such as trade agents, distributors and various service providers.

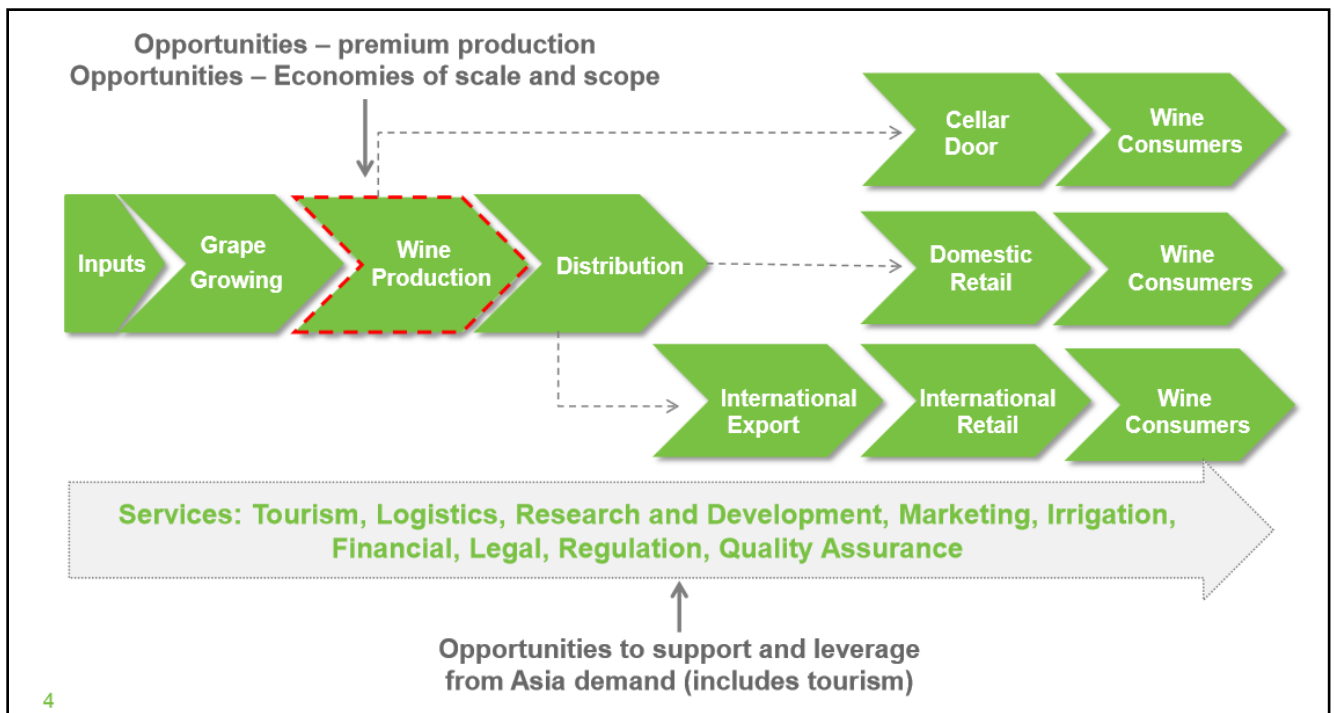
The actors are connected by interactions that represent tangible and intangible deliverables that create value. Value chains and networks also emphasise interdependence between the actors. In value chains, competitiveness is driven out of creating value delivered through collaborative relationships as well as through either cost reduction or production efficiency.

It is important to remember that, although the value chain is depicted as a vertical chain, intra-chain linkages are most often of a two-way nature (Kaplinsky & Morris, 2002). For example, the analysed food manufacturers are influenced by the constraints both in the upstream and in the downstream links in the chain.

The value chain can have several other stages and side chains such as waste material and side-stream management and value creation related to them, but these were not the focus of the interviews and data collection and are therefore not included in the analysis. However, these side chains are important when considering the further development of the food and beverage industry.

Phase 1 of the study assessed the food industry as a whole, but it should be noted that PIRSA has conducted studies concerning different food and beverage segments in which the value chains are differentiated following the individual elements of the segments. An example of this is the value chain analysis of the wine industry and its value chain, as can be seen in Figure 1.

Figure 1. Example of an industry value chain: Wine (source: PIRSA, 2014a).



The value chain analysis for this project started with a portrayal of the food value chain. Figures 2, 3 and 4 below are simplified portrayals of value chains. In the real world, naturally, value chains are often more complex than this and there are more links and alternative actors and directions in the chains.

The food value chain without third parties



Figure 2. The food value chain without third parties.

In VTT's analysis, the value chain figures include all the main actors of the food value chain, but the analytical focus is on food companies, which were the main respondents of the interviews.

Figure 2 (above) portrays the food value chain at its simplest form. Approximately 80% of the SMEs interviewed would prefer this kind of value chain where possible. This simplified value chain does not include third parties such as trade agents or distributors. Instead, in this kind of value chain food companies buy the raw materials directly from growers – and often are partly growers and farmers themselves - and they sell their products directly to retail and food service. Sometimes they also sell small amounts directly to consumers via hospitality venues, online stores and farmers' markets.

This kind of short and partly vertically integrated value chain is straightforward and relies heavily on companies' own networks and relationships. Micro businesses (fewer than 10 employees) and small

businesses (fewer than 50 employees) find the short value chain without third parties to be the most suitable for them.

Companies – both big and small – like to have direct contacts, especially with farms that produce their raw materials. This way, they can have control over the value chain and the quality of their raw materials.

On the other hand, larger companies may aim for full vertical control over the value chain, when more sophisticated and collaborative business practices are needed. Using distributors in sales is more common – locally direct connections are sought after, but nationally, and especially in exports, the good distribution networks are the most critical stage in the value chain. The global shift towards vertically integrated chains – in which the company owns its upstream suppliers and its downstream buyers – in international markets has further increased the competition on control and on final customers.

The food value chain with third parties

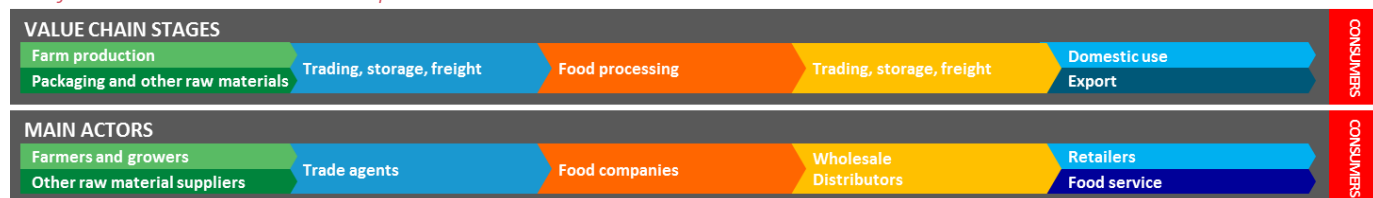


Figure 3. The food value chain with third parties.

Figure 3 presents the food value chain where third parties are included. In this model for example, food companies utilise trade agents and wholesale distributors in order to obtain raw materials and to move their products to retail and food service sectors. It was clear from the interviews that in this kind of value chain the most critical stage is between the food companies and the destination markets.

Within the local end markets in South Australia, and with company owned or otherwise easily accessed transport services, it is optimal to sell directly to retailers, such as supermarkets, and to food service, such as restaurants. However, when moving further to national or to international markets, the role of distributors and distribution networks becomes more critical.

Especially in specialised functional and luxury markets, local knowledge about products and the markets, and well-established networks of foreign distributors, are needed. Many interview participants already exporting emphasised the long-term (more than 10 years) work they have done in order to establish the overseas distributor connections and market access points.

The South Australian food industry value chain

Figure 5 presents the overall picture of the studied value chain and its components for South Australia. It includes the stages and actors in the value chain, examples of goods and services produced, and support services across the value chain.

The first stage consists of **primary production**; the most important actors being farms, of which South Australia has approximately 13,000 (ABARES, Australian Bureau of Agricultural and Resource Economics and Sciences, 2015). The types of farms are shown below in Table 3, and the value of production in Table 4.

Naturally, the majority of primary production/raw ingredients are in the commodity category of food, which is outside the scope of this research project. Potato is a good example of a commodity product in which price is the key driver for purchase for consumers (see PIRSA, 2012b).

Figure 4. South Australian Food Value Chain (mapping template adapted from Economic Development Board South Australia, 2015).

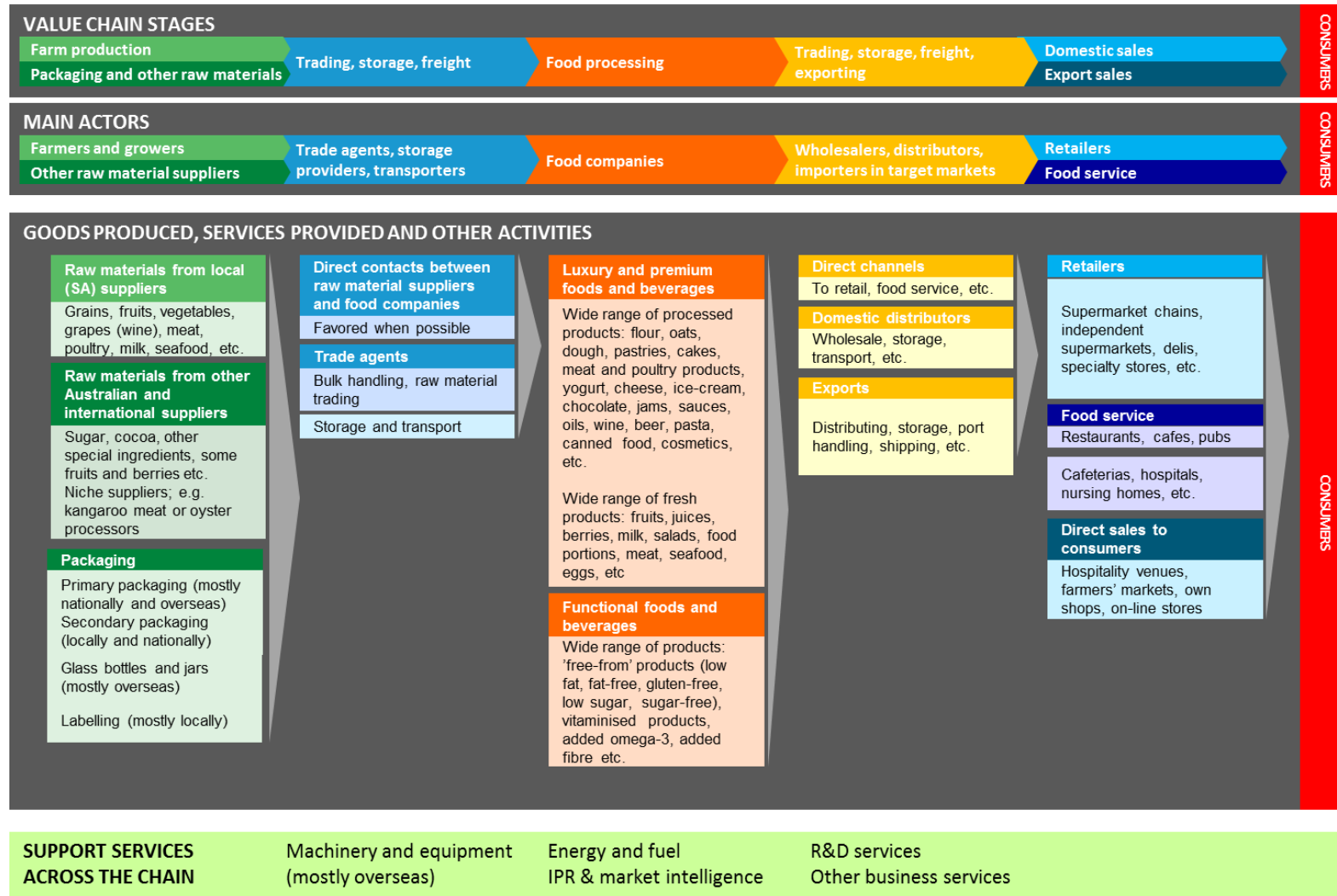
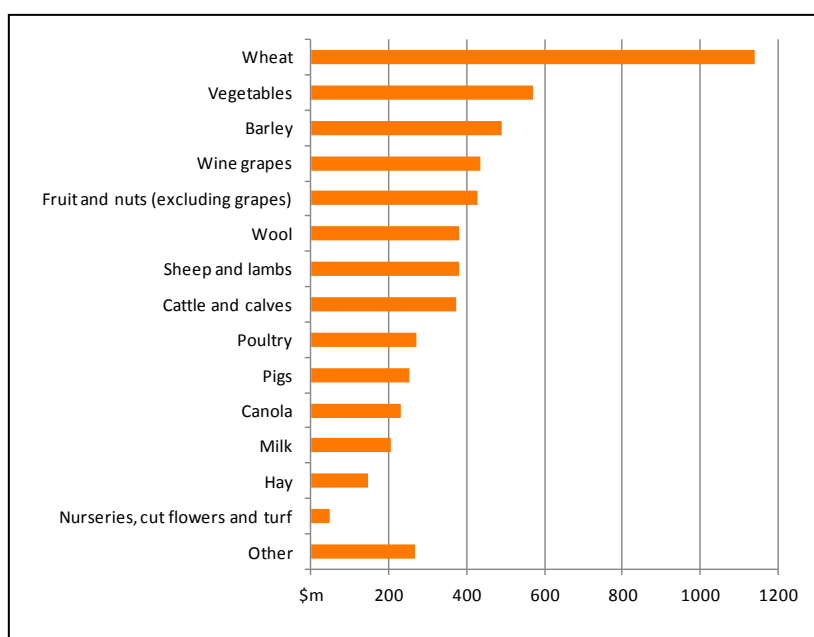


Table 3. Type and number of farms, by industry classification, 2012–13.

Industry Classification	South Australia		Australia	
	no.	%	no.	%
Fruit and nuts	2 332	18	10 136	8
Mixed grains and livestock	2 253	17	11 558	9
Grain growing	2 136	16	11 595	9
Sheep	1 626	12	11 938	9
Beef Cattle	1 336	10	39 380	31
Mixed livestock	615	5	6 434	5
Vegetable	469	4	3 980	3
Dairy	366	3	7 612	6
Other livestock	316	2	4 123	3
Nurseries, Cut Flowers and Turf	90	1	1 558	1
Poultry	90	1	1 031	1
Other	1 339	10	17 817	14
Total Agriculture	13 025	100	128 682	100

Note: Estimated value of agricultural operations greater than \$5000. Source: ABARES, 2015.

Table 4. Value of agricultural production, South Australia, 2012–13. Source: ABARES, 2015.



Together with farms, fisheries are a key segment in the primary production stage. In 2012–2013, South Australia contributed 19% of the total value of Australian fisheries production; the main luxury and premium products being Southern rock lobster and abalone.

The main export products include tuna, prawns, Southern rock lobster and abalone. Japan and Hong Kong are the major destinations for South Australian fisheries exports, accounting for 57% and 23% of the total value of exports in 2012–13, respectively. Other major export destinations include Vietnam (13%) and China (2%) (ABARES, 2015).

In addition to farms and fisheries, some food companies source unique raw materials such as kangaroo meat and other game meat from processors.

In the value chain, according to the interviews, approximately 80% of raw materials come from local South Australian sources, and 10–15% from elsewhere in Australia.

International supply of raw materials is generally quite small (approximately 5–10%). Supplying from overseas is heavily influenced by the global market volatility. The global supply is affected by availability of arable land and by the ongoing effects of climate change, which has reduced the reliance on production for a number of major producers and exporters (see the SA Food Strategy 2010–2015). As markets sustain variable economic conditions, volatility will be an ongoing challenge. In addition, global changes are mostly beyond the influence of the South Australian food industry. Related to this, greater market intelligence and risk management are required in order to grow.

Packaging is also assessed within the raw materials stage, but the situation and challenges related to packaging are presented separately as a part of the researchers' SWOT analysis.

The second stage along the value chain includes **trading** from the farms to the food companies. As noted, food companies interviewed prefer having direct contact with the farms that produce their raw materials, and third party traders are often not favoured at this stage of the value chain.

In the middle of the value chain, we have the actual **food companies**. Food and beverage companies are the main actors undertaking the value adding activities in the value chain. In practice, value adding examples include production processes such as marinating meats, making small goods, condiments and jams, special packaging, or anything that gives the product greater perceived value.

The other element of value adding is to the service offered around the product, such as in hospitality and tourism (for example the *Eat Local SA* initiative). This added value around food and beverages consists of elements of customer service and the experience of the product that is created in seeing, smelling, touching and understanding where the food comes from and then experiencing the eating or drinking of it (Regional Development Australia, 2014).

The food companies also package the products, usually by themselves with a packaging material sourced partly locally and partly nationally and internationally.

The fourth and fifth stages of the value chain include **wholesale and distribution** from the food companies to domestic and international use through **retail and food service**. Wholesalers and distributors are optional actors in the value chain; however, for larger and export-oriented companies they are generally critical. Established companies have developed strong relationships with key importers in target countries. These importers facilitate business on behalf of the South Australian companies (see e.g. PIRSA, 2011b), and for example can have sub-contracted distributors and transportation, which add more actors to the value chain.

At the end of the value chain are the **consumers**. Retailers and food service are constantly responding to consumer trends which are influenced by changing household demographics, lifestyle preferences, personal aspirations and technology. All these consumer trends in turn affect the food manufacturers. Generally the Australian food market is highly competitive (see e.g. a FOODmap

analysis by the Department of Agriculture, Fisheries and Forestry, DAFF, 2012) indicating an abundance of products, and a competitive market.

At the bottom of Figure 5 are different supporting services that go across the value chain. These include, for example, basic energy and water suppliers, machinery and equipment providers and different knowledge providers and cooperation platforms such as Food South Australia, the South Australian Wine Industry Association (SAWIA), Primary Producers South Australia (PPSA), and other intermediary organisations.

Research organisations and universities also provide new knowledge, but among the small and medium size food companies interviewed, collaboration between industry and research organisations is quite rare, and would require more work in order to act as a successful innovation driver.

Currently, PIRSA is addressing this challenge through the Advanced Food Manufacturing (AFM) grants that encourage businesses to collaborate with researchers in developing new products. Ten new grants were awarded in June 2015. The limited interest in research and development among South Australian food processors and manufacturers is addressed later in the SWOT analysis included in this report.

Other local organisations, such as technology centres, enterprise incubators, and development companies, whose primary tasks are to facilitate the transfer and commercialisation of technology, could provide more help in the development of innovation networks (e.g. Koskenlinna et al., 2005).

Successful industry-research collaboration requires a variety of actions that have been studied on several occasions. For example, a report prepared for the Minister for Science and Information Economy of the State Government of South Australia by LeMessurier Solutions (2014) calls for, amongst other things, an increased awareness of South Australian research capability and engagement with industry, for creating a “researcher mapping and matching system”, for increasing support for engagement and collaboration activities in South Australian research institutes, for increasing SME and researcher access to “soft skills” to improve collaboration and upskill commercialisation capability, and for providing innovation training for first time collaborators.

Macro level factors affecting the industry

In Phase 1 of the study, macro level factors affecting the industry were analysed using PESTLE (Political, Economic, Socio-cultural, Technical, Legal and Environment) and SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis tools. A number of the issues identified in the PESTLE analysis as relevant to South Australia also apply to Australia in general (PESTLE summary, Table 5 below).

Challenges identified in these analyses were used as discussion starters with interview participants. The challenges are categorised below based on the framework of core functions, transformation functions and context functions.

Table 5. PESTLE analysis: Summary of local factors affecting the industry.

PESTLE Analysis						
	Political	Economic	Socio-cultural	Technical	Legal	Environmental
Luxury	<p>Stable government with an increasing interest in advanced manufacturing, agriculture and food and wine lays a good basis for the development of luxury industries.</p> <p>Exporting premium wine and food is one of the economic priorities of the government.</p>	<p>Similarly to most Western economies, the SA economy is service driven. Economic growth is somewhat dependent on mining and agriculture sectors. The financial system is generally stable and quite strong, but the economic growth has lagged a little behind the rest of Australia. Markets are open, with no notable restrictions.</p> <p>Notable taxes affecting the industry are GST and WET (Wine Equalisation Tax).</p> <p>Industries are sensitive to the movement in exchange rate.</p> <p>There are challenges related to high-cost environment.</p> <p>The local South Australian market and the Australian national market are competitive and quite saturated: this affects growth rate and creation of new sales. Some industries such as grain and wine are also in overproduction.</p> <p>Growth in the number of premium & high quality food outlets e.g. Thomas Dux, and a growing number of high net worth individuals with the ability to buy special food.</p>	<p>The population of South Australia continues to grow. Rapidly growing ethnic populations, especially Chinese and Indians are driving demand for specific ethnic foods in Australia e.g. saffron in the luxury field.</p> <p>Affluent older population seeks to indulge in high end products in small amounts.</p> <p>Population is well-educated, and the food culture is vibrant with initiatives fostering local food (e.g. Eat Local SA). Much enhanced interest in gourmet cuisine in Australia as a result of popular TV shows.</p> <p>Significant increase in expenditure on eating out, which is growing at double the rate of general retail expenditure.</p>	<p>High focus on top-quality products that do not require much technological investments. The companies have usually automated their processes where suitable and feasible, and do not have many technology-related issues in the operation.</p> <p>Demand for luxury products with a premium story and high end retail options drive the luxury food industry development.</p>	<p>No major regulatory guidelines related to luxury food industries.</p> <p>Quite flexible business laws. Some expansions of regulation have increased compliance and food costs (e.g. related to trade waste).</p> <p>Consumers are more and more concerned about labelling information and food production attributes such as traceability (Country-of-Origin), No Growth Hormones Used, Free Range and Animals Treated Humanely and Environmentally-friendly.</p> <p>The food industry also emphasises a need for more clear certifications, standards and labelling, for example in terms of clean and sustainable food and organic products.</p> <p>IPR knowledge and support is needed to overcome trade barriers related to technical regulations, standards and conformity assessment procedures and labelling rules overseas.</p> <p>Functional food is regulated nationally by two main bodies – FSANZ and TGA.</p>	<p>Water scarcity affects food and beverage industries.</p> <p>The industry is widely dependent on natural resources and energy.</p> <p>Environmental and climate issues are important and Australians are investing in replacing fossil energy by renewable fuels such as solar, wind and marine.</p> <p>Via regulation (e.g. water restrictions), all industries have had pressures to adapt and mitigate in the hope of alleviating or managing climate change</p> <p>‘Clean and green’ standards are well represented.</p>
Functional			<p>Diversity of population and multi-cultural society. Possibilities to target specific populations. Growing aging population and increasing incidence of chronic diseases driving interest in functional foods.</p> <p>Increasing interest in nutritional–biological values of food, and increasing knowledge on functional food transmitted for</p>	<p>Small local functional food industry looking at imports. Natural functionality and naturally healthy food are of high interest, but interest in technology is also growing. E.g. high-protein and gluten-free products are currently popular.</p> <p>Food technology and business experts are available (e.g. SARDI, CSIRO); advancements achieved by food technologists include the development of products such as UHT milk, longer</p>		

PESTLE Analysis						
Political	Economic	Socio-cultural	Technical	Legal	Environmental	
	Free Trade Agreements with Japan, Korea and China improve market access for SA companies.	example by the media. Functional foods are traditionally regarded more therapeutic (drug based) than food based, but this can change.	shelf life, and Cryovac packaging. Entrepreneurs have indicated interest in technological innovation and knowledge related to it.	Regulations currently restrict the use of claims on food to nutrient content and health maintenance claims. Claims regarding prevention or reduction of disease risk are currently prohibited (with one exception about folate) though in spite of this health claims are present on labels, in advertising and the internet		

Some companies believe that they operate both in the functional and the luxury domains, meaning their products may have both functional and luxury features. Only a few companies manufacture purely luxury products and none exclusively manufacture functional foods. Most of the selected companies classified their products as premium quality, and terms such as premium, luxury and fine foods are used quite broadly (see also Definitions, above).

However, among the interviewed companies, luxury and functional foods are widely recognised as interesting, but challenging, forms of value adding.

The status quo of the industry is quite strong (see Context, above) and the interviews revealed lots of strengths to build upon. However, the analysis of interviews identifies a number of challenges and limitations, outlined in the SWOT analysis, presented below (Table 6).

Company performance ranked against global competition

The interviewed companies were assessed by the experts of the project, based on the assessment framework of different functions. This assessment includes the actual food, wine and beverage businesses and excludes other interviewees such as industry associations, packaging companies and business service actors.

Figure 5 maps the company development level against global competition. The companies are categorized as follows:

1. Companies capable of performing at the level of global competition (10 companies)

These companies have established exports and international presence in the food and beverage market. They usually export at least 20% of their products, but some companies export even 90-100% of their products. They have ambitious growth plans (for example doubling or tripling the size of their operations in the coming 3–5 years) and strong visions; they are willing to take risks and invest continuously in research and development and innovation (R&D&I). They are globally networked and can act as innovation champions in their field.

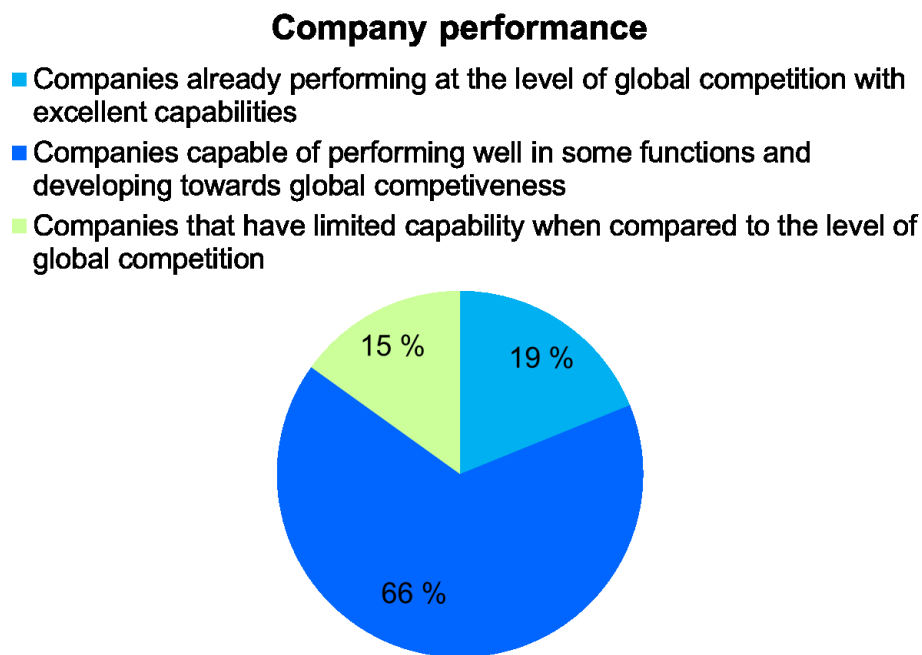
2. Companies capable of performing well in some functions, but overall could do better when compared to the level of global competition (35 companies)

These companies perform well in their current state and they are interested in growing and moving towards exports. They have experience with smaller scale export activities (less than 20% of production goes to export) and look for new opportunities. They can improve their capabilities especially related to new technology and food innovation and to market and export intelligence. They benefit most from the experienced mentoring network, and from the new collaboration initiatives and support. They are more cautious in their product development, but demonstrate interest in new ways of value adding.

3. Companies that have capability limitations or dysfunctions when compared to the level of global competition (8 companies).

These companies represent stagnant and diminishing companies. Reasons for the stagnation vary: for example, some of these companies are sunset enterprises planning to finish their business, some are struggling to survive. However, a company in this category may also just be satisfied with their current status and merely choosing to stay put. These companies present only a little development potential and no interest towards growing or exporting. They are mostly interested in acute, short term concerns related to their business.

Figure 5. Company performance ranked against global competition.



As seen from Figure 5, most of the companies (66%) represent category 2. We argue that these companies form the basis for the development of South Australian luxury and functional food and beverage industry.

Even if the current selection of luxury and functional products offered is limited, these companies perform well in providing premium quality, well-received products for their customers (the interviewed companies receive good feedback from their customers). These enterprises can also benefit greatly from the presented innovation ecosystem approach (refer the 'Towards An Innovative Business Ecosystem' section of this report) and from the mentoring provided by well-seasoned exporters and luxury and functional pioneers. Recommendations related to these are presented in the VTT Final Report for this research project.

Core, transformation and context functions

The insights gained from the company assessment (see above) were used to complement the findings in this section of the study. The 53 food, wine and beverage companies identified for interview were evaluated qualitatively against the core, transformation and context functions.

Core functions

In the interviews, a number of core functions were identified as important factors and potential constraints on development of the South Australian food industry.

The availability of a quality workforce

Many companies interviewed emphasised the importance of a high quality workforce for their business, and difficulties in finding and maintaining the best possible staff. Availability of a skilled workforce has been recognised as a highly important issue and a limiting factor for the food industry already in the SA Food Plan 2007–2010, but the challenge still remains today. Skills shortages were also a common theme identified in the Australian Government's Department of Industry, RDAR and PIRSA report *Mapping Capabilities and Connections in Riverland, SA* (2015). Particular types of skills are anticipated to become increasingly scarce in the future, and many of these disappearing skills are essential for plant design, repair, maintenance and management. Team management and business management were also strongly identified as skills shortages.

Access to a high quality workforce is a challenge, especially for bigger companies and companies located in more distant areas of South Australia. In summary, human resources are one of the greatest problems of the food industry in South Australia at every level, from technical staff and seasonal workers to specialists. Some companies mentioned that there are huge gaps in finding suitable employees who understand and are genuinely interested in the food business. These, and other human resource related issues, have also resulted in the situation where food companies are reluctant to hire more staff. Also the generational changes can cause problems if the aging family business owners cannot find successors for their work.

The current state of local packaging providers and materials

Availability of local packaging is a relatively weak link in the current functional and luxury value chain. Standard packages are easily available and the grand Australian packaging players are relatively healthy, but local supply for non-standard, customised packages and bottles that suit the needs of functional and luxury foods and beverages is limited.

Many companies stated that using local packaging manufacturers is not feasible, and also that the quality and design suitable for product differentiation is not good enough compared to overseas competitors. For example, for luxury wines all the bottles must be sourced from Europe, and the capacity to produce coated paperboard that is generally used for premium and luxury packaging has diminished locally.

In particular, needs related to special and custom packaging cannot be fully met by the local, or even national actors, although the food companies like to source all they can locally. Many interviewees viewed packaging as a critical part of their operation and emphasised the differences between premium and standard packaging. In addition, a major part of the current product development involves variation through packaging and bottling.

Packaging companies who were interviewed also noted the weakening situation for their industry. For example, despite some healthy packaging actors, imports of pre-converted

boxes and bags have increased by approximately 25% annually (source: market intelligence interviewee). Imports come from a variety of sources, including China.

One interpretation is that the markets are fragmented and incumbents are no longer able to meet the needs of the emerging and diverging markets. The main focus of the incumbents has been to improve the existing value chain; whilst these actors are more innovative and collaborative today than in the past, they are unable to satisfy the demands of the emerging players in the food sector.

In summary, the food industry is moving faster and is more entrepreneurial than the packaging sector. Insufficient attention is being paid for example to packaging design, which is important if moving up the value chain towards more luxury products is desired. Generally, the packaging industry needs to become less transactional and cost driven and more relationship and value focused, and the industry linkages between food and packaging need to be improved in the light of new and emerging demands of the developing food industry.

Despite these concerns related to development of the packaging industry, the Literature Review addresses opportunities related to packaging [See Functional and Luxury Food Project Literature Review]. Locally-based packaging solutions support the potential to open new trade opportunities through significantly reduced costs via enhanced packaging; for example issues such as traceability, sustainability, presentation, convenience and enhanced freshness/shelf life can be addressed through packaging.

Transformation Functions

The second component of the interviews assessed the transformation functions, that is, the companies' ability to change and innovate.

The importance of differentiation

Differentiation in terms of added value is a well-recognised key to success among the companies interviewed. The ways to add value are somewhat traditional and limited, and, for example, the functional products available represent quite basic functionalities, such as reduced fat or added vitamins. More radical and disruptive food technology and innovation cases are very rare.

Luxury products represent around 5% of the food and beverages manufactured in South Australia, and only a few companies expressed an interest to substantially increase the range of their luxury products. Generally, the luxury category was seen to be too restrictive in terms of sales. 90% of the interviewed companies seemed to be satisfied with their current situation and position, which is to offer high-quality, premium-end products to a variety of customers.

Only 5–10% of the interviewed companies claimed to be highly selective with their customers and target markets. These cases however, represent a genuinely innovative and intelligent way of doing business; within these companies, for example, the value of stories and narratives related to the products and stand-out design is emphasised.

Differentiation is important also because Australia generally does not have the right boundary conditions to develop economies of scale, and competing with quantity is not feasible for most Australian companies, especially for manufacturing firms (see Roos, 2014). Instead, opportunities lie in low-volume, high-value adding, high-variability, medium- to

high-complexity manufacturing – that is, in realising economies of scope above economies of scale. This means having business processes, technical systems, and manufacturing processes and systems that allow high variability in what is produced (Roos, 2014). This approach requires additional investments and high level of planning.

The level of automation

The level of automation within the companies interviewed is generally low to medium, with a few examples of high level of automation. Many food and beverage industries are labour-intensive and require, for example, an extensive seasonal workforce to do routine tasks. In some industries the premium and luxury value and experience also comes from the handmaking practices.

The companies interviewed have usually automated their processes where suitable and feasible, and do not have many technology-related issues in the operation. In terms of increasing volume, more automation is needed and companies looking for growth in volume wish for more funding for automation.

However, companies not interested in volume sales seem to be quite happy with their current systems and equipment. Some entrepreneurs indicated interest in technological innovation and knowledge related to it – generally there is quite a lot of room for utilising technology trends and the intelligence related to them.

In Australia in general, the food industry has invested moderately in equipment and dwellings since 2007, with capital investment growing at a rate of +1% per year in the past eight years (Estrada-Flores, 2014). Indications are that this trend will continue and attention should be paid to mechanisms that support smart and beneficial investments by the food industry.

Context Functions

The last section of the interview questions related to context functions: drivers and barriers for the industry's development.

Drivers of the industry

The interviewees gave different answers to the question of what drives the development of the industry, but together with the increased efficiency and the reduction of costs, the most prominent driver is customer needs and demands, as this was mentioned by more than 50% of the interviewees.

In the South Australian Food Strategy 2010–2015, consumer demands and their role in shaping the industry direction were similarly emphasised. Understanding customer needs both in Australia and abroad is critical in establishing a successful and competitive food industry.

Higher income, value for money (price), urbanisation, migration, demographic shifts, improved transportation, and consumer perceptions regarding quality and safety and ethical values based on production system integrity are changing food consumption patterns all over the world. Having a greater understanding of consumer needs is a part of the critical market intelligence required in order to succeed in exporting.

Similarly, community and industry groups have an impact on industry development; for example more than 90% of the businesses interviewed mentioned Food South Australia as a great asset and an impactor of the local food industry. Similarly, all of the wineries

interviewed regarded industry associations, both local and national, SAWIA and Wine Australia respectively, as assets.

Size of the local market

Both the local South Australian market and the Australian national market, where the products are sold throughout a country, are highly competitive and at some level saturated, meaning that growth is slow and there is a limited chance of new sales.

Simultaneously, many industries such as grain and wine are moving towards over-production and then slowly shrinking. The situation is further impacted by the changing dynamics in global trade; a good example is the emergence of countries such as Brazil, Russia, India and China as competitors in a number of Australia's established markets (e.g. the South Australian Food Strategy 2010–2015).

The small size of the local market has resulted in a limited interest in product development and innovation in the functional and luxury food domains, because companies usually want to have a strong market presence in their home markets first before going overseas.

Wish for more standardised and simple certification systems and labelling

The companies interviewed emphasised a need for clearer certifications, standards and labelling, for example in terms of clean and sustainable food, and for organic products.

The Department of Agriculture has several approved organisations working with certifications and standards. For example, for organic food there are at least seven different certifying logos with varying requirements available.

Similarly with food safety, the certification system is complex and different states and territories may interpret the code in different ways and priorities; many interviewees wished for more consistent and clearer standards.

Technical regulations, standards and conformity assessment procedures, and labelling rules are often also trade barriers. Food companies need help in interpreting and fulfilling the various overseas standards in order to succeed in exporting. Food companies do not oppose the standards that protect the customer, but in the competitive global market, efficient and clear standards are advantageous. There is also increasing media and community interest in food security and standards (see PIRSA, 2011a).

In addition, non-technical trade barriers such as import tariffs and acceptance related barriers need to be addressed regularly.

Labelling

Labelling has the potential to drive consumer behavioural change, leading for example to improved dietary patterns but, in practice, labelling is often inconsistent and inconclusive.

It is widely reported that the mandatory, standardised Nutrition Information Panel used in Australia and elsewhere, and located on the side or back of packaged foods, is difficult to understand and therefore underutilised in the food choice process (Grunert and Wills, 2007; Tymms, 2011).

In response, summary-style nutrition labels that require only minimal nutritional literacy have emerged on the front of packaged food. Grunert and Wills (2007) have determined that while consumers like simplification, very basic front-of-pack information, such as

simple 'traffic lights' or single logos are less acceptable to consumers than those front-of-pack schemes that supply a more verifiable message.

In summary, it can be stated that consumers' ideal front-of-pack nutrition label would be: a) easy to use, b) trustworthy and easy to verify and c) non-paternalistic, that is, it would not pressure certain behaviour. These basic rules of labelling are simple but, for example in exporting, the consumer expectations in different countries may vary a lot and ideals may be in conflict, or may be weighted differently by consumers.

Food transparency

An important and ongoing food regulatory trend in 2015 is food transparency. Consumers increasingly want to know where their food comes from, and governments continue to seek ways to improve their food safety systems. In Australia, a national consultation process began in April 2015 with industry, business and consumers, to deliver clearer and more consistent country of origin food labelling without imposing excessive cost on industry (Department of Industry, 2015).

SWOT analysis

A SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis is an analytical framework used to identify and structure the food industry's greatest challenges and its most promising opportunities. The strengths and weaknesses are internal factors that stem from the industry, and the opportunities and threats represent factors arising from the external environment.

Strengths, opportunities, weaknesses and threats were previously assessed in the South Australian Food Strategy 2010–2015 (Government of South Australia 2010); the SWOT in this report presents an updated analysis emphasising the recent industry insights from the interviews, with a focus on functional and luxury food businesses.

The strengths, opportunities, weaknesses and threats identified from the interview data are summarised in Table 6, with the most notable issues and challenges arising from the material presented. Table 6 includes a variety of different elements based on previous work and the VTT interviews.

Strengths

In summary, the main strengths build on the strong social capital of the South Australian food industry and on the many unique businesses, niche market players and 'gap fillers' with novelty value within the food industry.

In addition, the foods produced are known to be safe and of high quality due to the Australian safe food system and standards together with the existing biosecurity safeguards. Comparatively low use of antibiotics in production animals is one competitive advantage for Australian meat products (Gartry, 2014). However, the available survey data on antibiotic resistance in the animals in Australia is quite old (2003–2004), and thus might not reflect the most recent situation.

The Australian Government's Department of Health (2015) has recently published its first national antimicrobial resistance strategy. Such strategies have resulted in continuous microbial resistance monitoring in EU countries, and it is hoped that similar results may be obtained in Australia (see e.g. DANMAP, 2014 and SVARM, 2014).

Long traditions and a quite strong business culture, with a variety of different companies and high-quality products, strengthen the core of the industry. In particular, the luxury brands of food and wines in South Australia are predominantly family owned, and customers tend to place more trust in

products which come from family companies as opposed to multinational organisations (see the Economist, 2014). An appreciated heritage and small familial structures are attributes of luxury and strength within the South Australian food industry, as described by those businesses interviewed.

There are many experienced businesses and some pioneering operations and initiatives across the state. Learning from more experienced businesses and interest in mentoring possibilities highlight the arising ecosystem thinking and benefits. Similarly, the businesses interviewed mentioned good relationships and a high level of trust among businesses, and sustainable relationships with suppliers, customers, regulators and other stakeholders as current strengths. Even if systemic collaboration is rare, there are some 'pockets' of collaboration and generally the companies are well networked with each other.

To make the value chains and the business ecosystem alive and renewable, a risk taking entrepreneurial culture and 're-cycling' – the continuous movement of ideas and people – are essential. Trust and a commitment to the common objective between businesses in the chain are also noted in PIRSA's previous value chain studies (e.g. 2011), however previous analyses have found that building trust between companies has not been easy, and requires more action.

Environmental issues do not excessively burden the functional and luxury foods companies interviewed. For example waste management and 'green and clean' standards are generally well handled and respected. Via regulation, all industries have had pressures to adapt and mitigate in the hope of alleviating or managing climate change, and with a strong dependence on natural resources and energy, the food industry has had to prepare for new ways of doing business (see e.g. water restrictions by SA Water³).

Expansion of regulation has increased compliance and food costs (especially related to trade waste), but generally the companies did not have significant problems in adapting to environmental changes and regulation. The food and beverage industry is sensitive to increased trade waste costs – this is already widely noted by the South Australian Government, and the industry is willing to work with the public sector to address the challenges.

Weaknesses

Weaknesses stem, for example, from conservative and traditional attitudes and quite slow development, with a few exceptions. Product development and transition within the industry is in many places slow and cautious. Only a small amount of genuine functional and luxury products can be found, and where they exist, the value chains are generally quite short. There may even be cultural reticence to move from premium towards luxury foods; this is mainly due to a fear of losing loyal domestic market.

An important weakness is that the size of the local customer base is too small for high value functional and luxury products, which has resulted in limited interest in product development and innovation in the functional and luxury foods domains. This weakness can be avoided by directly targeting export markets. However, it should be noted that the interest in, and capabilities related to, exports are also limited and, in addition, there are some difficulties in finding the right partners for export.

There are also challenges relating to continuous supply of raw materials to maintain a stable production level for companies operating using seasonal raw material supply and not able to import

³ For SA water regulation, see <http://www.escosa.sa.gov.au/>, accessed 3.8.2015.

raw material to compensate for fluctuations in availability. Growing production volumes are sometimes limited by the available volumes of raw materials.

There is also an unwillingness to prioritise investments in new machinery, automation, facilities and research and development. Both interviews and studies⁴ identify high costs (for example energy, water, waste and labour) as a competitive disadvantage for establishing, operating and growing food companies in South Australia.

Of the food processors and manufacturers interviewed, more than 50% stated that the current primary driver for growth is a focus on increased efficiency and the reduction in costs of production. This is one key driver for a limited interest in research and development, and as a consequence, the R&D community has focused its efforts (on attracting industry support) elsewhere. Businesses are mainly concentrated in doing what they have already done for a long time, therefore innovation through completely new functional and luxury products is currently quite rare.

Equally, it has meant that the food processors and manufacturers have, in the main, not employed staff that have the technical competency to, for example, identify their research and development needs or to be able to identify emerging technologies that could be applied within their company. This creates a vicious circle.

Another important weakness is the lack of widely accepted definitions of luxury food products. Terms such as luxury or premium are used mostly as market differentiators, and not as a systemic part of product development.

Opportunities

Opportunities identified include, for example, collaboration opportunities in exports and in improving the readiness to enter Asian markets. Utilisation of the specialities and resources of the region can be both improved and increased.

An unexploited opportunity is related to increasing the amount of research and development, product development, and technology when feasible. Spreading and utilising the existing knowledge within the value network would further increase the critical market intelligence within the industry.

Opportunities also lie in increasing understanding of the diverse range of customers and potential customers (needs, habits, culture, etc.), in providing help for partnership building, and in establishing international connections (e.g. international boards and visits). These are important, especially when entering new global markets in developing countries. Realisation of some of these opportunities may require an increased awareness that the present performance level is not up to global best practice. This awareness is normally created through exposure to best practice during visits to companies, enabling participants to form a picture of what is both possible and required.

⁴ Deloitte, 2015, Energy Markets and the Implications of Renewables – South Australian Case Study. Deloitte Access Economics;
ESAA, 2015. On a high: SA renewables and wholesale prices, https://www.esaa.com.au/members/on_a_high_south_australian_renewables_and_wholesale_prices_1;

Threats

Threats arise, for example, from the limited amount of support for and recognition of SMEs, from high costs (see above), from the limited knowledge of and preparedness to enter Asian markets, and from a challenging regulatory environment.

Threats have also been identified related to both the food companies' and raw material suppliers' vulnerability to natural and environmental threats, such as drought and other weather-related challenges, including climate change.

The highly competitive environment as relates to Asia – although potentially useful, in principle, in driving improved performance – can be challenging for smaller food companies. This is further complicated by the complexity and inconsistency of the regulatory regimes and behavioural customs in some of the target markets.

Similarly, some Australian regulatory actions appear as threats and cause debate; for example regimes such as Wine Equalisation Tax (WET) have changed the industry dynamics, but similarly abolishing WET would result in reduced profitability.

Table 6. SWOT Analysis of the luxury and functional food chains.

SWOT ANALYSIS	
Current state of the South Australian Functional and Luxury Food Industry	
INTERNAL	<p>STRENGTHS</p> <ul style="list-style-type: none"> • Many unique businesses, niche market players and 'gap fillers' with novelty value • Long traditions and quite strong business culture with a variety of different companies and high-quality products • Experienced businesses and some pioneering operations and initiatives: learning from more experienced businesses, interest in mentoring possibilities (ecosystem thinking and benefits) • Good relationships and level of trust among businesses and sustainable relationships with suppliers, customers, regulators etc. • Some "pockets" of collaboration • Diversity in regional climates, attributes and cultures • Innovative culture and tradition • Healthy independent retail sector • Primary industry funding schemes such as AFM (Advanced Food Manufacturing) grants and DSD's (Department of State Development) grants supporting innovation, SA innovation vouchers, micro finance fund grants • Demonstrated collaborative mechanisms and cooperation builders such as SA Food, SAWIA and other industry organisations
EXTERNAL	<p>WEAKNESS</p> <ul style="list-style-type: none"> • Conservative and traditional attitudes and quite slow development, with a few exceptions • Cautious product development • Small amount of genuine luxury and functional products – value chains generally quite short • Size of the local customer base is generally too small for high value luxury and functional products: resulting in a limited interest in product development and innovation in the luxury and functional fields • Limited interest and capabilities to export • Difficulties in finding right partners for export • Limited funds for new machinery, facilities and R&D • Limited collaboration in exports • Distance to Australian markets • Threats to water supply/security • Rising input costs associated with business operations • Scale and complexity of distribution systems • An ongoing need for infrastructure in some regional areas
INTERNAL	<p>OPPORTUNITIES</p> <ul style="list-style-type: none"> • Collaboration possibilities in exports • Recognition and full utilisation of the specialities and resources of the region • Improving the readiness to enter Asian markets • Increasing the amount of R&D, product development and technology – when feasible • Spreading and utilising the existing knowledge within the value network; increasing the market intelligence • Increasing health consciousness • Increasing the understanding of diverse range of customers and potential customers (needs, habits, culture, etc.) • Providing help in partnership building, and in establishing international connections (e.g. international boards, visits) • Simplifying and standardising regulation and certifications • Increasing demand for safe and nutritional food production systems • Increasing diversity of food markets • Ensuring a competitive trade and service provider network • Growing food service industry • Enhancing the food, wine and tourism experience
EXTERNAL	<p>THREATS</p> <ul style="list-style-type: none"> • Not enough funding and recognition for SMEs • Limited knowledge and preparedness to enter the Asian markets • Too much bureaucracy and tax burden • Vulnerability to natural and environmental threats (water, drought, energy etc.); impacts of climate change and variability • Highly competitive environment with a wide range of risks, regulation, and difficult requirements (Asian markets) • Complex and inconsistent certification system that needs standardisation • Exposure to commodity and currency volatility • Future labour shortages and low rates of skilled labour retention • High costs of business operations • Access to capital for future expansion • Challenges of the Australian packaging industry; worries of the interviewed companies related to local availability for differentiated and luxury packaging • Highly competitive environment with a wide range of risks, regulation, and requirements (Asian markets)

Technology Assessment

An assessment of technologies and capabilities was undertaken in Phase 2 of the project. Technology assessment determines the relevance and implications of food technologies. The Technology Readiness Level (TRL) method is used for evaluating the maturity of technology for operational deployment. Some technologies, such as food processing technologies, are relevant in the food and beverage industry as a whole, but the VTT research project tried to emphasise elements that are linked directly to functional or luxury food domains. Naturally, enabling technologies are more important to functional food than to luxury food.

This technology assessment is near future-oriented; that is, it looks at interesting new and emerging technologies and innovations that shape the food industry and its development now and in the near-future. Technologies were selected based on their current relevance for functional and luxury foods, and on their future-oriented value. Thus the technologies discussed typically have medium and high technology readiness levels (TRLs). Technologies that have low TRLs, and thus are not relevant for the South Australian food industry in the near-future, were not discussed.

Functional foods and beverages benefit more from technology, and tend to rely more on it than the luxury domain, in which the role of food technological advancement is relatively small (with the exception of packaging technologies).

In Phase 1 of the project, the interviews conducted revealed that many food companies in South Australia are interested in benefitting more from the latest food technology development and innovation. The technology assessment component in Phase 2 of the project provided more information in order to fully utilise new technology and innovations related to food production. Interviewed companies expressed an interest in increasing the amount of research and development (R&D) undertaken by them and in product development and the use of technology to achieve this, as well as in utilising outside R&D knowledge, but only when feasible (that is, outside of the organisation). A selection of relevant technology providers has been included with this assessment.

Both limited funds and limited local know-how within the food industry restrict the spreading of new food technologies and innovations. There is some food technology education in the local universities, for example both the University of South Australia and the University of Adelaide have combined food and nutrition sciences programs at the Bachelor level.

Closer links could be fostered with national and international research providers. For example, the Australian Research Council (ARC) has awarded more funding to promote industry-university linkages and is currently running an Industrial Transformation Research Program (ITRP) in which food and agriculture is one of the chosen topics for the year 2015, with a special focus on areas such as dairy innovation, rock lobsters, value chains and ASEAN markets⁵. Local capabilities within the food industry could be strengthened, for example, in utilising science and technology in nutrition, in tailoring the food products with enzymes and microbes, and generally in improving the functionality of foods. Utilising new technologies and techniques is important in order to develop new health promoting value added products.

Technology readiness

Technology readiness measures the extent to which a technology is suited for deployment in a real operational environment. It also provides a common understanding of technology status, that is,

⁵ See ARC, <http://www.arc.gov.au/>

how readily a food or beverage business can buy this technology and use it. In this study VTT applied the commonly used Technology Readiness Levels (TRL) categorised by the European Union, with number 9 being the most mature technology⁶.

The Technology Readiness Levels are:

- TRL 1: Basic principles observed
- TRL 2: Technology concept formulated
- TRL 3: Experimental proof of concept
- TRL 4: Technology validated in lab
- TRL 5: Technology validated in relevant environment (industrially relevant environment in the case of key enabling technologies)
- TRL 6: Technology demonstrated in relevant environment (industrially relevant environment in the case of key enabling technologies)
- TRL 7: System prototype demonstration in operational environment
- TRL 8: System complete and qualified
- TRL 9: Actual system proven in operational environment (competitive manufacturing in the case of key enabling technologies)
- Beyond 9 – full scale industrial use

The assessment below concentrates on technologies related to food preparation and processing, but also includes wider themes and trends, such as digitalisation and packaging technologies as a whole. Naturally all technology related phenomena, such as digitalisation as a wider megatrend in a society, cannot be described within the TRL system, and it is used when seen as suitable. The TRLs of portrayed technologies are presented in Table 7 and further explained in the text below. Manufacturing readiness levels inside South Australian food industry similarly vary, which the VTT researchers took into account when formulating recommendations and future pathways for the industry.

Table 7. TRLs of assessed technologies.

Technologies and innovations

Digitalisation: E-commerce solutions such as mobile commerce, electronic funds transfer, supply chain management, Internet marketing, online transaction processing, electronic data interchange, inventory management systems, and automated data collection systems
 Food processing technologies: High Pressure Processing (HPP)

Food processing technologies: Pulsed Electric Field (PEF)

Food processing technologies: Microwave treatment and UV pasteurisation

Food processing technologies: Cold plasma

3D printing in general, e.g. plastics and metals

3D food printing / bioprinting

Active food packaging technologies; absorbents, scavengers, antioxidative and antimicrobial packaging

Technology Readiness Level
High: 8-9 and beyond
High: 9 and beyond
High: 9 and beyond
High: 9 and beyond
Medium-high: 6-7
High: 8-9
Medium: 4-6
High: 9 and beyond

⁶ Technology Readiness Levels, http://ec.europa.eu/research/participants/data/ref/h2020/wp/2014_2015/annexes/h2020-wp1415-annex-g-tri_en.pdf, accessed 13.8.2015.

Intelligent food packaging technologies: Biosensors, chemical sensors
 Intelligent food packaging technologies: Silicon photonics sensors, carbon nanotechnology

Intelligent food packaging technologies: indicators, RFID labels/tags and sensor-enabled RFID tags (non-integrated, non-flexible), barcodes, QC codes, digital watermarks, printed electronics temperature sensors (flexible)
 Active and intelligent food packaging technologies: Sensor-enabled RFID tags (Flexible, integrated)
 Biotechnology: Food fermentation

Biotechnology: Microbial production of flavours and pigments

Biotechnology: Enzymatic processing

Extraction technologies for functional ingredient production

Medium: 4–6
Low-medium: 3–6
High: 9 and beyond
Medium: 4–6
Applications at many levels: 3–9 and beyond
Applications at many levels: 3–9 and beyond
Applications at many levels: 3–9 and beyond
High: 9 and beyond

Digitalisation of food industry

Digital technologies are creating major opportunities for the food industry. Digitalisation – also referred as digitisation – is a megatrend. Megatrends are large, social, economic, political, environmental or technological changes and macro-economic forces of development that impact business, economy, society, cultures and personal lives.

It is argued that by the year 2020, an entire generation, Generation C (for ‘connected’), will have grown up in a primarily digital world (PWC, 2015). The effects of an increasingly digitised world are now reaching into every corner of our lives because three forces are powerfully reinforcing one another (PWC; 2015):

- **Consumer pull:** Consumers are adapted to the digital environment. They expect to be always connected, are willing to share personal data, and are more likely to trust referrals from their closest friends than well-known brands.
- **Technology push:** Digital technology continues to expand its influence. The infrastructure backbone of the digital world is bringing affordable broadband to billions of consumers. In parallel, low-cost connected devices are being deployed in every industry, and cloud computing, and the vast information-processing machinery it requires, is developing quickly.
- **Economic benefits:** The economic benefits to be captured through digitisation are real. A wave of capital has poured into the new digitisation technologies and companies, and the public markets reward early movers with unprecedented valuations.

As identified in Phase 1 of the project, online sales and home shopping are quickly becoming the distribution mode of choice globally due to consumers’ ability to make informed decisions and compare prices. Online retailing is changing food and beverage trading, and the industry actors need to be prepared for the change. In Australia, e-commerce sales in general rose 14.4% in 2015 to pass \$10 billion (Table 8, eMarketer, 2015⁷).

⁷ eMarketer, 2015. <http://www.emarketer.com/Article/Australian-Retail-E-commerce-Sales-Top-10-Billion-2015/1011823>

Table 8. E-commerce sales in Australia.

Total retail and Retail e-commerce sales in Australia 2013-2018, billions						
	2013	2014	2015	2016	2017	2018
Total retail sales	\$222.09	\$231.41	\$238.59	\$245.75	\$253.12	\$260.46
Retail e-commerce sales	\$8.01	\$9.40	\$10.76	\$12.05	\$13.32	\$14.52
% Change in e-commerce	11.6%	17.3%	14.4%	12.0%	10.6%	9.0%

Even if less than 1% of food beverage sales currently occur online⁸, digitalisation is also a global food trend. It takes place especially through the changing rules of communication and human behaviour. For example, online shopping continues to grow rapidly and is influencing the retail landscape. Open innovation, crowdsourcing and co-creation are in the core of digitalisation of the food industry. As shopping habits are changing, niche online grocery services such as functional or luxury foods can disrupt the traditions of grocery retail.

A number of food and beverage brands have demonstrated original ideas using social media and digital technology (Weston, 2014; Muckersie, 2014). FreshMinds (Muckersie, 2014) have benchmarked five leading food and beverage companies that are pushing the boundaries in their industry, using digital technologies to drive innovation – including Starbucks, Coca Cola, AB InBev, Nestle and Cadbury.

For example, Starbucks globally launched a Tweet-A-Coffee service as well as mobile payments, Cadbury has used 3D printing to create edible prototypes and employed 3D printing as part of their new product development process, and KitKat has crowdsourced new flavours.

Coca Cola developed its existing business model to foster new growth – particularly with regard to devising marketing campaigns and developing new products. For example, via crowdsourcing Coca-Cola has obtained over 3,000 different interpretations of their new brand positioning from consumers in the form of videos, drawing and photos. These feed into the brand campaign, with one even being released as part of the company's marketing campaign in Asia. Coca-Cola has also been at the forefront of innovation in product development, for example their FreeStyle machine allows customers to mix flavours to create a unique drink. This is a good example of mass-personalisation and co-creation with customers.

AB InBev has recognised that by partnering with people from outside their organisation, they will be able to source new and innovative ideas. The company has created an Open Innovation Portal on its website, which lists both specific briefs and general areas of interest and encourages individuals to submit their solutions. Restaurants have got in on the act too, with novel ideas such as providing edible QR codes to check for mislabelled food, or giving customers iPads/tablets to create their own cocktails – with the chance to earn commission if others subsequently buy the drink.

Digitalisation is also a key theme in the 2016 Fruit Logistica (International Trade Fair for Fruit and Vegetable Marketing). Food fairs and events have recognised that digitalisation of the retail trade offers many opportunities, but it also presents a number of challenges. New packaging solutions are

⁸ Business Insider, 2015. <http://uk.businessinsider.com/e-commerce-disrupting-huge-grocery-market-2014-12?r=US&IR=T#ixzz3ihDmSc9K>, accessed 13.8.2015.

required, and providers need to cooperate as closely as possible – the key to this is urban retail logistics⁹.

Generally digitalisation impacts on all areas of the value chain. For online food and beverage companies to deliver the freshness consumers want, they have to be able to deliver orders fast, while still maintaining the quality of easily damaged foods such as fresh produce. But there are also advantages to online grocery shopping, especially in specialised functional and luxury products. For example, in the United States, only 15% of consumers have purchased general food items online, but 25% said they have bought specialty food and beverages online, which are otherwise hard to find elsewhere¹⁰.

Similarly, new start-ups that focus on concierge shopping and subscriptions for prepared meals develop online grocery models and offer services that are differentiated from traditional supermarket shopping. Business Insider (Smith, 2015) believes that these services could change the way people shop for food. In South Australia, Food South Australia supports e-commerce activities and provides help and contacts for interested businesses¹¹.

Since digitalisation does not refer to a single technology but to a myriad of different solutions, technology readiness levels within the digitisation development vary. TRL of most of the basic e-trade and e-commerce solutions such as online-stores, mobile payment and customer engagement platforms is already high (7-9), and more solutions are constantly being developed related to, for example, crowdsourcing and the Internet of Things (IoT) (see also the section on sensors and monitoring). Software solutions and applications related to the IoT are among the fastest growing emerging markets. In essence, this refers to the ability to connect remote or mobile machines to networks through advanced wireless connectivity and low-cost sensors. In addition, robotics technology – e.g. in batch production and as service robotics with face recognition capabilities – is a growing application field.

Digitalisation and the IoT have impacts on the monitoring of the mechanical, nutritional, quality and other attributes of food and food ingredients. Real-time monitoring of food appearance by a computer vision system is already being used and has become a key issue in the food industry, since it is a consistent, efficient, and cost effective alternative over the off-line destructive methods such as dye, peel or burst tests. The digital approach is a rapid, safe, reliable, and non-destructive technique, which requires no sample withdrawing and can be applied as in-line, at-line, on-line and off-line measurement tools for the shape, size, colour, and texture analyses in food processing operations.

One key attribute that enables image processing suitable for qualitative measurements during food processing is the relationship between the product quality attributes and the appearance of foods including physical structure, colour, and visual texture. Thus, a rapid image-based screening technique providing information regarding the organoleptic properties would be useful in food processing operations (Aghbashlo et al., 2014).

In order to survive and succeed in the future competition, it should be of interest to South Australian food industries to apply, for example, advanced, real-time inspection tools capable of in-process

⁹ Fruit Logistica, June 30, 2015. http://www.fruitlogistica.com/Press/PressReleases/News_10752.html, accessed 13.8.2015.

¹⁰ Business Insider, 2015. <http://uk.businessinsider.com/e-commerce-disrupting-huge-grocery-market-2014-12?r=US&IR=T#ixzz3ihDmSc9K>, accessed 13.8.2015.

¹¹ See Food South Australia, <http://foodsouthaustralia.com.au/guide-to/distribution/online-shopping/>, accessed 13.8.2015.

monitoring of food and beverage attributes. Such applications would enable automation while maintaining very high and consistent yields.

Food processing technologies

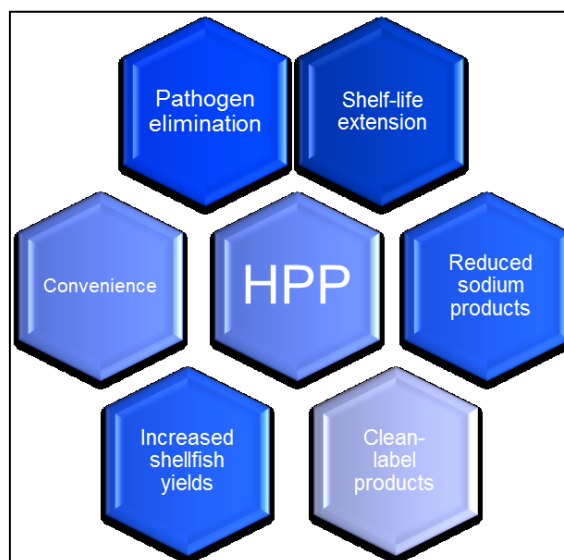
For the purpose of the Phase 2 technology assessment, VTT selected food processing technologies identified in the interviews with food companies as relevant for the South Australian food industry. Application domains of the chosen technologies include the dairy, meat, seafood, fruits and vegetables, and processed foods industries.

The main drivers for the development of new food processing technologies are higher quality products, improved product safety, and longer shelf life, as well as reduced resource footprint. Non-thermal preservation technologies such as High Pressure Processing (HPP) and Pulsed Electric Field (PEF) have less impact on the (fresh) sensory characteristics of the product than conventional technologies. With non-thermal preservation technologies, additives and heat treatments can be avoided. Thus these technologies are suitable for heat sensitive food materials (Saldana et al., 2014, Jermann et al. 2015). However, regulatory issues need to be considered.

High Pressure Processing

High Pressure Processing (HPP) enables significant reduction of microbial levels in a very short treatment time. It is commercially used to treat numerous different types of foods including meat, seafood, dairy, fruits and vegetables, and processed foods¹². In the dairy industry it can be used to simultaneously pasteurise and homogenise liquid milk (Hayes et al. 2005). Industrial scale HPP equipment is available for example from AVURE technologies¹³ and Hiberbaric¹⁴. Technology readiness level of HPP is 9 and beyond; the technology is already industrial-scale. The benefits of HPP are shown in Figure 6.

Figure 6. Benefits of HPP.



Commercial solutions of HPP include, for example:

¹² For more applications, see <http://www.hiperbaric.com/en/applications>, accessed 27.8.2015.

¹³ Avure Technologies, <http://www.avure-hpp-foods.com/hpp-equipment/>, accessed 27.8.2015.

¹⁴ Hiperbaric, <http://www.hiperbaric.com/en>, accessed 27.8.2015.

- *Meat and seafood*: Reduce or eliminate preservatives. More than 2-times longer shelf life; 100% meat separation from shells.
- *Fruits, juices and vegetables*: Meets FDA's 5 Log pathogen rule (enables 5 Log-value reduction in the levels of pathogens), no changes in flavour, sugars, citric acid, pH and aromatic components.
- *Processing parameters*: Large capacity: 370 kg / cycle. Fast processing time: 10 cycles / hour = 3700 kg/h.

Pulsed Electric Field

Pulsed Electric Field (PEF) inactivates microbes but leaves proteins mostly intact (retaining flavours). It enhances mechanical disintegration and can improve enzyme hydrolysis. In addition to pasteurisation, PEF can be used to enhance the cold extraction (up to 80%) efficiency of juices, colours and bioactive compounds from mainly plant-based materials such as roots, fruits, vegetables, grass and leaves, and protein rich products¹⁵.

Manufacturers of PEF equipment for industrial scale applications are for example Elea¹⁶ and Pulsemaster¹⁷. The technology readiness level of PEF for this equipment is 9 and beyond and the technology is already in industrial use.

Cold plasma

Cold plasma is an emerging technology and is not yet available for industrial scale food processing; technology readiness level is around 6–7. Plasma could be applied in the disinfection of (equipment) surfaces, packaging, food contact surfaces and even food itself. It has been tested successfully, for example, for the microbial decontamination of strawberries inside a closed package. Since plasma treatment requires no liquids it can be used to treat low water activity products¹⁸. In Australia, cold plasma has been studied, for example, as an effective method for killing pathogens on uncooked poultry (Sagar, 2012).

Some older technologies have now been upscaled for industrial processes. These include microwave treatment¹⁹ and UV pasteurisation (of beverages) (Rupasinghe & Yu, 2012). TRLs of microwave treatment and UV pasteurisation are at level 9 and beyond.

Biotechnology for food

Biotechnology has vast potential in the improvement and development of foods. It has an important role to play in helping to deal with emerging challenges, including those arising from climate change, pressure on global food supplies and the management of pests and diseases. Biotechnology can also benefit the environment through reduced chemical use, and consumers through the development of healthier products.

In Australia, the Federal Department of Agriculture is committed to making Australian agriculture, fisheries and forestry more sustainable, competitive and profitable²⁰. Many universities in Australia,

¹⁵ SteriBeamSystems, <http://www.steribeam.com/technology/Extraction-with-PEF-in-Brief.pdf>, accessed 27.8.2015.

¹⁶ Elea, http://www.elea-technology.com/uploads/documents/Elea_Brochure.pdf, accessed 27.8.2015.

¹⁷ Pulsemaster, <http://www.pulsemaster.us/pef-machinery>, accessed 27.8.2015.

¹⁸ Campden BRI, <http://www.campdenbri.co.uk/research/cold-plasma.php>, accessed 27.8.2015.

¹⁹ Industrial Microwave, <http://www.industrialmicrowave.com/>, accessed 27.8.2015.

²⁰ The Department of Agriculture, <http://www.agriculture.gov.au/ag-farm-food/biotechnology>, accessed 28.8.2015.

including the University of Adelaide, also offer undergraduate and postgraduate studies in biotechnology and in food and nutrition science.

Biotechnical applications utilise either living microbes or microbial components (enzymes, metabolites) in food processing. Biotechnology is a wide domain, with examples of these technologies at all technology readiness levels, and new technologies being developed continuously. For this assessment VTT selected a number of case studies that could be of interest, especially to the South Australian functional food industry.

Enzymatic processing

Currently the global interest in enzymatic processing is mostly focused on texture and structure tailoring and functionalisation of plant proteins. Cross-linking enzymes such as transglutaminase and deaminase are used in these applications (Buchert et al., 2010; Ercili-Cura et al., 2015; Jiang et al. 2015). Various oxidative enzymes also have the potential to be used for cross-linking. These include tyrosinases, laccases, peroxidases, sulphhydryl oxidase, lipoxygenases, and glucose and hexose oxidases (Buchert et al., 2007). Currently transglutaminase is the most widely used enzyme for texture/structure tailoring. Laccase is used in wine and beer stabilisation, and fruit juice processing (Osma et al., 2010).

Microbial products

Microbial products can be used to replace synthetic dyes (Malik et al., 2012) and flavours (Häusler & Munch, 1997). The cost of the technology for microbial pigment production on an industrial scale is still relatively high, and there is a need for developing low cost process for the production of the pigments that could replace the synthetic ones. Utilising cheaply available agro-food-industrial sidestreams as microbial substrates through solid-state fermentation may provide interesting opportunities.

In addition to pigments, microbes can also be used to produce natural food additives²¹. A specific example in wine production is utilisation of novel yeast protein extracts in white wines clarification and stabilization, instead of traditionally used animal and mineral based fining agents (Fernandes et al. 2015).

More traditional use of biotechnology involves food fermentation. Some traditional fermented foods have been reintroduced, or production started in new countries; e.g. cultured dairy products kefir²² and Skyr²³. Fermented dairy foods link with many consumer trends such as naturalness, gut health and high protein demand.

Functional ingredients production technologies

Functional ingredients (FIs) serve to introduce and improve quality attributes of food products such as nutritional properties, health benefits, and microbiological stability. Furthermore, they serve as the basis for formulation of functional foods (Besbes et al., 2012).

Currently in South Australia, functional food is mainly produced by adding functional ingredients into products or via 'free-from' products. Manufacturing and testing new functional ingredients is a

²¹ FDA, 2015,

<http://www.fda.gov/Food/IngredientsPackagingLabeling/GRAS/MicroorganismsMicrobialDerivedIngredients/default.htm>, accessed 2.9.2015.

²² PR Newswire, <http://www.prnewswire.com/news-releases/lifeway-foods-ramps-up-kefir-production-at-new-waukesha-facility-300131641.html>, accessed 27.8.2015.

²³ Skyr Iceland, <http://www.skyriceland.com/about-skyr>, accessed 27.8.2015.

specified technology domain that can provide opportunities for South Australia in the long term (five to 10 years).

Production of functional and bioactive ingredients typically involves the use of product-specific technologies. Various extraction technologies are used to isolate bioactive compounds from plant tissues, microbes, algae and microalgae. These include technologies such as (traditional) solvent extraction (including solid-liquid extraction), pressurised liquid extraction, subcritical fluid extraction, supercritical fluid extraction, pulsed electric field extraction, microwave-/ultrasonic-/enzyme assisted extraction, and instant controlled pressure drop-assisted extraction (Gil-Chavez et al., 2012; Azmir et al., 2013; Baiano, 2014).

Other technologies used in the production of bioactive ingredients include membrane technologies such as ultra- and nanofiltration (e.g. for the recovery of bioactive peptides and lactose and whey processing) (Salehi, 2014; Pabby et al., 2015); chromatographic and electrophoretic techniques (Aider et al., 2011).

3D printing and food

There is a lot of hype around additive manufacturing, and it is said that 3D food printing has the potential to revolutionise food production (Wiggers, 2015). 3D printing is generally stacking materials layer upon layer, based on an electronic blueprint on a computer.

3D food printing connects information and software to cooking. There are many challenges in 3D printing of foods, for example how to make food materials with the right consistency so that they will not stick in the printing machine, but at the same time retain their form after printing.

Another challenge is that often more than one material needs to be mixed to create a conceivably good dish (Huen, 2015a). At the moment 3D food printing is a niche technique, but it will affect the future of food – currently it is being explored, for example, as a unique and creative method to showcase food. However, in the coming 5-10 years, 3D printing of food potential may be realised in domains of nutrition, appearance and structure-texture design, flavour, and hybrid and personalised products.

For health-conscious consumers, 3D food printing could provide newer, better options for sweets, pastries, ice creams - or something entirely different. In the functional and specialised food industries, the biggest opportunities lie in the growing interest in on-demand customised food for people with special dietary needs, such as pregnant women, athletes or those who are managing health conditions, such as diabetes (Crawford, 2015).

3D food printing can help transform alternative ingredients like proteins from algae, beet leaves or insects, that are otherwise hard to process into tasty products with recognisable structures that are good not only for health, but also for the environment (TNO, 2015).

Innovative companies such as Phillips are interested in the combination of medicine and food. For patients who swallow daily medicine, a food printer would be an ideal solution (3ders, 2011). 3D printed food could also enable food service providers to more easily substitute vegan or vegetarian options for animal proteins or create novelty items with personalised messages or shapes.

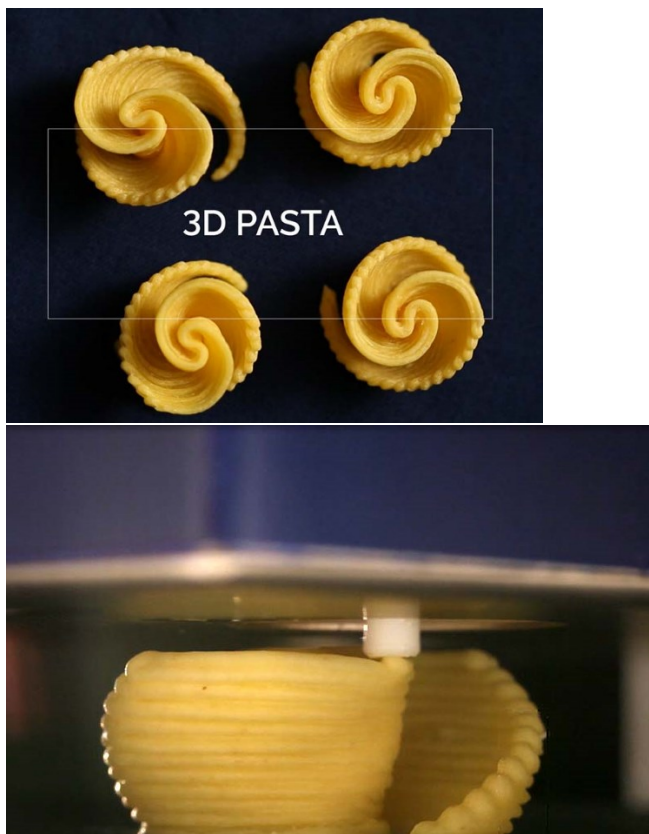
In the luxury food business, the biggest impacts are related, for example, to fine dining and restaurants. 3D food printing offers a huge degree of freedom in terms of design. This applies not only to the 3D shape but also to the composition, structure, texture as well as taste (TNO, 2015). The printer can also ensure that a personalised meal is made at exactly the right moment in the home or in a restaurant. This convenience can lead to flexible decentralised (local) production (TNO, 2015).

3D printer options

The Dutch research organisation TNO (2015) currently combines expertise in 3D printing technology with food science to create ultra-modern technology for the production of new food products, and argues that food printing is a new way to create food products with unique quality aspects that can be fully personalised. It can make tangible contributions to people's health and sustainable production in the future. For example, together with Barilla, TNO has developed a prototype pasta printer that is capable of printing 3D pasta shapes. In Australia, CSIRO provides Australian companies with access to additive manufacturing technologies, but currently only in non-food areas.

Within the medical sector, Australia has had a relatively long history in bioprinting research and development, for example the Queensland University of Technology (QUT) offers master's degrees in biofabrication. In South Australia, existing capabilities are more limited, but as the use of bioprinting will continue to expand as the technology matures (Desmond, 2014), the potential similarly grows. 3D printer expert Kjeld Van Bommel from TNO, who visited South Australia in April 2015, estimates that in five years there will be various food printers on the market that will make this technology accessible to many more businesses (Staight, 2015).

Figure 7. 3D Pasta Printing by TNO (2015), Photo courtesy of TNO.



3D printing has been around for more than 30 years, but lately it has been making more headlines in the food industry. From 3D Systems' educational partnership with The Culinary Institute of America (CIA), to the *Top Chef* TV programme, and to the launch of the

educational Culinary Lab, engineers, advertisers and even some Michelin Star chefs are emphasising 3D printing's potential effect on the food industry (Huen, 2015a).

Technology readiness of 3D printing

The technology readiness level of 3D printing varies. With some materials, such as plastics, the technology is widely implemented and ready for markets (TRL 9 and beyond). For differentiated materials such as food, more development is still required (TRL around 4-6; with very special materials such as meat TRL ca. 3).

The VTT researchers indicated that in approximately ten years, 3D printing will become a mainstay in restaurants, including fine dining. The most immediate effect can be seen in the food form, as chefs are able to create forms that would not be possible to make by hand, such as sculptural forms with complex curvature, intricate latticework or filigree, and even structural elements that can act as vessels or scaffolding for elaborately assembled dishes.

In summary, the opportunity horizon for 3D printing is wide. When the technology advances, anyone will be able to create new textures, new flavours, and new combinations like never before. 3D food printing also makes it possible to develop unique new products that cannot be made using other methods, or to change the formula, shape, structure or texture of existing products so that, for example, the taste experience remains the same yet the salt or sugar content is reduced (TNO, 2015).

Packaging

Active, intelligent and sustainable food packaging

The basic functions of traditional food packaging are protection, communication, convenience, and containment (Yam et al. 2005).

Packaging solutions targeted to the functional and luxury food domains have to fulfil the basic functions of convenience and containment while special emphasis on (brand) protection and communication. When it comes to luxury food packaging, the brand owners need to shift from 'designing for a product' towards 'creating an experience' to achieve a higher level of brand desire (Lacroix 2015), including polysensuality, aesthetics and signalling.

The main aim for functional foods packaging is to make the package communicate the benefits of the functional product to consumers. Many of the new innovations in intelligent, smart and active food packaging are aimed at enhancing the product safety and shelf life of the product, and at augmenting and securing the brand experience.

The packaging section of the Functional and Luxury Foods Project Literature Review highlighted several opportunities for South Australia including flexible plastic modified atmosphere packaging, smart labelling and informative design, sustainability, active packaging (i.e. laminated plastics with antioxidants), and luxury food packaging for brand enhancement. For this study, VTT focused on technologies enabling these opportunities.

Active packaging

Active food packaging is defined as a system which changes the condition of the packed food to extend shelf life or to improve safety or sensory properties, while maintaining the quality of food (Ahvenainen 2003). Examples of active food packaging include absorbing and scavenging systems, releasing systems, and systems where substances are grafted or immobilised onto the wall of the packaging (Lee & Rahman 2013).

Oxidation is one of the major contributors to food quality deterioration. It may facilitate microbial growth, off-flavour and off-odour development, colour changes, and lead to nutritional losses, therefore limiting the shelf life of food. There are several ways to reduce oxidation of food, such as barrier materials, oxygen scavengers, modified atmospheric packaging and antioxidative packaging. Modified atmospheric packaging (MAP) has a great importance in active packaging but as it is a rather mature technology, it is not discussed in detail here.

Currently, several oxygen scavenging or removing devices are commercially available, for example for packaged muscle-based (meat, fish, etc.) food systems including (Kerry 2013):

- Sachets: Ageless (Mitsubishi Gas Chemical Co.), ATCO (Emco Packaging Systems), FreshPax (Multisorb Technologies, Inc.), and Oxysorb (Pillsbury Co.)
- Labels: ATCO DE 10 (Emco Packaging Systems)
- Polymer-based oxygen scavenging films: Cryovac OS2000 (Cryovac Division, Sealed Air Corporation), ZERO 2 (developed by CSIRO, Division of Food Science Australia, in collaboration with VisyPak Food Packaging, Visy Industries, Melbourne)

With regard to *absorbing systems*, for example for muscle-based products (meat, fish), several companies manufacture drip-absorbent sheets or pads: for example Cryovac's Dri-Loc (Sealed Air Corporation), Peaksorb (Peakfresh South Australia), and Fresh-R-Pax (Maxwell Chase Technologies).

High carbon dioxide levels in MAP are desirable for foods such as meat, poultry, and seafood to inhibit surface microbial growth and to extend shelf life. There are active packaging approaches that combine MAP with oxygen absorbing and CO₂ releasing systems for fresh meats and fish; Ageless G (Mitsubishi Gas Chemical) and FreshPax (Multisorb Technologies) (Han 2013). According to Kerry (2013), carbon dioxide emitting sachets or labels, such as Verifrais package (SARL Codimer) and CO₂ Fresh Pads (CO₂ Technologies), can also be used alone to extend the shelf life of fresh meat or fish.

Antioxidative packaging systems

Antioxidative packaging systems have been developed to reduce or to stop oxidation. There are several commercially available synthetic antioxidants, such as butylated hydroxyanisole (BHA), butylated hydroxytoluene (BHT), and Irganox® which can be incorporated into food packaging polymers, such as in PET.

Due to consumers' concerns regarding synthetic antioxidants, the use of natural oxidants, such as tocopherol, ascorbic acid, curcumin, tyrosine, essential oils and plant extracts of barley husks, borage, cinnamon, citronella, clove, ginger, green tea, marigold, murta leaves, rosemary, oregano, and thyme, have also recently been studied, especially for their potential to be incorporated into packaging polymers and released to packaging contents in a controlled manner (Lee 2013).

Antimicrobial food packaging

Antimicrobial food packaging could present significant potential to reduce microbial growth in food systems and to extend product shelf life. However, Corrales et al. (2013) have noted that antimicrobial packages have had relatively little commercial success outside of Japan.

In Japan, the most common antimicrobial agent incorporated into plastics has been silver-substituted zeolite. Although antimicrobial packaging could extend food shelf life, there are some obstacles to overcome before commercialisation. These include regulatory

requirements, cost-to-benefit ratio, production capability, commercial viability, consumer acceptance, and sensory effects on food. Examples of commercial antimicrobial materials include (Corrales et al. 2013):

- concentrates; e.g. Agion, (Agion Technologies LLC)
- extracts; e.g. Nisaplin (Integrated Ingredients)
- films; e.g. MicroGARD (DuPont, Wilmington, DE)

Antimicrobial packaging systems are intended to provide controlled release of antimicrobials. The novel developments in antimicrobial food packaging are related to advances in nanotechnology and micro- and nanoencapsulation. Corrales et al. (2013) foresee that food biopolymers and hydrocolloids could be promising materials to produce micro- and nano-scaled carriers of bioactive compounds. Other biopreservation strategies, such as probiotics, have been suggested to expand the possibilities for antimicrobial packages (Corrales et al. 2013).

Intelligent packaging

Intelligent packaging is a system capable of carrying out intelligent functions to facilitate decision making, to extend shelf life, and to enhance safety. Examples of these functions include detecting, sensing, recording, tracing, communicating, and applying scientific logic (Yam et al. 2005). Three main intelligent packaging components include 1) indicators, 2) sensors, and 3) barcodes and indication tags, (e.g. NFC, RFID) (Yam et al. 2005, Vanderroost et al. 2014).

Food packaging indicators

Food packaging indicators provide visual and qualitative (or semi-qualitative) information about the packaged food (Vanderroost et al. 2014). The main mechanisms for detection are a colour change, an increase in colour intensity, or diffusion of a dye along a straight path (Kerry et al. 2006). Due to intensive research in this field there are several s for food packaging, as shown in Table 9.

Table 9. Examples of commercially available indicators for food packaging (Vanderroost et al. 2014, Steeman 2015).

Indicator type	Company or product name	Description
Gas	Novas Insignia Technologies O ₂ Sense™	A special pigment for products packed in a modified atmosphere (MAP) plastic packaging showing damaged packages. Visual indicator based on colour change for sealed food packaging. Indicates breach of integrity in the package.
Freshness	FreshTag® RipeSense®	Indicator based on colour change which detects volatile amines (e.g. in seafood). Indicator based on colour change which indicates the ripeness of fruits.
Time-Temperature	3M MonitorMark, Timestrip Complete, Fresh-Check, CheckPoint, CoolVu Food, Innolabel Timestrip, K1 /Cryopak	E.g. indicating how long a product is within a certain temperature range. CheckPoint indicator is adapted to toxin formation of Clostridium botulinum in a certain temperature range (for sea food). Cryopak's K1 is an electronic temperature indicator.
Thermochromic ink	LCR Hallcrest; Chromatic Technologies Inc; Matsui International Company, Inc.	Temperature dependent reversible colour change.

Food packaging sensors

Unlike indicators, food packaging sensors are able to provide quantitative information (for example on concentration, humidity, pH, temperature, light exposure) and can store the measurement data and time.

Chemical sensors have recently received increasing attention for monitoring food quality and package integrity. One of the potential applications is the use of volatile organic compounds (VOC) and gases (H₂, CO, NO₂, O₂, H₂S, NH₃, CO₂, CH₄) to detect food spoilage and package leakage in modified atmosphere packaging (Vanderroost et al. 2014).

Unlike food packaging indicators, a large scale market entry for intelligent packaging sensors is still in the future. The barriers to apply sensors on a large scale include: current large size and rigidity, high development and production costs, insufficient robustness and sensitivity, strict legislation; and food safety considerations (Vanderroost et al. 2014).

Research in this field has been advancing rapidly and there are several technologies, such as printed electronics, carbon nanotechnology, silicon photonics, and biotechnology that may enable the development of better chemical sensors. Data exchange technologies (RFID, NCF) combined with sensor and indicator technologies is a promising future concept for intelligent food packaging. There are some sensor-enabled RFID and NCF tags commercially available, thus further development is needed for large scale commercialisation (Vanderroost et al. 2014, Thinfilm 2015).

Automatic Identification technologies

Automatic Identification (Auto ID) technologies comprise radio frequency identification (RFID), barcodes, Quick-Response (QR) codes, magnetic, conductive inks and the like. Automatic identification technologies are typically applied for identification, automatisation, anti-tamper and anti-counterfeit purposes (Vanderroost et al. 2014).

RFID technology is widely used in various applications in the agri-food sector. Applications such as the traceability of fresh produce and food products, cold chain monitoring, shelf life prediction, quality monitoring, and supply chain management have been reported (see e.g. Kumari et al. 2015). Luxury food brand protection (such as security and anti-counterfeit) is one of the key applications for RFID technologies.

A Norwegian printed electronics company, Thin Film Electronics, has recently launched a printed electronics RFID tag based on near-field communication (NFC) technology, aimed at product security and consumer engagement, shown in Figure 8. According to Plimmer (2013), by including NFC-enabled tags in their packaging and labels, brand owners can provide valuable information to their customers, build brand loyalty and enhance the brand experience.

Figure 8. Commercialised intelligent RFID- based packaging system for wine (Thinfilm, 2015 b, Thinfilm, 2015c). Photo courtesy of Thin Film Electronics ASA.

Case: Smart Wine Bottle

Thinfilm and G World have launched an anti-counterfeit Smart Wine Bottle and will carry out a field trial in collaboration with Ferngrove Wine Group, a Chinese-owned, Western Australia premium wine company.



Source: www.thinfilm.no

Thin Film OpenSense™

- Identifiable NFC tags which can be integrated into consumables and their packaging, e.g. wine
- Tag senses the “sealed” or “opened” state of the product or package and wirelessly transmits status information along with the tag’s unique identifier
- Interactive mobile content can be customized based on sealed/opened status
- Passive tag – requires no battery.
- Based on printed electronics

Auto ID technology has progressed from bar codes to QR codes and to digital watermarks. Digital watermarking as such is not a new technology, but the use of embedded machine-readable images within the graphics application in packaging and labels sector is still emerging. The technology allows brands to keep their design clean (Steeman, 2015).

Besides brand enhancement and protection, this technology can be used for consumer engagement. Availability of apps for smart phones that recognise digital watermarks and are able to link commands to multi-media internet content has contributed to the introduction of digital watermarking technologies to packaging (Plimmer, 2013).

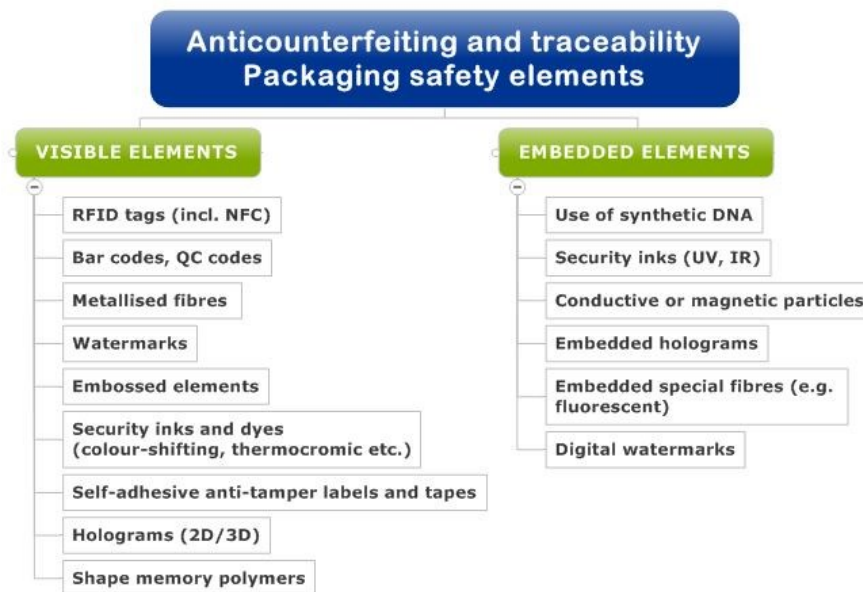
Touchcode is a new concept, where brand protection and enhancement is based on a conductive ink signature embedded in packaging, labels and other objects that a smartphone or other sensing device can detect through capacitive touch, without need for camera imaging (Steeman 2015).

Augmented reality

Augmented reality (AR) is another type of interactive tool that enables brand owners to interact with consumers on their smart phones and mobile devices. It also allows adding a digital component to static packaging. In recent years some of the large food companies, such as Nestlé, Kraft Foods, Kellogg’s, General Mills, and Mondēlez International have integrated augmented reality into their brands (Plimmer, 2013; Johnson, 2013). Augmented reality can also be used as an enabler in B2B applications. For example Tyler Packaging offers AR apps to visualise their packaging designs, creating a short-cut from design to manufacturing (Tyler Packaging, 2015).

Intelligent packaging solutions and applications have practical implications for anti-counterfeiting and traceability which are both critical elements for export, especially into China. Figure 9 summarises the anti-counterfeiting and traceability techniques.

Figure 9. Anti-counterfeiting and traceability techniques.



Biopackaging solutions

Sustainability is seen as one of the key drivers in packaging development, along with economic and demographic drivers. According to Tetra Pak’s director of consumer intelligence, Michela Vallalta,

“...sustainable packaging is effective at alleviating consumer guilt when it communicates its benefits to consumers beyond the recycling symbol—an imperative that plays to the overarching trend of selling provenance along with the product” (Muratoglu 2015).

Sustainability has gained importance in functional food packaging, and it is seen as an important driver for functional food purchasing decisions (e.g. Cosgrove, 2007).

Sustainability can be improved by lightweighted, bio-based materials, such as bioplastics and fibre-based packaging. The main categories of bioplastics include so called drop-in chemicals like bio-PET, -PE, and -PP (e.g. Braskem /Coca-Cola Plantbottle), other biopolymers, such as polylactic acid (PLA), polydyroxyalkanoates (PHA), and starch-based bioplastics.

The main market for bioplastics is in the category of short shelf life products, such as fresh fruits and vegetables, and long shelf life products, such as pasta and potato chips (Peelman et al., 2013). Use of bioplastics in luxury chocolate packaging has also been reported (e.g. Plantic, 2008).

Convenient food packaging solutions

According to Maratoglu (2015), consumers desire convenient food packaging:

“...packaging that is appropriately sized, and easy to grip and hold, open and close, is the difference between frustration and a return customer. Additionally, packaging aimed at

seniors should be mindful of aging eyes, with larger print and clear and intuitive markings indicating openings”.

Convenience is seen to be an important driver for food packaging innovation (e.g. Bertrand Connolly, 2014). When targeting a highly safety-conscious export market, anti-tampering requirements and packaging convenience needs to be balanced. There are several commercially available easy-to-open and resealable food package solutions currently available. In Australia, NSW Health has published both design guidelines and a database of accessible food packaging solutions, although the target group in this case is hospital patients and elderly people at home (NSW Health no year; ACI, 2014).

Technology providers

Examples of global technology providers in the food area include companies such as GEA, Bühler, Alfa Laval, Krones and Tetra Laval (DeLaval).

GEA produces and maintains a multitude of industrial food processing equipment for many products, such as coffee and tea, food ingredients, fruit and vegetables, oil, starch and sweeteners, confectionery and bakeries, frozen food, liquid food, and poultry, meat and seafood. They provide technologies for distillation and fermentation, drying, filling and packaging, and separation and particle processing. They also provide holistic solutions for livestock farming and the dairy industry. In addition to processing equipment, they offer a range of services including modernisation, (preventive) maintenance, training and upgrades²⁴. In Australia, GEA has offices in Victoria.

Bühler also operates in a range of different food processing areas. Bühler is especially famous for its expertise in grain processing (dehulling, cleaning, sorting, milling, grinding, flaking, sifting and grading) and also provide equipment and services for pelleting, extrusion, coating, packaging etc. Bühler also provides a wide range of services from maintenance to consulting, analytical laboratories, a technology centre and testing facilities, and financial services²⁵. Bühler Australia operates from Melbourne.

Alfa Laval provide equipment for food and pet food industries. These include fluid handling (mixing, pumping, tanks), heat transfer systems (boilers, burners, heaters, heat exchangers, heating, ventilating and air conditioning (HVAC) solutions), separation (filters, separators, strainers, membranes), and process solutions (for example for dairy, starch, beverage, plant oil and protein processing). Like other big players in food technology they also have an extensive service portfolio²⁶. Alfa Laval has service centres in Victoria, Western Australia, Queensland and New South Wales.

Krones provides plant engineering, process, filling and packaging technologies, intralogistics and IT solutions for the food industry. A range of process technological solutions are provided for beer, soft drink, juice water, milk, and spirits production²⁷. Krones Pacific is located in Sydney.

Tetra Laval, well known for its TetraPak liquid food packaging, also provides technology for dairy farmers. The DeLaval branch of Tetra Laval offers automatic and conventional milking systems, cooling and feeding systems, effluent and housing systems, and farm management support systems. DeLaval provides a wide range of services and consumables in the areas of liners and tubes, farm

²⁴ GEA, <http://www.gea.com/global/en/company/index.jsp>, accessed 4.9.2015.

²⁵ Bühler, <http://www.buhlergroup.com/global/en/process-technologies.htm#.VegOIG3yWpo>, accessed 4.9.2015.

²⁶ Alfa Laval, <http://www.alfalaval.com/about-us/our-company/>, 4.9.2015.

²⁷ Krones, <http://www.krones.com/en/index.php>, accessed 4.9.2015.

supplies, services and original parts, milk quality and animal health²⁸. DeLaval's offices are located in Victoria.

Smaller technology providers active in South Australia are typically focused on primary production, engineering and irrigation, but not on food processing. Some other companies with local presence, such as Food Processing Equipment (FPE), are resellers of food processing equipment from other manufacturers.

²⁸ Tetra Laval, <http://www.tetralaval.com/>, accessed 4.9.2015.

Roadmaps for the South Australian Food Industry

Phase 2 of the project explored preliminary roadmaps for functional and luxury foods [for more information on this technique and how VTT have applied it in this project, see also Methodology, above, and Building roadmaps, below].

Certain elements, such as some drivers and trends, affect the food and beverage industry as a whole and thus are represented in all roadmaps. Other elements are tied more closely only to functional foods or only to the luxury domain. Roadmaps are also structured differently following the different industry structures.

The roadmap for functional foods emphasised the role of enabling technologies and the process leading towards better functional products – the main focus is on adding functional ingredients to products. For luxury food VTT outlined six different roadmaps based on identified product opportunities – the main focus is on maintaining the luxury quality throughout the process. Packaging solutions and technologies complement the roadmaps.

Roadmap structures

There are basically three ways to build roadmaps. The first way is future-oriented, that is, to define a desired vision and the related future targets, and start to extrapolate steps backwards from the vision towards the present stage. This method is known as backcasting. The second method is present-oriented. This approach defines the present state and start to build steps, finally reaching the long-term state or a vision. The third method is a hybrid between the future-oriented and present-oriented methods. Hybridisation allows the roadmapping process to escape process lock-ins that can result from too rigid a process. VTT used the hybridisation method for this study.

The structure of a general roadmap is presented in Figure 10, below. This sample roadmap depicts the impacts of the objects under scrutiny: for example, a new industrial practice and emerging service business at an overall systemic level. In a strategy roadmap, the system could refer to an entity consisting of different actors, such as the actors in the food value chain and the regulatory context of the value chain, or the system could also refer to a convergence of sectors such as food and tourism.

The key purpose of a roadmap is to connect the development of technologies and innovations to a wider societal sphere. The aim is to endorse the formation of policy conclusions based on an in-depth understanding of the technological developments and their socio-economic frameworks.

A road map will have a series of roadmap ‘levels’ depicted as rows. The first roadmap level in a roadmap is known as drivers. This level depicts the key drivers and the so-called ‘grand challenges’ that are assessed as the most important factors structuring the roadmap topic. The second level is markets and market changes. These two levels can be presented together, as has been done in this report. The third level is products and applications, with an emphasis particularly on emerging solutions. This level provides critical contextual setting for the policies. The fourth level is that of key enablers, with a primary focus on technologies that enable the industry development. Roadmaps can also have additional levels such as actors and actions, which VTT included in the roadmaps in this project (Figure 11).

An important stage in the roadmapping process is the embedding of results into the local industry context, in this case the South Australian food producing value network, and the related innovation and policy system.

The preliminary roadmaps were finalised as part of Phase 3 of the project by the the construction of short term pathways for the industry (pathways with a 3 to 5 year time horizon) and more long term

concise pathways (beyond a 5 year time horizon). These are shown in detail in the 'Pathways for Future Growth' sections in this Reference Report.

Figure 10. Basic Roadmap Structure.

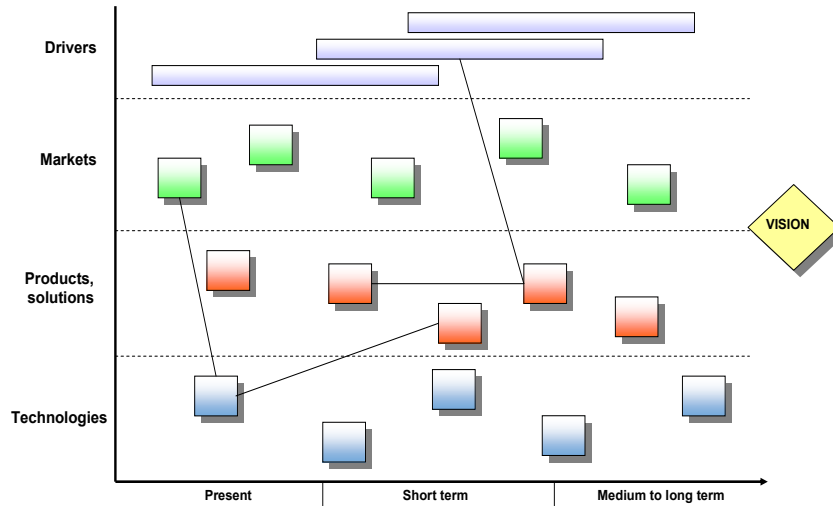
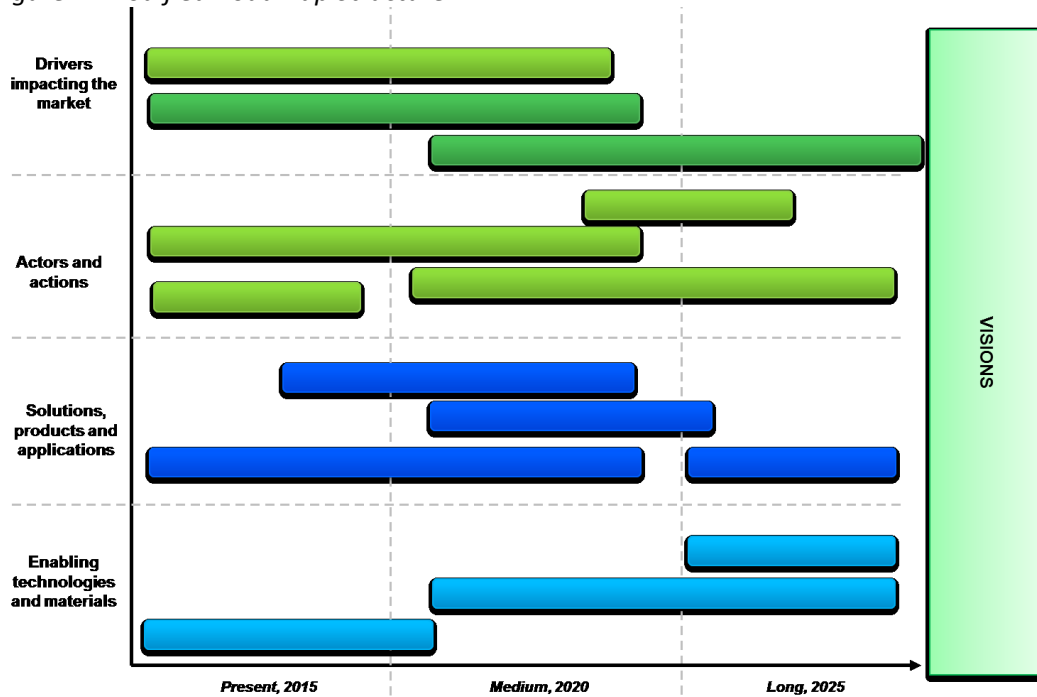


Figure 1. Modified Roadmap Structure



Towards an Innovation Business Ecosystem

Innovating through functional and luxury products can bring new business opportunities to the South Australian food industry, but greater value can emerge from activities combining value chain and innovation ecosystem thinking (see e.g. Hekkert et al. 2007; Nambisan & Baron, 2013).

Having a resilient, innovative economy in South Australia is integral to the core regional goals as outlined by PIRSA (2013b). The ecosystem approach emphasises the utilisation of local knowledge and competencies. The definitions used for innovation ecosystems and hubs often reflect the models of regional innovation systems such as the Triple Helix (Etzkowitz & Leydesdorff, 2000) or learning regions, but the logic behind constructing innovation systems varies from the localised, path-dependent inter-firm learning processes to regionalised national innovation systems, where research and development, and scientific research have taken a much more prominent position (Asheim & Coenen, 2005). However, all ideal models and types emphasise strong regional networking. Another and more demanding criterion is the connection to global value networks and the ability to create value in the global economy (Prahalad & Krishnan, 2008).

The term innovation ecosystem generally refers to a dynamic, interactive network that breeds innovation (Oksanen & Hautamäki, 2014). In practice, the term can refer to local hubs, global networks, or technology platforms. It also has roots in industry and business clusters (Porter, 1998; Estrin, 2008).

Figure 12: Actor mapping in an innovation ecosystem.



Similarly, clusters ecosystems are about collaboration, not just locating firms in the same place (see *The Economist*, 2011). In South Australia, VTT saw seeds of an innovation ecosystem and ecosystem thinking, when local actors work together to produce solutions to different challenges. In the interviews, many respondents stated that the most important support and help they have received is from more experienced businesses. Learning from more experienced businesses and interest in mentoring possibilities highlight potential ecosystem benefits.

The main features of the ecosystem include a symbiotic combination of large established companies (incumbents) and new innovative start-ups, specialisation of and cooperation among companies, service companies specialised in the needs of local companies, a sufficient local market for new innovative products, top-level universities and research institutions, sufficient financing, and global networking (e.g. Kenney, 2000).

Figure 12 reflects the South Australian food business and innovation ecosystem and its key actors, and the mapped actors are presented as a part of the value creation system. The presentation of the key elements and actors follows the business and innovation ecosystem approach, which is useful in anticipating the future developments of different industrial sectors (Andersen et al. 2014).

The food innovation ecosystem may start with how South Australian actors internally structure their processes to deliver the products and services, with the value network that consists of partners, and ultimately, with the stakeholders such as governments, affiliated industry players such as Food South Australia with 270 members (2015), and related industry segments such as tourism, packaging, transport or agriculture. In addition, in the ecosystem approach the supporting services are seen as very important.

In the centre of Figure 12 there are the food companies. South Australian food value chains incorporate a number of types of companies, such as incumbent corporates with large scale capital investments in product development, co-operative entities providing core services to producers to enable products to be transformed into a marketable state, and lots of small and medium size companies manufacturing and developing new products, or supporting other companies to take the various products to market.

The value chain actors and ecosystem elements surround the companies and form the dynamic, interactive network that breeds value adding and innovation. Successful innovation requires a special ecosystem that includes top level universities and research institutions, sufficient financing and a local market, a skilled labour force, and specialisation as well as cooperation among companies and global networking (Oksanen & Hautamäki, 2014).

This kind of ecosystem requires the development of world class innovation hubs where a high quality of life and excellent business possibilities are combined. It is part of regional development, which is shifting towards large clusters, cities, and metropolitan areas, while most of the value creation, research and development activities, and patenting, happen in the global-level innovation hubs.

Such a hub can be built through deep cooperation among local and national actors. However, even if innovation tends to cluster in certain sectors or areas which grow, in reality relatively few regions have exhibited this kind of renewal capability (Etzkowitz & Klofsten, 2005). For smaller regions and urban areas, it is essential to identify and support the full innovation potential of the area, especially in times of structural changes such as the ceasing of the Australian automotive manufacturing industry.

The innovation ecosystem can be evaluated by analysing the current status of the public policy driven activities, public-private partnerships, and company and forum driven activities in comparison to global best practice environments (see e.g. Launonen & Viitanen, 2011). The overall starting point for South Australia is quite good, with a lot of ecosystem assets and strengths that need to be fully recognised and utilised – food is among the already identified industries that have a lot of potential.

Table 10. Examples of supporting actors in SA food business ecosystem.

Supporting organisations			
Research, innovation and food technology	Market intelligence, branding , exporting etc.	Business & Finance	Industry associations and others
Flinders University, the University of Adelaide, the University of South Australia, Torrens University Australia, Bread & Butter Food, Technology, IMVS, Food, Processing Specialists, Medvet, SJC Food Processing Consultant, South Australian Laboratory Service, South Australian Research and Development Institute (SARDI), Advanced Manufacturing Focus, Food Processing Specialists, Graycorp, Independent Institute of Food Processing.	Baker Marketing, Feeney Marketing, Makrid Priess & Associates, SOS Group, The Write Alternative, KS Design Studio, Detour Design, Austrade, DSD and other local and national supporters and market intelligence providers, Council for International Trade and Commerce SA.	Hayes Knight, Mayfair Finance, National Australia Bank, Baker Marketing, Makrid Preiss and Associates, Feeney Marketing, HACCPtown, the Government of South Australia, Australian Tax Office business help, Business Licence Information (BLIS), IP Australia.	Food South Australia, SAWIA, PPSA, Dairy SA, SAOGA, SANFA, SA Beef, SA Poultry, SA Tourism, and a variety of other smaller, bottom-up associations such as Cheese SA by Woodside Cheese, Berry Growers SA, Fleurieu Peninsula Food, Organic & BioDynamic Alliance, Rare Fruit Society etc., national organisations such as Wine Australia, Australian Olive Association, NASAA.

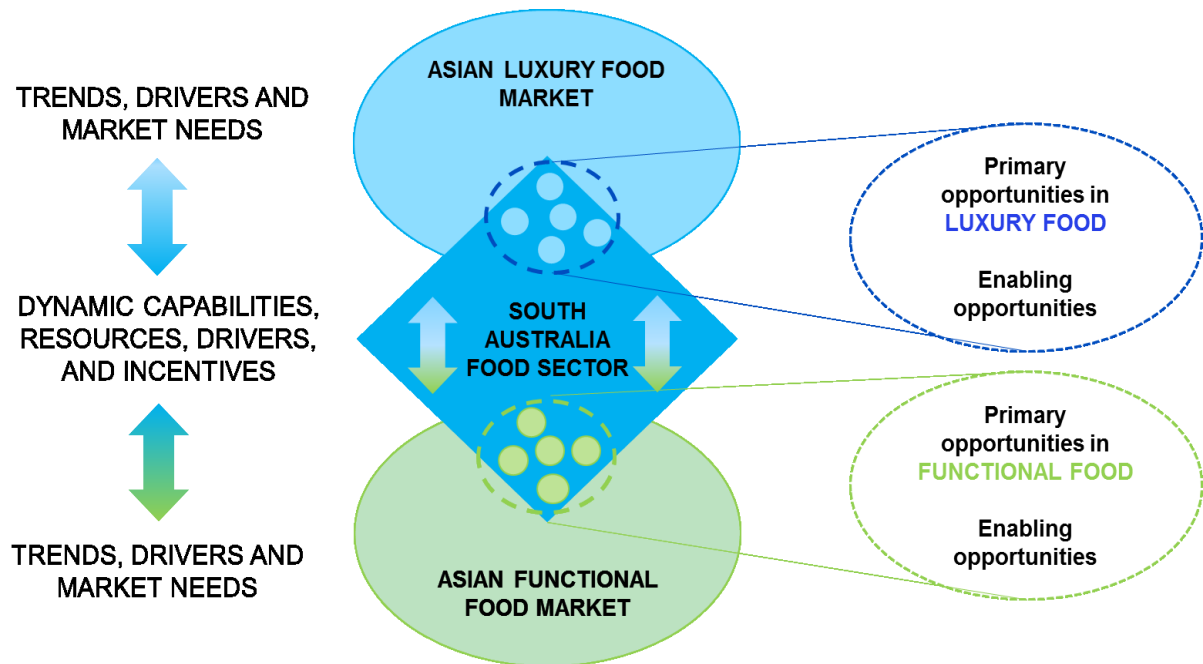
The opportunity landscape

The term ‘opportunity landscape’ refers to information available to decision-makers in order to anticipate future developments, to act accordingly, and to aid SMEs in particular in keeping up to date with change (see e.g. Savioz & Blum, 2002). It is supported by the elements of PESTLE analysis (P for Political, E for Economic, S for Socio-cultural, T for Technological, L for Legal and E for Environmental), which is an orienteering tool and a framework for understanding the markets from many different angles. The outcome of PESTLE is an understanding of the macro level forces surrounding the industry (see also Table 5).

During the research phase of this project, a review of the current situation showed several recurring themes driving the future value adding activities of the South Australian food industry. The opportunity landscape is presented following these thematic areas.

The opportunity lists presented are neither exhaustive nor exclusive but, depending on the case, some aspects will prove to be more important, while others will be less important. Considering the different opportunities allows for clear implications for new value formation. Figure 13 portrays the opportunity landscape as a whole.

Figure 13. The opportunity landscape for the South Australian food industry.



The identified opportunities for the food industry to add value to the luxury and functional food value chains have been divided into primary opportunities (Figure 14), and enabling opportunities (Figure 15). The primary opportunities are directly related to food, ingredients, origin, image and experience that functional and luxury food from South Australia could create. More information on the functional and luxury products can be found in the Functional and Luxury Project Literature Review.

Figure 14. Primary opportunities in luxury and functional food value chains.

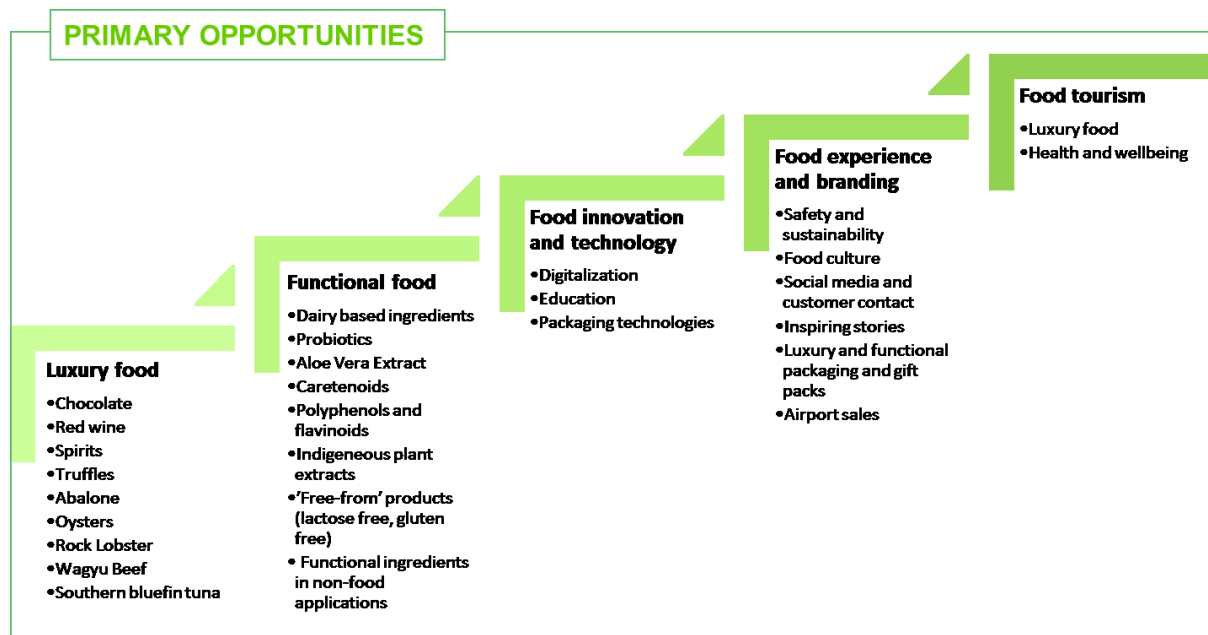
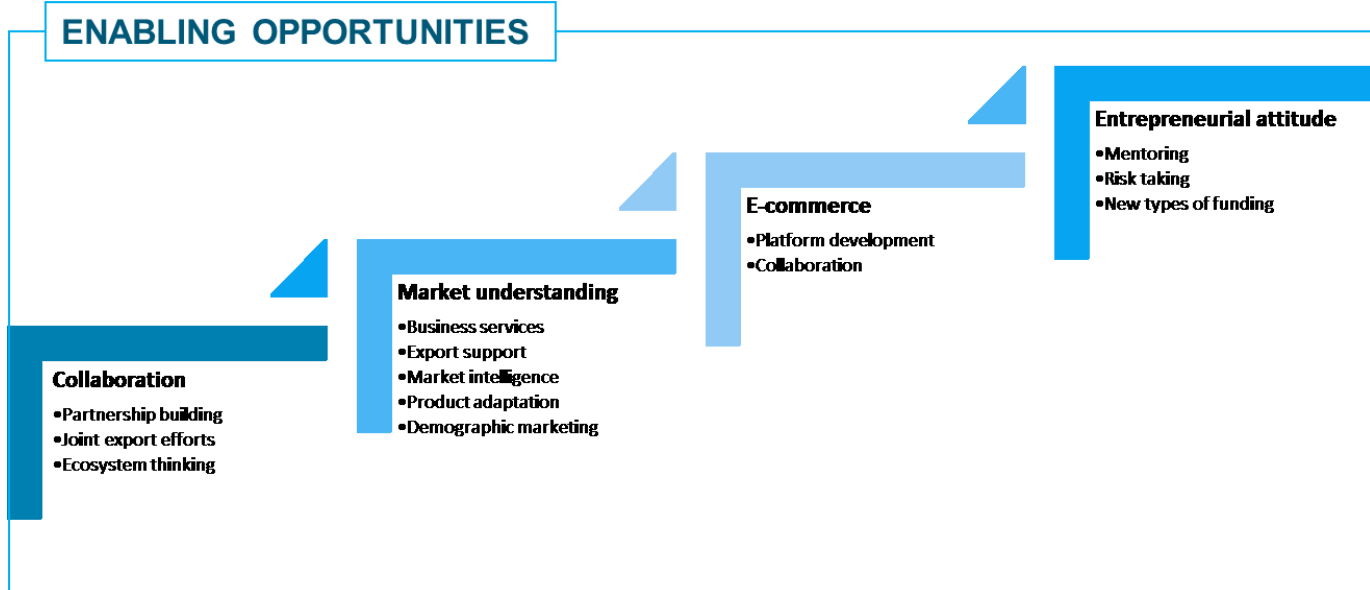


Figure 15. Enabling opportunities for adding value to the luxury and functional food value chains.



The primary opportunities focus on recognition and utilisation of the specialities and resources of the region, and development of products by matching South Australian capabilities with the needs in the target markets. The enabling opportunities are seen as opportunities that support the value adding actions and the food industry development, and strengthen the capabilities of the South Australian food companies.

Food innovation and technology

The interviews undertaken for this project revealed that many food companies in South Australia are interested in benefitting more from the latest food technology development and innovation. However, even the leading companies stressed that more support is needed in order to fully utilise new technology and innovations related to food production.

Generally, companies are somewhat interested in increasing the amount of research and development, product development and technology, and in utilising outside research and development knowledge, but only when feasible. Both limited funds and limited local know-how restrict the spreading of new food technologies and innovations.

There is some food technology education in the local universities (both University of South Australia and University of Adelaide have combined food and nutrition sciences programs at the Bachelor level, but not at higher levels), and closer links should be fostered with national and international research providers. For example, the Australian Research Council (ARC) has awarded more funding to promote industry-university linkages and is currently running an Industrial Transformation Research Program (ITRP) in which food and agriculture is one of the chosen topics for the year 2015, with a special focus on areas such as dairy innovation, lock lobsters, value chains and ASEAN markets (see ARC, <http://www.arc.gov.au/>).

More research is needed, for example in utilising science and technology in nutrition, in tailoring the food matrix with enzymes and microbes, and in improving the healthiness of foods. In addition, innovations in minimal processing, minimal waste, and functional foods can save on both costs and resources.

The interviews indicated that there is a need to increase the absorptive capacity of food value chain actors. Absorptive capacity is seen as the ability of a company to recognise the value of new,

external information, assimilate it, and apply it to commercial ends to adapt new technologies (Cohen & Levithal, 1990). A long term approach in increasing the absorptive capacity of local companies could be achieved by investing in regional food technology education, and enhancing the assimilation of the latest food technology and innovation.

With the help of food innovation and technology, different groups with special nutritional needs can be better served. For example, the aging population is one of the quickest growing consumer groups all over the world. This progression is especially strong in Japan where the proportion of seniors in the population is the greatest among the OECD countries (OECD, 2014).

The amount of food eaten often diminishes along with aging, but there should be enough energy, protein, fibre and vitamins (especially vitamin D) even in small food portions. Enriching the nutrient content of a meal without increasing the portion size can be done, for example, by fortifying meals with good quality fibres (e.g. pea or oat fibre), protein concentrates and fats (Heiniö et al., 2014).

Seniors also consider the attributes of good food packaging to include being environmentally friendly and easy to open without tools (Heiniö et al., 2014); here, packaging development and innovation play crucial roles. Food innovation can also be social and inclusive; in South Australia, initiatives to improve the food served in regional aged care facilities has already proved successful (see the Maggie Beer Foundation, 2015).

Packaging

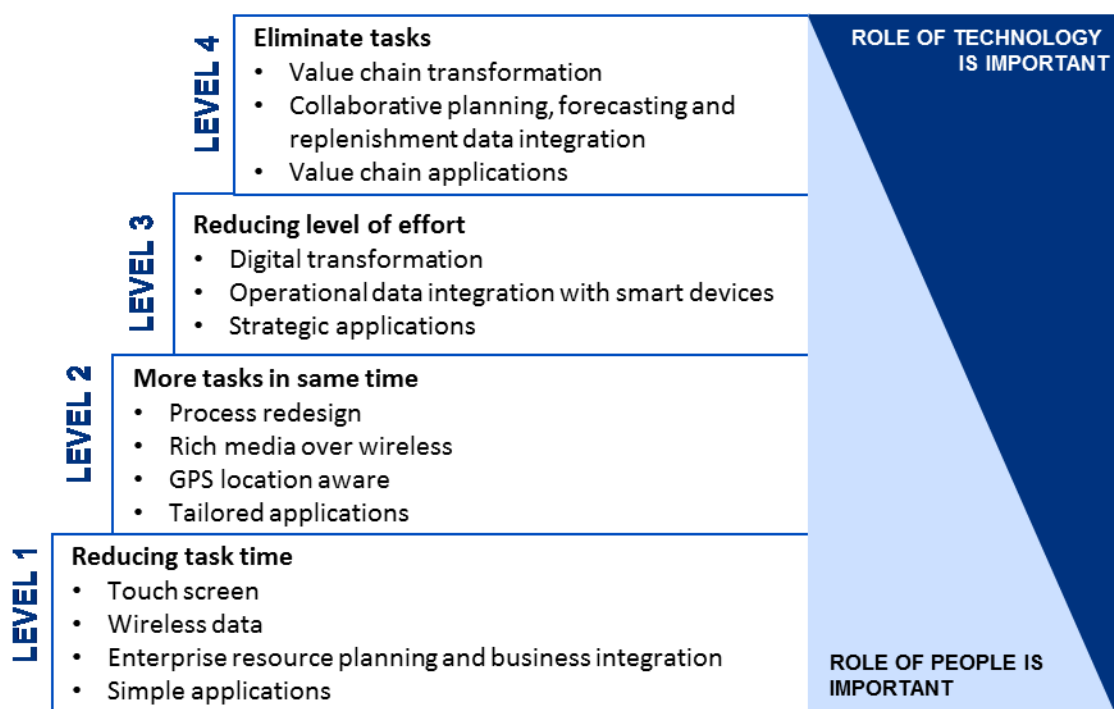
Packaging is another field where technology and innovation are identified. The current state of the local packaging providers could be improved with new approaches to packaging.

A number of technologies are potentially available to address the food industry needs, including flexible modified atmospheric packaging (MAP), vacuum skin packaging, smart packaging and labelling, and sustainable packaging. Food packaging innovation targets extending product shelf life, enhancing consumer convenience, and ensuring product safety and sustainability. The VTT researchers argued that tamper-evident and tamper-resistant packaging innovations can provide a means to combat counterfeit products and unauthorised refills, and protect luxury food brand image in Asian markets. Sustainable packaging – meaning the development and use of packaging which results in improved sustainability – is another packaging trend to be noted; it suits well both the functional and luxury food production.

Digitalisation

Digitalisation is likely to drive food industry (see e.g. Scott-Thomas, 2011). It will affect the whole value chain, starting from raw materials, product development, processing, packaging, logistics, distribution, marketing and sales (see also Ch. 3.4.8 E-commerce). Digitalisation helps to manage the enterprise more efficiently (e.g. PwC, 2011) (Figure 16), it creates market opportunities for food companies by connecting them with digitally empowered customers and by improving understanding of needs of consumers in emerging markets, and enables value chain transformation.

Figure 16. Productivity improvements enabled by digitalisation (Adapted from PwC, 2011).



NOTE: More technology and innovation-related opportunities and information (e.g. 3D printing and biotechnologies) were identified and assessed during the strategic roadmapping exercise in Phase 2 of the project and are covered elsewhere in this Reference Report.

Branding and food experience

Branding is generally critical in luxury markets, with brand (either of a product or of a broader location) being critical to the symbolic aspects of luxury food consumption. As an interesting weak signal, there may be a branding opportunity for South Australia to position itself as the functional and/or luxury foods region for Asia, given that this kind of branding is not extensively undertaken by any region currently.

Many regional branding activities are done with a category focus, such as in Bordeaux in France. Luxury foods are generally categorised as food that are scarce, painstakingly prepared, and of consistently high quality. These foods are often endorsed by high-end clientele and restaurants in different geographies that follow cultural cues, ethnicity, purchasing power parity, tastes, indulgence, habits and historical evolution of tastes of inhabitants of a particular country and have high perceived value (Som & Blanckaert, 2015).

Health and wellness gifts related to functional food and beverages, and luxury food gifts are a growing trend in Asia. The Literature Review has identified gift packs as a product opportunity, which resonates well with branding. South Australian producers could package and sell functional food containing health and wellness packs with the ‘made in Australia’ label to indicate quality, food safety and Australia’s history of medicinal plant use which is similar to that of China. However, a clear differentiation between packaging for functional food and luxury food gifts and brands is required.

Consumers of luxury products have higher disposable incomes, allowing them to spend relatively freely on non-essential food items. For example, growth of chocolate demand (fuelled by emerging consumer interest across Asia primarily China, Japan and India) is very high, especially in gifting, which promises growth in this higher margin sector.

Airport sales are another rapidly growing channel for luxury foods. As documented in the Functional and Luxury Project Literature Review, it is considered that there is an opportunity for South Australian producers to further exploit this channel, for example via South Australian luxury food outlets at major international airports.

PIRSA actively promotes the South Australian food and wine industry. The Premium Food and Wine from Clean Environment Strategy (see PIRSA, 2015), together with South Australia's brand, is a good starting point for further promoting safe and sustainable luxury and functional food produced in South Australia. Opportunities can be exploited via differentiation and via further development of the South Australian brand towards designed and desired food experiences.

The luxury market has been noted as transforming from its traditional conspicuous consumption model to a new experiential luxury model (Wiedmann et al., 2007). For example, Bulgari and Baccarat are pursuing new business opportunities in the hospitality sector by opening hotels in locations such as Milan, London, New York and Bali, thus tapping into the growing experiential luxury market (Som and Pape, 2015).

Experienced entrepreneurs also create value through experiences and meanings related to food and beverages. The importance of experience and the meaning of products and services is widely recognised and examined within design thinking studies (see e.g. Verganti, 2009). The meaning components include elements such as economics (price, brand), environment (durability, sustainability), societal aspects (communality, ethical values), usability (quality, complexity) and personal aspects (experience, usefulness, life management), which convey new reasons for customers to use and buy things.

Entrepreneurs, researchers, technologists and artists are all interested in understanding and interpreting possible future environments and habits. In practice, food producers may integrate social and psychological knowledge into their expertise, or firms can integrate anthropologists or artists into their teams.

It is also argued that the most valued experience building requires understanding of societal, cultural and technological changes and their implications (Hautamäki & Oksanen, 2015). The required knowledge about the dynamics of social and cultural models is often a tacit knowledge; it cannot be easily found in books or reports or foresighted by building forward-looking scenarios. This dynamic consists of numerous unpredictable interactions between different actors (companies, users, designers, media, schools, researchers, artists and so on). In this context, food innovators need to utilise the notion that they are also in a network that constantly reflects different meanings from other industries, societal groups and individuals.

Food tourism

Food tourism is closely linked to the branding and food experience examined above. Food tourism is a growing market, comprising travellers seeking the authenticity of the places they visit through food.

The existing Eat Local SA initiative for consumers and premium wine and food tours serve as a good basis for further development of South Australian food tourism and promotion of South Australia as the luxury food region. Enhanced promotion of South Australia as a luxury food destination could expand the inbound tourism opportunity. The romanticism of having visited vineyards, cheese production facilities, and mushroom growing areas is an important part in the food experience for travellers. For example, the Central Market in Adelaide is a food tourism asset visited by hundreds of thousands of tourists every year; the facilitation of capabilities of different regions of South Australia could be similarly strengthened. Adelaide Farmers' Market at the Wayville Showgrounds has been

voted the best farmer's market in Australia by Australian Traveller and the Barossa Farmer's Market is also in the top-10²⁹.

South Australia has potential to expand its positioning as a luxury food tourism location, but this requires a range of initiatives, including unified definitions for products, stronger understanding and utilisation of the cultural heritage, co-operation of industry stakeholders (producers, hotels, travel agents etc.), and ensuring the sustainability and the maintenance of high quality services and products.

A potential option could be to enhance the existing Wine Centre (and other centres) into an expanded luxury food centre, with a goal of developing South Australia as a luxury food region. In addition, targeted marketing efforts, including activities in social media (e.g. food blogs and food travel blogs), could bring visibility, facilitate brand enhancement, and promote South Australian luxury food as desired experiences.

Collaboration

PIRSA and Food South Australia have been identified as key players for promoting collaboration and networking within South Australian food industry actors. Currently there exists some 'pockets' of collaboration, and generally the companies and other industry actors are well networked, although small companies could benefit from more collaboration in export, marketing activities, brand building, and promotion. However, without systemic support and guidance, the collaboration activities remain occasional and coincidental. More support for partnership building and for establishing international connections would lower barriers and risks for SMEs to enter and succeed in Asian markets.

For example, the oyster industry is primarily comprised of small businesses that are wholly dependent on export (e.g. ABARE-BRS, 2010). However, despite the dominant position for premium wild-caught product, the companies maintain very little control over marketing variables in their key markets in Asia. This, along with a rapid appreciation of the Australian dollar has negatively affected the industry's profitability. It is claimed that without a significant cooperative response to these challenges, the survival of many of these exporters, along with the industry's economic and social contribution to Australia is in jeopardy (see Manning & Freeman, 2011).

More recently some collective actions have been taken in order to succeed and capitalise in the new Asian markets: for example, Australia's Oyster Coast collective is focusing its resources to sell the Sydney rock oyster to Asian markets (Becker, 2015).

Collaboration along the value chain is generally seen as beneficial, and the benefits of collaborative value chains outweigh the costs, but the latter are not insignificant. Costs (of money and time) are often perceived as prohibitive by value chain actors. The biggest cost associated with building collaborative value chains is management time – generating the trust and goodwill necessary to integrate key business processes in order to reduce costs takes time, and results in a degree of interdependency with which many feel uncomfortable, and about which those outside of these collaborative value chains remain sceptical (see Fearné, 2009).

Market understanding

The company interviews indicated that there is a need for improving the readiness to enter Asian markets.

²⁹ <http://www.australiantraveller.com/australia/australias-10-best-farmers-markets/#>

Opportunities here lie in spreading and utilising the existing knowledge within the value network – some of the most innovative companies emphasised that the most important benefits and learnings they have got from the more experienced industry actors and business mentors. In practice, it means increasing market intelligence, that is, by improving the understanding of a diverse range of current and potential customers (demographics, needs, habits, culture, etc.). In addition, a stronger focus on target marketing based on one or a few key segments could prove to be beneficial. For example, demographic marketing provides opportunities for functional foods, as there are growing demands for child specific and geriatric specific nutrition based on the demographics of the target countries.

Besides market understanding, market adaptation such as ‘easternisation’ of functional food offerings is proposed as an opportunity to South Australia. The most successful companies have already understood the requirements of individualising markets: adaptability and local knowledge and presence in the each market (Porter, 2014).

E-commerce

Online sales and home shopping are quickly becoming the distribution mode of choice in Asia due to consumers’ ability to make informed decisions and compare prices. Some South Australian food companies already have online stores but, especially in luxury foods, there are opportunities for South Australian producers to increase online sales, for example through opening e-commerce sites on Tmall, China’s largest merchant e-commerce site and one used by many overseas vendors.

The success of ventures such as Net-A-Porter has shown that consumers are willing to buy luxury products online, and at undiscounted prices (Dauriz et al., 2014). Along with online sales, social media shows strong potential in luxury business and online advertising. For example, Instagram offers brands new advertising options, such as ways to expand the brands’ ability to convey a richer and more detailed story, or integrate bottom-of-funnel communications (Sorin, 2015).

Internet retailers have proven the case for selling luxury online, working creatively to overcome the limitations traditionally associated with retailing designer fashion – sizing, fit and feel to name a few (see e.g. the Luxury Society, 2012). Online food commerce is different from other luxury products, and presents some new challenges such as tasting. The fine wine industry still lacks unified and global e-commerce platforms. However, regardless of the challenges, online retailing is changing food and beverage trading, and the industry actors need to be prepared for the change.

Entrepreneurial attitude

Finally, entrepreneurial attitude is identified as the key enabler for benefitting from the opportunities.

The company interviews presented a somewhat positive, but still emergent, entrepreneurial attitude among the South Australian food industry. Developing and encouraging an entrepreneurial mindset and promoting inspiring and local success stories in global channels (blogs, articles in business and lifestyle magazines, video clips etc.) could further improve the visibility of the South Australian brand and companies.

Entrepreneurial attitude arises from the will to improve the current situation: many of the interviewed companies demonstrated satisfaction with their current profit and situation, sometimes resulting in a reluctance to grow and take new risks – to enhance the entrepreneurial mindset, the companies’ willingness to explore new horizons need to be strengthened. The more innovative companies emphasised the importance of risky pursuits and experiments for success.

Overall, a few skills that are related to strengthening the entrepreneurial spirit can be identified (see Llopis, 2013): these are broadening the observations beyond obvious details before you (for example, towards food exports to new countries with products not currently produced in South Australia) and simultaneously cultivating the most promising opportunities by giving them the right amount of focus and attention (choosing focus areas and prioritising them in terms of funding and other resources, and in turn not wasting energy on opportunities with limited potential).

Target Markets: Actors and Issues

Phase 1 of the project identified key target market actors in Asia and in relation to the identified opportunity areas. This activity was based on publicly available sources, company website information and market intelligence data.

The most important export targets for South Australian food industry include six countries (with Hong Kong classed separately from China):

- China (luxury and functional)
- Hong Kong (luxury and functional)
- Singapore (luxury and functional)
- Japan (luxury and functional)
- Malaysia (luxury and functional)
- South Korea (luxury and functional)

These countries are identified as the immediate priorities for South Australia for both functional and luxury foods.

The immediate country market opportunities were identified based on the following analysis:

- For luxury foods, opportunities are currently most significant in countries where the predominant culture emphasises luxury food consumption as an indicator of social status, and where there are relatively large numbers of high net worth individuals and a significant power distance index.
- These countries have the largest current markets for luxury products and functional foods. For example, Hong Kong, although a much smaller market in population terms, has a significantly larger luxury market than India or Indonesia.
- For functional foods, demographic factors such as a significantly aging population, as well as rapidly growing health expenditure, are more evident in these countries.

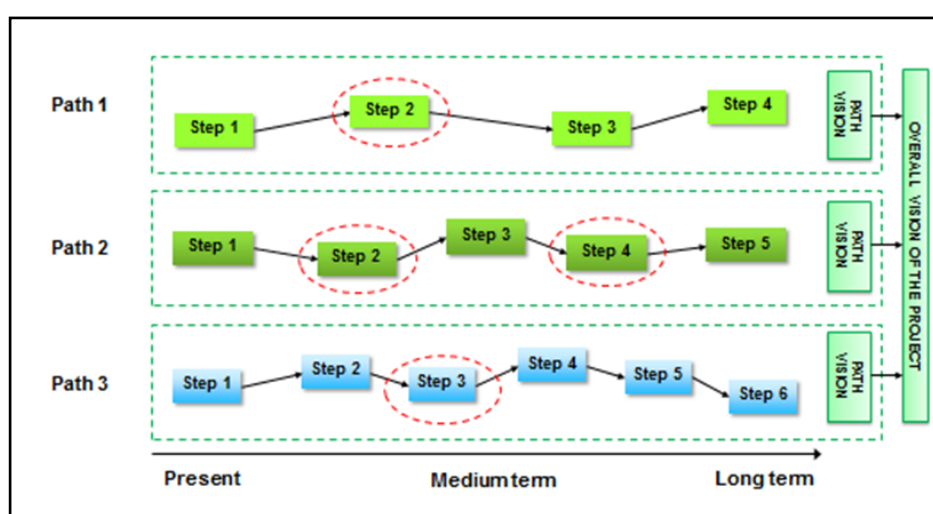
Other countries, such as India, Indonesia and Vietnam, are rated as lower priorities (although still with potential). This does not mean that these markets are necessarily inappropriate for South Australia, but that they are of lower priority, given the need for focus.

Pathways for Future Growth

This component of the study was undertaken in Phase 3. The future pathways aim at focusing on specific growth opportunities for the local industry through adding value [for detail on the approach to this component of the study, see also Methodology].

Potentially, the most interesting pathways should be the ones where a shared opportunity beyond a single business can be identified. Each pathway should work towards a vision of exploiting an identified business opportunity, and the necessary steps to achieve that vision. Such steps may include development of local specialised capabilities such as business networks, innovation, technology, research, education, and infrastructure, as well as policy activities (regulation, public research and development support, procurement, standardisation, certification schemes, promotion of exports and investments etc.).

Figure 17. Future pathways design for project group work.



This component of the research project aimed to highlight the general premises and facts behind the suggested pathways, such as:

- background
- needs and requirements
- potential customers and markets
- required capabilities and competencies
- key enabling technologies
- required infrastructure and ecosystem
- key companies in the field

The five pathways originally suggested to workshop participants are shown in Table 11.

Table 11. Five suggested pathways for functional and luxury foods in South Australia.

Possible pathways for functional and luxury food	Possible steps		
	Short term	Mid-term	Long term
Pathway 1: Food technology upgrading	Adoption of commercially available processing technology	Attraction of technology manufacturers in South Australis	Food technology development in South Australia

Pathway 2: Ingredients for functional foods	Add commercially available functional ingredients to products	Production of ingredients from local side-streams	Identify, develop and produce new unique ingredients
Pathway 3: Active and intelligent packaging solutions for differentiation and food chain management	Diversification of packaging supply	Develop active and intelligent packaging solutions	Develop solutions for comprehensive food chain management
Pathway 4: Branding and differentiation based on local strengths and underutilised local resources	Enhance the South Australia food branding and differentiation	Branding indigenous local raw materials	
Pathway 5: Food tourism for Asian consumers	Targeted offering for combined luxury wine and food tourism	Service products for health and well-being tourism	

Each group was invited to discuss their selected pathway and, if needed, to refocus it. They were also asked to formulate a vision for the pathway, and to think about how South Australia's food and wine industry should look when the pathway is fully realised. Finally, participants were asked to identify the steps to be taken to realise that vision, plotting the steps on a timeline and identifying the activities local actors could undertake to achieve the vision.

The outcomes of the group work, as presented below, were then used in outlining the future pathways in more detail (see Final Report for completed pathways).

Pathway 1: Food technology upgrading

Figure 18. Group work output for pathway 1 - Food technology upgrading.

Pathway 1: Food Technology Adoption

Vision: SA reputation for innovation across whole supply chain – Like attracts like

Short term 0-1 yr Inspire through demonstration: "Inspire me"	Midterm 1-3 yrs Adoption: "I'm inspired", "I'm changing"	Long term 3 + yrs "I'll be a change maker" + An early adopter
<ul style="list-style-type: none"> Identify manufacturers of food tech equipment suppliers (show us: youtube videos, case studies etc.) International food tech capability mapping – exploring possibilities with SA food manufacturers Able to outsource help to work out financial business case of adopting and investing into technology SA government working with food industry to determine what's needed Clear economic incentives to innovate i.e. R&D tax concessions 	<ul style="list-style-type: none"> Appoint "Go to people" – who point in right direction – "in a one stop shop" Continue Business Transformation Voucher within food industry Government: change funding cycles (for co-investment + de-risking) 	<ul style="list-style-type: none"> Continual improvement & innovation to stay ahead of the game Attract technology machine suppliers reps to Adelaide on a regular basis so we can stay we can stay in touch with new + uptake early Partner business with appropriate researcher and/or technology provider to create new tech Reputation as industry leaders in innovation and early adoption Attracting business in food to get in SA due to reputation Like attracts like – build the international desire/attraction to SA

Background

Adoption of new processing technology has the potential to increase productivity of the business and improve quality of the products, extend shelf life, and improve product safety. The technological capability within South Australian food industry is generally considered low in international comparison. Partly this is due to the small average size of the firms.

Most of the food technology suppliers are global players. Local industry is very limited. Some key global suppliers have representation in Australia, but most of their activities are related to marketing and sales.

General needs and requirements

To upgrade food technology in South Australia requires demonstrating the benefits of technology adoption to food businesses. As many businesses currently view technology uptake as a cost rather than an investment with potentially high return (ROI) there is a need for awareness building activities for demonstrating these benefits. This includes identifying potential technologies for any individual firm and helping in assessing the required size of the investment and the expected payback time for various production parameters (volumes etc.).

The easiest option is the adoption of commercially available food processing technologies to improve quality of products and productivity of the business. More effort is needed to attract technology manufacturers to establish presence in South Australia by building up a significant demand base for advanced food technology.

It is critical to develop capacities in utilising available technologies for payment and transactions. The technological solutions include e-commerce solutions such as mobile commerce, electronic funds transfer, and online transaction processing. This would also include integrating with the channel to market, for example for the retailers who use different systems between the different channels.

Needs for food technology development

The competence base needs to be improved to trigger food technology development activities in South Australia by building up a demand base of a group of sophisticated customers and a world-class ecosystem of supporting activities.

As any locally operating food company alone (due to their relatively small size) is not likely to attract global suppliers to establish development activities in South Australia, there is a need to concentrate innovation activities under one roof to reach sufficient scale. A food innovation centre with applied research capability and innovation programs of significant scale could serve as a hub for aggregating and leveraging fragmented technology and product development efforts. As such, it would also serve as an attraction point for collaboration with global technology suppliers.

- Technology adoption of more advanced (widely applicable) food processing technologies, such as HPP, PEF, industrial scale microwave, and 3D printing. There are also a multitude of food sector specific equipment needs that were not included in discussion for in this project. These typically involve equipment that can be used to replace manual labour such as conveyor belt systems, cutters, different kinds of robots and packing machines.
- In the case that a decision is made to start the production of functional ingredients in South Australia (instead of buying them): upgrading the capabilities in technologies related to functional ingredients, particularly extraction technologies, such as:
 - Traditional solvent extraction (including solid-liquid extraction, SLE), pressurized liquid extraction, subcritical fluid extraction, supercritical fluid extraction; pulsed electric field extraction, microwave-/ultrasonic-/enzyme assisted extraction, and instant controlled pressure drop-assisted extraction. Typically there are optional ways for the extraction of the ingredient. The method of choice depends on the specific ingredient (and the purity needed), raw material to be used, and production volumes. For instance, a panel of extraction techniques have been used to isolate phenolic compounds from the wine-making residues. Although the most widespread technique used to extract the (poly)phenolics from winery residues is currently SLE, other techniques such as supercritical fluids extraction (SFE), ultrasound assisted extractions (UAE), microwave assisted extractions (MAE), and high pressure and temperature extraction (HPTE) can also be successfully used on phenolic extraction (Teixeira et al. 2014).
 - Dry fractionation technologies for enrichment of protein, starch and dietary fibres; air classification can be used for high-protein ingredients (Pelgrom 2015) and high-fibre ingredients, especially beta-glucan (Sibakov 2014). In addition, electrostatic separation can be utilised to further enrich fibres from oats and wheat (Hemery et al 2011; Sibakov 2014). Industrial scale equipment for air classification is available from Hosokawa Alpine AG³⁰ and for electrostatic separation from Bühler AG³¹.

³⁰ <https://www.hosokawa-alpine.com/powder-particle-processing/machines/classifiers-and-air-classifiers/>

³¹ http://www.buhlergroup.com/global/en/downloads/LEURON_en.pdf

- Besides wet extraction and dry fractionation technologies ultra- and nanofiltration and chromatographic and electrophoretic techniques are used in the production of functional ingredients. Dairy industry uses ultra- and nanofiltration for milk and whey protein concentration, and nanofiltration for lactose concentration of the ultrafiltration permeate³²(Kumar et al. 2013).

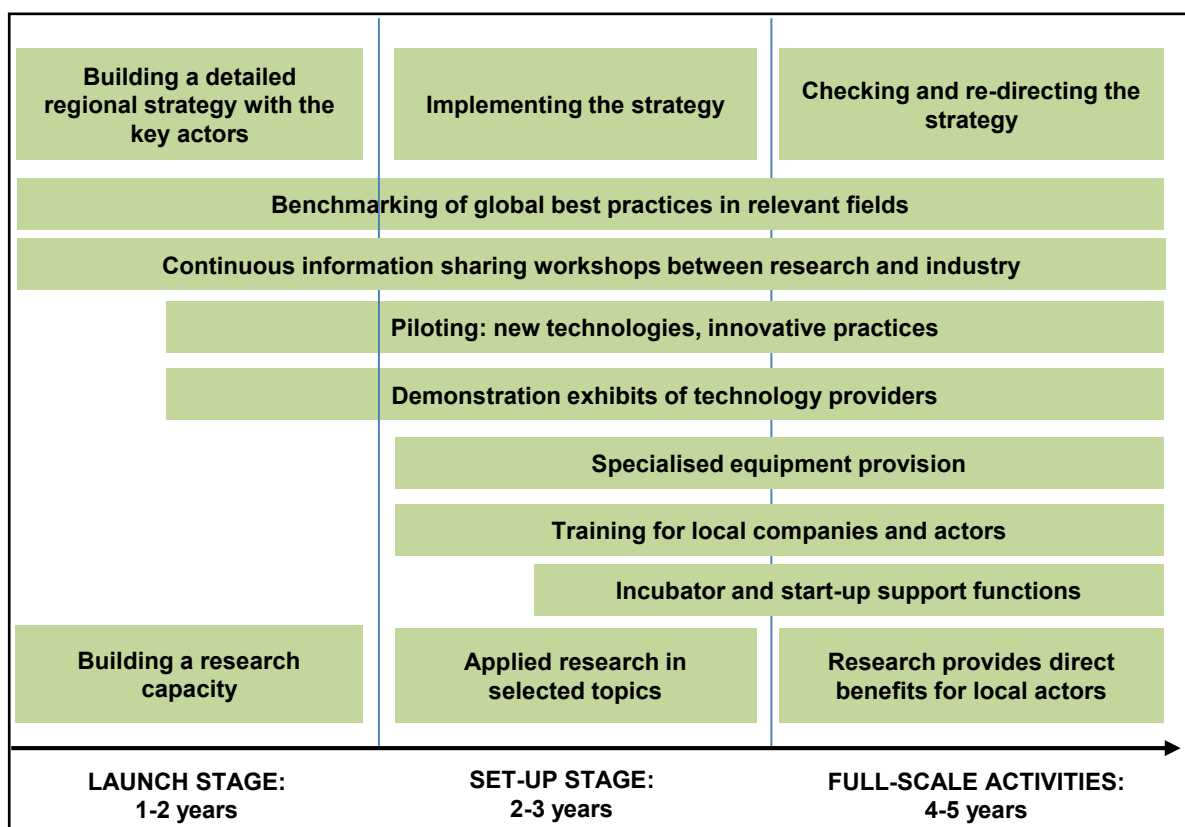
Starting ingredient manufacturing in South Australia is a separate challenge. Few food companies (typically only the big players) produce the functional ingredients they use themselves (some dairy companies can produce the probiotics they use and some cereal companies (with both mills and bakeries) can produce the fibre ingredients). Instead, this is typically a highly specialised branch of the industry. To set up an ingredient factory, highly specialised equipment is needed (some of these are mentioned above). In addition:

- Existing ingredient competition (local/global) needs to be considered
- For new ingredients, there will not be an existing market and therefore risks are high
- Also, with new ingredients there is typically no, or low, know-how related to production, which means that production start-up may be slow (however, if successful and if the company owns the IPR, also the benefits can high)

Due to their relatively small size, a locally operating food company on their own is not likely to attract global suppliers to establish development activities in South Australia. There is a need to concentrate innovation activities under one roof to reach sufficient scale. A regional centre for innovation with applied research capability and innovation programs of significant scale could serve as a hub for aggregating and leveraging fragmented technology and product development efforts. As such, it would also serve as an attraction point for collaboration with global technology suppliers. In a regional centre of food innovation and research, the main focus should be on piloting and scaling up production currently realised in the laboratory phase. The centre should be targeted to the commercialisation and utilisation of innovations, and the research should endorse this target. The centre could be set up in three stages (See Figure 19).

³² <http://advanceddairytech.com/nanofiltration.php>

Figure 19. Functions of a regional centre of food innovation and research: a stylised overview.



Launch stage

In the launch stage (1-2 years duration) the basic functions of the centre are built. The first step would be to build up a detailed regional strategy for food research and innovation with the key actors. These actors should represent all the relevant stakeholders in a triple helix mode (research, industry, government) or in a 'quadruple helix' mode (research, industry, government, citizens including NGOs).

The second step would be to start up a benchmarking of global best practices in the relevant domains defined in the strategy. Benchmarking should be an ongoing practice that is reviewed at regular intervals.

The third step would be to build an initial research capacity. This includes hiring key personnel and setting an operational plan to integrate relevant local researchers under the auspices of the centre.

The fourth step in the launch stage should be to start continuous information sharing workshops between researchers and local industry. At first, these workshops could be more about finding a common ground and common agenda, but already in the in the set-up stage the discussion could be informing participants about research results and new industry needs.

The fifth step in the launch phase would be to start piloting projects that are defined in the regional strategy. Piloting projects could be, for example, topics such as adoption of novel production technologies and testing out new industry practices. These piloting projects could be combined with simultaneous demonstration exhibits by the technology providers.

Set up stage

In the set-up stage (2-3 years duration) the focus of the centre should be in implementing the regional strategy. All the steps started in the launch stage would be established and becoming regular practices in the centre.

There would also be new steps in the set-up stage. Firstly, there would be a need for applied research programmes in the relevant fields, as shown by the strategy. Secondly, the centre should start its specialised equipment provision for the local SMEs. Basically this means that centre would acquire new or cheaper used instruments and would rent the use time for the industry. The renting would include the training of the basic functions of the instruments, and the searching for the specific time for the companies to use the devices.

Thirdly, the centre should start training sessions for the local companies and actors. The training topics would be initially outlined by the strategy, but also research and industry workshops could be used to steer the contents of the training.

Fourthly, the centre should begin setting up a start-up incubator and also start-up support functions. In the long run, the aim of the centre should not just be to direct already existing industry, but to catalyse the formation of new technology-based high value-adding companies.

Full scale activity

In the third stage of full-scale activities (in 4-5 years) all the above mentioned steps should be, more or less, in full utilisation. The applied research would already be providing some direct benefits for the local companies, and all the other activities would supporting the development of a new company culture in the South Australian food sector. In some 4-5 years, the regional strategy should also be re-checked and aligned with changes in local and global operational environments.

Potential customers and markets

Industry development along this food technology upgrading pathway would support capacity building for the whole food industry, improving its productivity and consistency of quality. Thus, it would support also functional foods and luxury foods, but is not limited to the industry players active in these domains.

Acquisition of new equipment that would enable the production of higher quantities/volumes of food of even/good quality without additional personnel would be an obvious route to follow. This kind of approach would benefit especially the functional food industry; luxury foods tend to more artisanal (although consistent and superior quality is needed for them as well).

The non-thermal preservation technologies especially have diverse application fields in the food industry. They enable improvement of the quality of the foods (both microbiological and sensory) and can increase the shelf life of perishable products. Increased shelf life is especially important for export markets.

Across the Australian food industry, the pathway for supporting capacity building varies from large business through to small businesses. Most large businesses, whilst they might have access to

capital, are limited by manufacturing constraints due to technologies already in place and reliance on manufacturing large volumes of product. This can inhibit large organisations from investing frequently and the investments tend to be more strategic, being around key growth priorities into which the business is willing to move.

Whilst small businesses are more nimble and can be highly flexible, for example in implementing new technologies, they can have limited access to financial capital to acquire new technology or upgrade existing equipment.

The luxury segment in the food industry is still very new. Whilst premium or super premium categories have forged ahead in sectors such as wine, red meat, and ice cream, the Australian consumer is still not prepared to pay for luxury foods. Functional ingredients have definitely had a wider impact across a number of categories, in particular in dairy, where it is easier for the consumer to understand the functional benefits of ingredients in foods such as yoghurt (such as for gut health etc.)

A pathway whereby functional ingredients are produced will be very different. For functional ingredients, customers outside South Australia are needed. Typically, ingredient markets are global, therefore global competition and markets need to be analysed carefully.

Different functional ingredients have different limitations in terms of how these can be incorporated into functional foods without compromising the activity/bioavailability of the compound and the sensory properties of the food. The ingredient industry has to meet this need and ensure ingredients are easy to incorporate and as neutral as possible (for example, in colour/taste) to be useful to the food industry.

Required capabilities and competencies

Because different food industries have very different needs in terms of food processing equipment and technologies, the required capabilities and competencies vary greatly. Many branches of the food industry (dairies, breweries, beverage manufacturers, non-artisanal bakeries) typically produce high volumes of food and are often already highly automated.

For these industries new technologies would probably replace some existing processes. New competencies needed would be related to the use of specific new equipment/processes. In these cases, the equipment manufacturer trains the staff. To help industries understand which technologies to implement, collaboration with equipment manufacturers and research institutes with food pilot facilities would be very beneficial.

Small companies have very different challenges. Due to the small size of these companies, they often have only basic or essential equipment. Any kind of know-how related to the use of new equipment needed is usually easily available from the equipment manufacturer. Here, the challenges relate to the investment itself and implementation of the equipment (for example, finding suitable space for the equipment). Small companies would greatly benefit from the approach described below for the clinic activities.

Relevant activities would include definition of specific industry needs, identification of relevant technologies worldwide, introducing technology suppliers to food and beverage companies and facilitation of technology adoption activities.

As stated above, ingredient manufacturing is typically a highly specialised industrial field. In many ways it is more similar to the pharmaceutical/chemical industry than to the food industry. The required capabilities and competencies are product-specific and personnel are usually trained in-

house. In the case of new equipment, this training would be in collaboration with the equipment manufacturer.

In South Australia, peer learning seems to be common among wineries (based on the industry interviews). This is a highly recommended method of learning, since very specific problems can be solved this way. This type of learning works probably best for small and medium sized companies who know each other well and have probably already worked together in other areas (e.g. joint export efforts).

Key enabling technologies

There are a large variety of relevant enabling technologies commercially available in the market, most of them provided by global suppliers. According to the technology analysis conducted in this project, the most promising general technologies to be used for processing of a variety of food materials are cold pasteurisation (non-thermal preservation) technologies, high pressure processing (HPP) and pulsed electric field (PEF). A diverse range of other technologies is also available, whose application is pertinent to specific categories of food and beverages. Since the specific needs of different food industries are so varied, only the general/widely applicable technologies can be considered here. Examples of the different technologies and their application fields are given above.

HPP and PEF are both efficient alternatives for thermal pasteurisation in terms of microbial inactivation. Both technologies inactivate vegetative microbial cells and many enzymes at ambient temperature conditions, resulting in a high retention of the nutritional and sensory characteristics of the fresh products. Thus these technologies are suitable for heat sensitive food materials. Products processed with such technologies are often sold at a premium price (Saldana et al., 2014, Sampedro et al., 2014, Jermann et al., 2015).

HPP is used to treat a wide variety of packaged foods such as meat products, avocado products (and other dips and salsas), fruit products, ready to eat meals, seafood products, juices, and dairy products³³ (Balasubramaniam et al. 2015). PEF is typically used to treat liquid foods such as fresh and fermented dairy products, and juices³⁴ but it has also other applications such as to treat peeled potato cuts³⁵ (Odrizola-Serrano, et al. 2013).

Jermann et al. (2015) conducted two independently designed surveys of a North American (Survey 1) and a European group (Survey 2). The respondents were food professionals from industry, academia and government. The questions sought to identify novel technologies either applied now or with the potential to be commercialised in 5–10 years, commercialisation factors, associated regulations and limitations.

In Survey 1, HPP (80%), microwave (88%) and UV (84%) were the main technologies applied now and anticipated in the next five years. PEF was third instead of UV in Survey 2. The main drivers were higher quality products (94%), product safety (92%) and shelf life (91%). HPP and microwaves were identified as main technologies now and in the next 10 years. There were geographical differences, with North America finding UV and radiation, and Europe finding PEF of more importance now. Cold

³³ <http://www.hiperbaric.com/en/applications>

³⁴ <http://www.tasteofscience.com/articles/195/premium-quality-of-dairy-products.html>;
<http://www.wageningenur.nl/en/Expertise-Services/Research-Institutes/food-biobased-research/Expertise-areas/Healthy-and-delicious-foods/Mild-preservation/Pulsed-electric-field-processing.htm>

³⁵ <http://www.pulsemaster.us/pulsemaster-introduces-new-generation-pef-technology-potato-processing>

plasma and PEF were anticipated to be more important in Europe in 10 years' time while HPP, microwave and UV remained more important to North America. PEF is more popular in Europe, especially the Netherlands, where a commercial scale unit exists (for example, Pulsemaster B.V. delivers equipment up to 5000 l/h capacity for the microbial inactivation of liquids³⁶).

Limitations of HPP and PEF – effect on quality-degrading enzymes

The effectiveness of HPP and PEF for controlling quality-degrading enzymes in food product varies, depending on the origin of enzymes as well as on the environment in the food product. For example, polyphenol oxidase (PPO), peroxidase (POD), and pectin methylesterase (PME) are highly resistant to HPP and are at most partially inactivated under commercially feasible conditions. Polygalacturonase (PG) and lipoxygenase (LOX), on the other hand, are relatively more pressure sensitive and can be substantially inactivated by HPP at commercially feasible conditions (Terefe et al. 2014).

PEF can result in substantial inactivation of most enzymes, although a much more intense process is required compared to microbial inactivation. Depending on the processing condition and the origin of the enzyme, up to 97% inactivation of pectin methylesterase, polyphenol oxidase, and peroxidase as well as no inactivation have been reported following PEF treatment (Terefe et al. 2015).

Processing costs of HPP and PEF vs. thermal pasteurization

Sampedro et al. (2014) estimated the cost of HPP and the environmental impact of PEF, HPP and thermal pasteurization of orange juice in the US. The cost analysis was based on commercial processing conditions that were validated for a two month shelf life of orange juice under refrigeration conditions. Total electricity consumption was estimated to be 38,100 and 1,000,000 kWh/year for thermal and HPP processing, respectively. The total pasteurisation cost of HPP was estimated to be 10.7 ¢/l for processing 16,500,000 l/year (3,000 l/h). The total HPP cost was seven fold higher than that of conventional thermal processing (1.5 ¢/l). PEF treatment (3.0 ¢/l with around 5,000l/h capacity) was cheaper compared to HPP, but still double compared to thermal pasteurisation. The equivalent CO₂ emission was 90,000 kg for thermal processing and 700,000 and 773,000 kg for PEF and HPP, respectively. This corresponds to an increase of between 7- and 8-fold in comparison to the thermal processing. The authors concluded that despite the cooling requirements being lower in PEF and HPP, the non-thermal processes still generate more equivalent CO₂ emissions than thermal pasteurisation due to the higher electricity consumption.

Based on a sensitivity analysis (Sampedro et al. 2014), increasing the production output by two to six fold would reduce the total production costs of non-thermal processing by 43–75%. In the case of the PEF system, doubling the production size (from 1,000 to 2,000 l/h) reduced the total costs by nearly 50%, whereas an increase of three and five fold (from 1,000 to 3,000 and 5,000 l/h) reduced the overall costs 60 and 75%, respectively. In the case of the HPP system, an increase in production size of two, four and six-fold (from 500 to 1,000, 2,000 and 3,000 l/h) reduced the overall costs by 43–72%. This could be accomplished by reducing the cycle time or increasing the vessel filling ratio by a better package design in the HPP system.

Other food technologies and their potential in South Australia

Another step is to assess other commercially available technologies for the specific context of South Australia food industry. Examples of these include large-scale microwave treatment (for thermal food processing) and UV pasteurisation.

³⁶ <http://www.pulsemaster.us/pef-machinery>

Microwave (MW) systems of 2450 and 915 MHz and between 10 to 200 kW heating capacities are used in the food industry for precooking bacons (e.g., in Subway's restaurants), tempering deep frozen meats when making meat patties, and precooking many other foods products. Commercial systems performing microwave pasteurisation and/or sterilisation of foods are currently available in Europe (e.g. TOP's Foods). The advantage of microwave treatment is reduction in thermal processing time, which enables retaining the visual appeal and nutrients. It is also instantaneous and enables post packaging treatment³⁷. Costs for the MW-unit are difficult to estimate. Approximately 6500 kW power (or maybe a bit less) would be required. Looking only at costs for small MW-equipment as a basic for calculation, VTT calculated 1000 € for 1 kW, this would lead to 6.5 million €. Of course such a big MW installation would have much lower costs, but this is very difficult to estimate (maybe around 2–3 million €).

The use of UV pasteurisation is limited to the brewing and beverage industry, where it can be efficiently used to lower microbial loads of both water/ingredients and equipment³⁸. Sampedro et al. (2014) estimated that the costs of conventional thermal processing at around 1.5 ¢/l. Another pasteurisation technology is cold plasma, which is however not yet in industrial use. Potentially it could be used to disinfect surfaces in equipment, packaging, food contact surfaces or even food itself³⁹. It has, for example, been used to lower the microbial load on the surface of (small) food products such as strawberries (Misra et al. 2014).

There is an interesting opportunity to explore possibilities from novel food-related technologies such as 3D printing. There are two main ways to use 3D printing; either it used to produce individually shaped pieces of food (typically chocolates, but could be other confectionery materials that can be extruded/injected). Another option is to produce tailored foods to consumer groups with specific needs. One example is easy to swallow foods for elderly people and people with dysphagia^{40, 41}. Using 3D printing is only feasible in the context of low volume speciality foods. As this technology is still novel and its application in food industry is only experimental, its unit price as measured in traditional means is high. However, in the low volume specialty foods category interesting business opportunities could be found in the food service domain, in combination with other service activities (e.g. food printing in aged care facilities) in which case the high relative unit price is warranted as it contributes to higher overall service quality. The costs of 3D are difficult to estimate since the technology is currently fast developing.

Required infrastructure and ecosystem

Regional technology diffusion programs should be established to undertake the intermediation and promotion activities in the area food technology. The best outcome is achieved when the program (or a portfolio of programs) is flexible and can meet the different needs of the industry. Thus the programs can vary between fairly simple ones to a quite high level of sophistication depending on the need. Ideally, answering both immediate and longer term development needs of the industry (both small and large) should be possible. Short term programs should ensure solving existing

³⁷ <http://microwaveheating.wsu.edu/factsheet/index.html#applications>

³⁸

http://www.aquafineuv.com/Portals/0/PDF_1/INDUSTRIES/FOOD%20&%20BEVERAGE/TSG%20090D-09%20Food%20&%20Bev%20Marketing%20Brief.pdf

³⁹ <http://www.campdenbri.co.uk/research/cold-plasma.php>

⁴⁰ [http://theplate.nationalgeographic.com/2015/03/10/the-next-frontier-for-3-d-printers-is-healthy-food/;](http://theplate.nationalgeographic.com/2015/03/10/the-next-frontier-for-3-d-printers-is-healthy-food/)

⁴¹ <http://techcrunch.com/2014/04/09/a-german-company-is-printing-food-for-the-elderly/>

production related problems quickly whereas longer term programs would enable actual research and development work. Examples of different kind of activities are given below.

An example of a rapid targeted program to help food SMEs to solve their acute problems related to processing and hygiene were the Hygiene and Baking Clinic in Finland. In the Hygiene Clinic, SMEs could address specific food safety and hygiene-related problems in the form of small research projects (typically up to some weeks research work). Experts at VTT conducted the research and the company paid 50% of the costs. Tekes, the Finnish Funding Agency for Innovation⁴², provided the other 50% with minimal bureaucracy and paperwork.

The Hygiene Clinic offered services in hygiene investigation, consulting in auto-control systems, cleanability testing using pilot scale equipment, expertise in foodborne pathogens and spoiling organisms, application of rapid microbiological methods and testing of packages and packaging materials. The Hygiene Clinic was very successful and the same model was later applied for the Bakery Clinic, providing research and development services to small bakeries. These Clinics proved that there is a need to provide rapid answers/help for the acute problems in SMEs who are often unable to solve these problems themselves quickly enough.

An example of joint efforts within industry is PBL Brewing Laboratory (registered name Oy Panimolaboratorio – Bryggerilaboratorium Ab). PBL is a company owned by the biggest players in the Finnish malting and brewing industry: Oy Sinebrychoff Ab, Oy Hartwall Ab, Olvi Oyj, Polttimo Oy and Laitilan Wirvoitusjuomatehdas. PBL offers top level expertise in the fields of malting, brewing and beverages for its shareholders to utilise in their own operations and innovations. Activities focus on scientific and pre-competitive, applied research⁴³.

Each shareholder develops its own commercial applications outside the activities of PBL. The company coordinates and funds research activities that are mainly conducted at VTT, and utilises national and international research networks. This creates a critical mass that enables top level expertise and training, as well as active participation in international research and technology networks covering universities, research institutes and companies. In addition to its own funding, PBL applies for public funding for its projects. This kind of approach would be very useful when there are enough companies with enough uniformity in terms of production, equipment, competencies and personnel.

There are also successful examples of local collaborative activities in the food area (instead of sector specific activities). Foodwest (established in 1995) is owned by companies in the food industry and the towns and municipalities in Southern Ostrobothnia, Finland. Foodwest has offices in Seinäjoki and Tampere, and its customers are located all over Finland. Foodwest serves as a business partner to all kinds of food companies regardless of size, providing information and product development solutions and market expertise. They also coordinate projects, for example, the BSR Food Cluster Network is a project that helps small and medium-sized food producing companies in their international activities and efforts⁴⁴.

Another model of enhancing industrial technology development is to utilise the services of companies in contract research and food innovation. One example is NIZO food research in the Netherlands. NIZO can provide a broad range of food grade production facilities, and a network of

⁴² <http://www.tekes.fi/en/tekes/>

⁴³ http://pbl.fi/docs/PBL_2014.pdf

⁴⁴ <http://www.foodwest.fi/en/company.html>

research professionals, equipment suppliers and manufacturers⁴⁵. Since the customer has to pay all the costs related to work to be done (typically in the range of 100 000 – 200 000 €) these kinds of services are accessible to big companies only. There are a number of companies providing contract research globally; a critical issue here is the quality of their food pilots and contacts with equipment manufacturers.

A potential model for the permanent program in South Australia could be a public-private partnership approach where a relevant industry association would coordinate the programme (in the case of South Australia this would be Food South Australia). The State Government would provide financial support (through PIRSA), and private consultancies, relevant federal government organisations, or Regional Development Associations could be contracted to execute specific outreach tasks to implement relevant activities. The target companies should be required to co-fund some share of activities so as to assure necessary business engagement. The industrial funding level could depend on the size of the company and on the nature of the task (anywhere between 30-70%). In more general cases (more potential end-users) the fee could be lower to the participating companies.

Another model is an industry-led initiative whose finance is provided by industry itself and associated businesses. This approach, while it would ensure robust assessment of return on investment (ROI) on each technology adoption decision, risks providing little support to cultivation of learning between businesses, as any individual company would be likely to be reluctant to share information between the peers without external incentives.

Companies in the field

The target firms for technology adoption activities should be selected from those companies which have recognisable capabilities to migrate towards higher value-add products in the functional foods and luxury food categories, and are willing to grow their business beyond their present size. Interested companies could be identified by open calls and information sessions for interested parties.

Another key group to consider are the technology suppliers, most of which are to be found overseas. Examples of globally active technology providers in the food area include companies such as GEA, Bühler, Alfa Laval, Krones and Tetra Laval (DeLaval). Details of these companies' activities are described in detail above in the 'Technology Providers' section of this report.

⁴⁵ <http://www.nizo.com/home/>

Pathway 2: Ingredients for functional foods

Figure 20. Group work output for Pathway 2 - Ingredients for functional foods.

Pathway 2: Ingredients for Functional Foods

Drivers	Needs of population, Future needs What's available? – benefits, uses, unique features New product testing Validate health benefits (riskier)
Markets	Pathway to market - Target ingredients to market → aim at market concerns of pull Cultural acceptance & authenticity
Products / Solutions	Unique SA products here – Indigenous food – Ancient grains Development of new crops → Continuity & scale of supply Side streams add value to waste or by-products
Technologies & Enablers	R&D support – technology pilots – integrated support How to use ingredients in foods/processing? – some ingredients aren't direct replacements Technology for scaling up: 1. Research 2. Pilot processing 3. Equipment manufacturers
Policy & Regulation	No claims environment → hard to make meaningful claims – e.g. "acceptance levels" of ingredients → lists of ingredients Not medicalised Self substantiation now possible Health Star system – Health claims vs. high-in...

Background

The foundation for any production of functional foods is the ingredients providing the enhanced functionality, and the processing technology for removing substances with undesired characteristics.

As analysed in Phase 1, the key opportunities in the functional food market for South Australia are driven by growing living standards, increasing health awareness, increasing healthcare expenditures, an aging population, and increased incidence of medical disorders such as metabolic syndrome. No functional food ingredients producers operating on an industrial scale were identified in South Australia during this study.

The opportunity analysis, realised in the Phase 1, identified the following functional ingredients as the primary opportunities in South Australia:

- poly-unsaturated fatty acids (PUFAs)
- proteins and peptides (e.g. from dairy)
- Vitamin D
- probiotics (health promoting microbes); prebiotic and other fibres (prebiotics are fibres that specifically promote the growth of certain gut microbes)
- aloe vera extract
- phytosterols
- carotenoids
- polyphenols
- indigenous plant extracts.

PUFAs can be found in a variety of products, including drinks, infant nutrition, cereals, etc. Proteins can be added into almost any type of food where an increase in protein-content is desired, for example dairy, cereal bars and biscuits, and beverages. Only a small number of these products are actually functional (i.e. they deliver a health benefit); instead they are usually targeted to consumers interested in fitness. For health benefits, specific consumer groups and food products need to be targeted for protein and peptide supplementation (e.g. foods for infants and elderly, for bioactive peptides specific consumer groups (Madureira et al. 2010)). Vitamin D is typically added into dairy products, but it can be added e.g. into beverages as well. The use of probiotics (living microbes) is restricted to foods which are not heated, and which do not have too low pH (dairy products, fruit juices, and fermented cereals, vegetables and meats) (Saarela 2011). Vitamins, minerals and plant based ingredients (such as aloe vera, plant extracts) are typically used in beverages⁴⁶. Fibres are incorporated into various cereal products (bread, breakfast cold/hot cereals, power bars) whereas prebiotics can be used more broadly (in cereals, dairy, confectionary, etc.)⁴⁷. Phytosterols were initially introduced into spreads, but can today be found in a variety of products (dairy, juice, baked goods etc)⁴⁸.

Another, very different, category within functional foods is 'free-from' products (mainly lactose-free and gluten-free). Lactose-free ingredients are produced by either enzymatic (lactase) treatment or by removing lactose by ultra nanofiltration. Lactose-free milk is then sold as such or processed into variety of foods, such as yoghurts, quarks, spreads and ice creams. Since lactose intolerance is not an allergic condition, often also simply reducing the levels of lactose in the product will suffice.

The gluten-free approach is very different from lactose-free. The most important consumer group of gluten-free products is people with celiac disease, that is, a proven allergic reaction to the protein gluten. In the cases of allergies, even very low levels of the allergen can be harmful and thus (unlike lactose-free products) a rigorous control of the whole production chain is necessary.

Since gluten is crucial in the formation of dough structure it does not make sense to produce gluten-free flour from gluten containing cereals (wheat, barley, rye). Instead gluten containing cereals are replaced with non-gluten containing cereals such as oats and buckwheat. During the milling process of non-gluten cereals it is very important to have separate or dedicated processing lines to prevent cross-contamination with gluten-containing products. (Sontag-Strohm et al. 2008). [NOTE: For examples of lactose and gluten-free products see the complementary Market Analyses report for Functional Foods.

An example of a completely new value chain in the area of functional ingredients is faba beans (or broad beans, as they are known in Australia). VTT has conducted a feasibility study related to a new domestic protein source from faba beans for human nutrition. Faba beans (*Vicia faba*) have been cultivated for a long time in Finland, but they have been mainly used as animal feed. New value-added ingredients and food products from faba bean were identified in a nationally funded project and their values were estimated according to the local market prices (Figure 21).

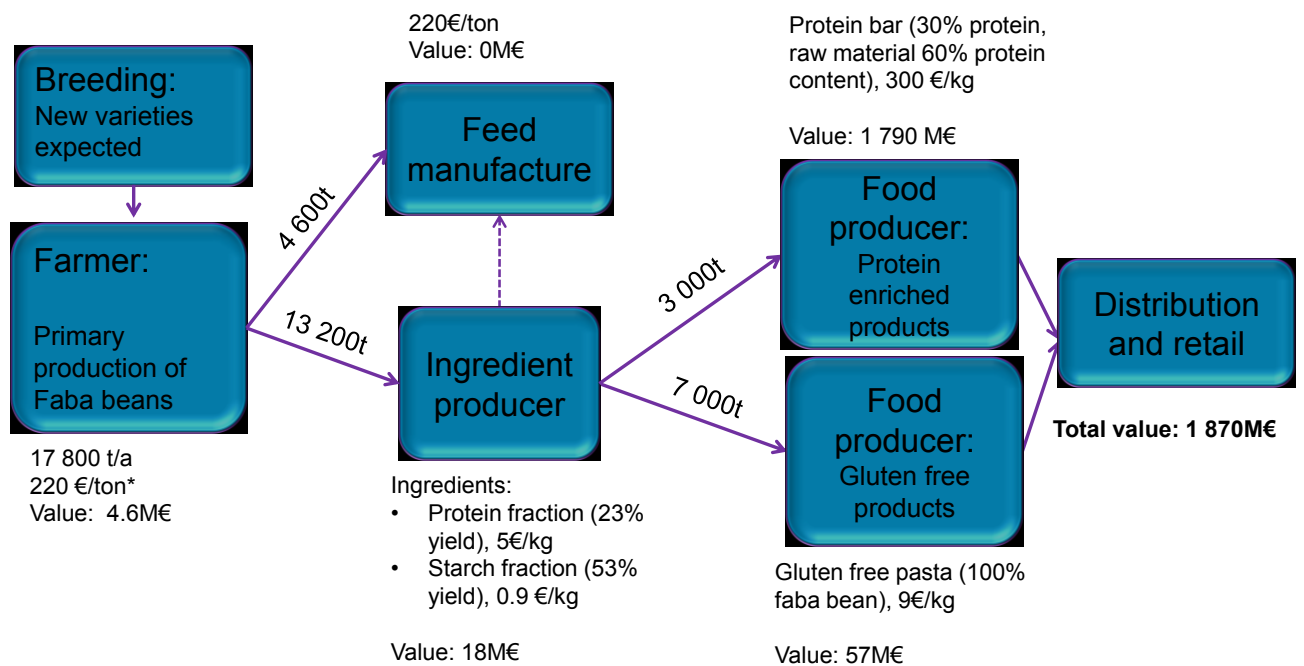
⁴⁶ <http://www.foodsafetymagazine.com/magazine-archive1/junejuly-2012/regulatory-report-beverages-at-the-forefront-of-innovation-in-booming-functional-food-market/>

⁴⁷ <http://www.cargillfoods.com/na/en/product-development/FunctionalFoods/liquid-inulin/index.jsp>

⁴⁸ http://www.foodinsight.org/Functional_Foods_Fact_Sheet_Plant_Stanols_and_Sterols#sthash.e15E43Tl.dpbs

The on-going project (2015) aims at commercialisation of two patents which VTT has recently filed. The first patent is related to the fractionation and fermentation of faba beans in order to improve their nutritive value, the second patent about applications of the obtained fractions in pasta has been submitted. The processing costs of fractionated and/or fermented faba ingredients were evaluated by a techno-economic assessment based on the annual production capacity of 13200t (Figure 22). The assessment revealed that the most profitable way for the valorisation of faba beans was to fractionate the beans into protein and starch enriched fractions (with around 31 and 59% mass yields, respectively, taken into account ca. 10% losses). The production and investment costs of the fractionation process could be fully covered by the value of the starch fraction, if the market price of the starch rich fraction was 1.8 €/kg (as estimated in Figure 21). The profitability of fermented protein fraction (Case 4, Figure 23) was also good, but still lower compared to Case 3 when faba beans were only fractionated to starch and protein fractions.

Figure 21. Value chain and potential added value of applications related to faba beans.



*The price of raw material (220 €/ton) is based on the market price in Finnish feed market. This value chain doesn't take into account the processing and investment costs, only the final values of each ingredient or product.

Figure 22. Flow diagram and mass balances of the faba bean fractionation and fermentation process.

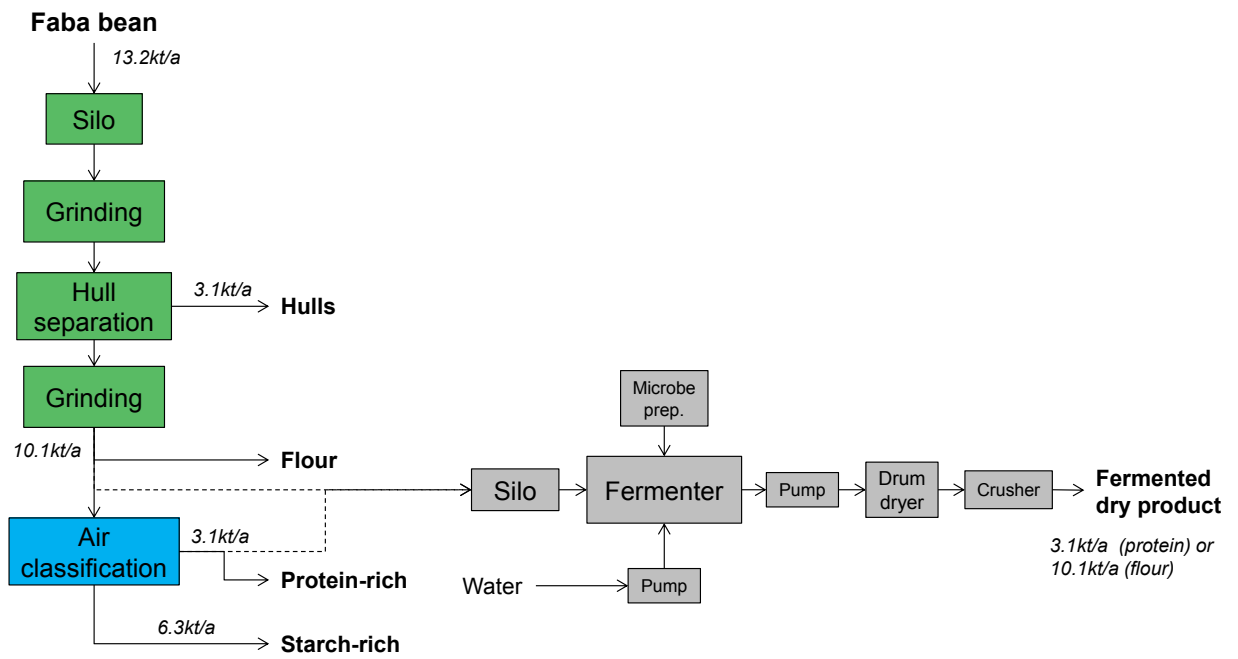
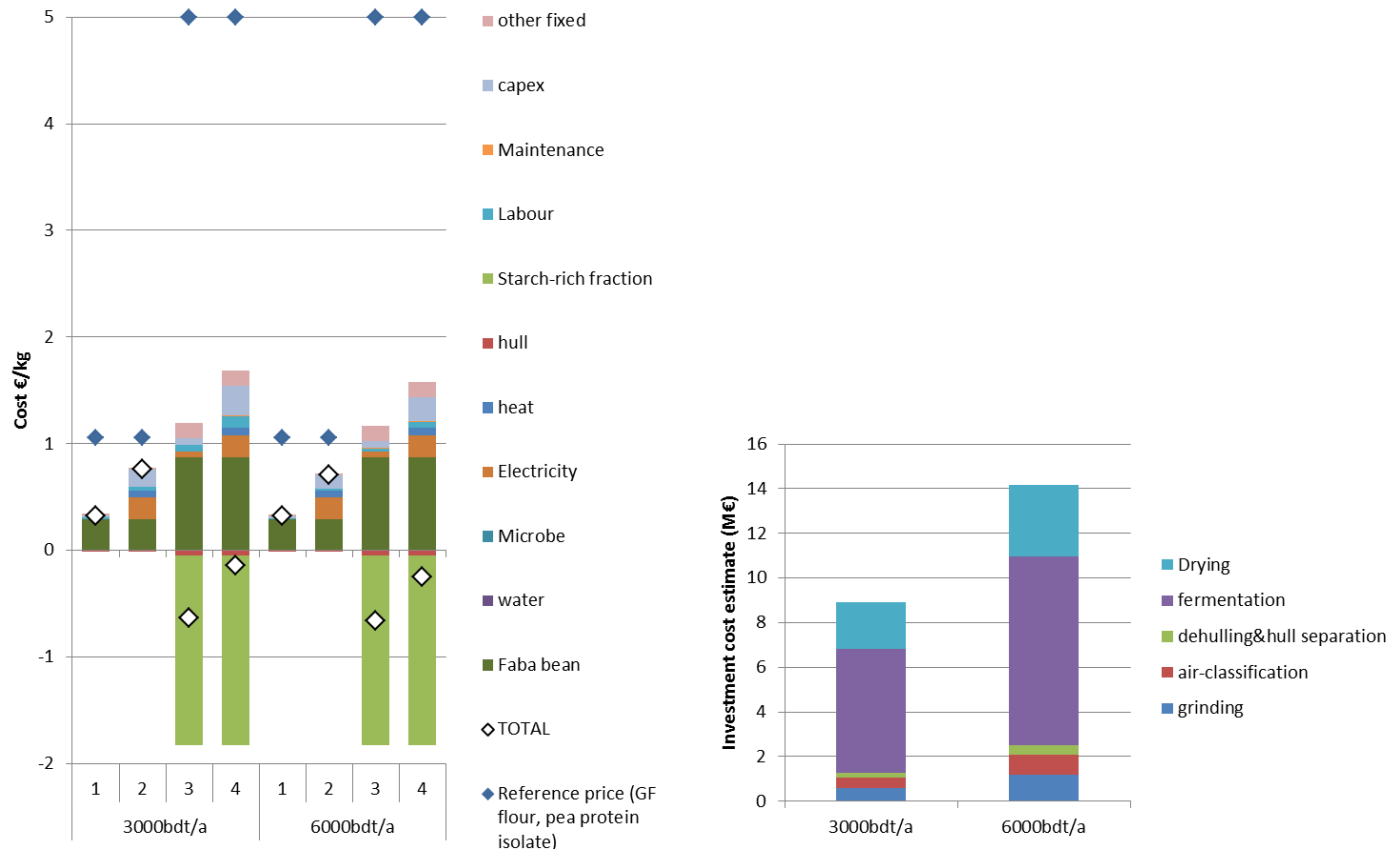


Figure 23. Processing and investment costs of faba bean production based on two different capacities (3000 or 6000bdt/a).

Definitions for different cases: 1. Faba flour (without fractionation and fermentation). 2. Fermented faba flour (without fractionation). 3. Fractionated faba (to obtain protein + starch fractions) . 4. Fractionated flour, where only the protein fraction is fermented.



General needs and requirements

As functional ingredients are not produced in South Australia, food manufacturers have to add commercially available functional ingredients and/or source globally available technology for extracting specific ingredients. The key to successful market entry in the functional ingredients market is the ability to identify market opportunities created by consumer needs for these functional ingredients. Australian consumers are very accepting of new additions to their mainstream food; however it cannot be too different or appear unnatural. For instance, sterols in margarine have worked well, however sterols in milk and yoghurt have not fared so well as the addition of sterols in these foods is seen as unnatural.

For smaller firms, it is important for them to be supported in learning to understand the market, the category opportunity and the innovations to drive to new products. Technology alone is not going to solve and meet the consumer need. There will need to be a combination of innovation support (so how to identify the opportunity areas and create/develop the right ideas into products will be critical). The technology side is the enabler. The other aspect of an innovation in the market is ensuring there is a return on investment from the new technologies; Australia is a small market so companies need to be encouraged to make the opportunity as big as possible, so must go beyond the domestic market.

Most common ingredients are easily available from global distributors. A single ingredient can be available in many different formulations dedicated for different food applications. Thus, the first step in the process is to decide which food applications are to be targeted. For functional foods, these should be foods that are consumed on a daily basis in suitable quantities in order to deliver the health benefit.

Ingredient distributors often give advice on how to utilise their products in specific food matrices such as bakery, dairy and meat products. In addition, the food/health claim regulations of the target market country should be studied to determine which types of supplementations (and at what levels) and health claims are allowed. If the ingredient in question is already an established one, the manufacturer is the best source of information for the actual food formulations. If a new formulation is targeted, then research and development support will be required in product development.

In South Australia, production should begin by experimenting with production of ingredients from easily available raw materials such as wine industry side streams (e.g. flavonoids), cereals or dairy, and by building the required capability. In the first instance, adopting/licencing of the best technology currently available overseas should be considered to initiate learning in the industry. At the same time, technology upscaling capability should be achieved by developing necessary concentration of expertise (e.g. food innovation upscaling centre previously described).

There is also need to identify, develop and produce new unique ingredients, some of which could be extracted from native raw materials in Australia. To explore this avenue, extensive patent landscape analysis needs to be performed. Production processes for functional ingredients tend to be heavily patented. A careful feasibility evaluation is necessary to identify opportunities (keeping in mind technology licensing). For example, functional ingredients can also be utilised in non-food

applications, such as in cosmetics. Some functional ingredients, such as food-grade antioxidants and probiotics are already used in cosmetics^{49, 50}.

Potential customers and markets

The potential customers for functional ingredients are the producers of functional foods and supplements. Consumers often have a choice whether to consume the ingredient as a supplement (liquid, powder or pill) or as a part of a food. These preferences, as well as preferences regarding the consumption of specific ingredients, vary in different countries (for full discussion, see Functional and Luxury Project Literature Review).

The main reasons behind the consumption of functional ingredients are increasing obesity (and related metabolic disorders), aging (and related health problems) and lifestyle related issues (stress and mental issues, gastrointestinal symptoms etc.). Some consumers want to avoid certain food components (lactose, gluten). The use of lactose free products is typically restricted to lactose intolerant people (lactose malabsorbers) whereas gluten free products are consumed mainly by celiacs. Different functional ingredients and their potential health effects have been discussed in detail in the Literature Review.

The demand for functional ingredients is increasing rapidly in Asian countries. As analysed in the Phase 1, the key opportunities in functional food markets for South Australia are driven by growing living standards, increasing health awareness, increasing healthcare expenditures, aging population, and increased incidence of medical disorders such as metabolic syndrome.

Required capabilities and competencies

The local technology capability is largely limited to laboratory scale production of ingredients within universities and research institutes (e.g. high-lutein wheat (University of Adelaide), bioactive components in wine (University of Adelaide) and in seaweed (Flinders University)).

Upscaling technology developed from laboratory scale to industrial scale will be expensive and typically will require pilot scale development facilities. As capability to upscale ingredient production to industrial scale does not exist in South Australia, it would need to be developed. The capabilities required are applied research competencies, pilot scale technology and product development facilities, and commercialisation skills.

An obvious starting point is to start to produce the ingredients for which scientific and production support is available locally. The pathways to the actual industrial production vary: for high-lutein wheat upscaling the growing of the specific wheat variety is needed, followed by dedicated industrial milling facilities (this is comparable to the production of gluten-free products). For the production of bioactive ingredients from grape/wine production side-streams, dedicated processing facilities are needed.

The preferred model for building upscaling competence is to establish a local hub for knowledge, expertise and technical facilities under one roof in a food innovation centre. A centre would bring together competencies from universities, provide pilot facilities for companies to scale up towards industrial scale, attract equipment suppliers to collaborate and provide local support, as well as support education activities and nurturing start-up firms. This model would allow pooling scarce

⁴⁹ <http://www.esdor.es/en/>

⁵⁰ <http://beautystat.com/site/skincare/what-are-probiotics-and-the-best-probiotic-skincare-and-cosmetic-beauty-products/>

resources into a shared capability between universities, leading companies, and expert service providers.

International examples of this approach include biotechnology centre QB3, a biotech incubator facility in San Francisco, USA⁵¹. Its main field is the quantitative biosciences, a domain that combines methods of physics, chemistry, and computer science for the use of molecular biology. It is a combination of new start-up companies, serial entrepreneurs, investors and university competencies (UC Berkeley, UC Santa Cruz and UCSF). In its operations, QB3 utilises research facilities, educational programs, internships, mentoring, incubators, and a seed-stage venture fund⁵². According to Richard Yu, Scientific and Operations Director of QB3, the aim of the incubator is to create an open space for early stage start-up companies to start their business and share the lab equipment (source: interview by VTT, 7 April 2015).

The incubator is a private company funded by different investment funds. The operation model is based on renting state-of-the-art research equipment for the companies that are located in the space. In the QB3 laboratories, the rent is based on the metres of standard laboratory table required by the companies for their operations. Office spaces are basically open offices that aim to facilitate as much interaction among companies as possible. One basic idea of the incubator is to set more experienced and completely new entrepreneurs in the same space to catalyse the information and experience exchange between them. The QB3 model of knowledge exchange is founded on workshops that are organised among the companies in the facilities. QB3 also has regional or country clients for whom the centre tailors different training programmes (<http://qb3.org/about/global>). Australia is a country client for QB3 through the Rosenman Institute, based at the University of California in San Francisco, and the field of training is development and marketing of medical instruments.

A food innovation centre in South Australia would also allow executing and coordinating capacity building projects, training programmes, technology diffusion initiatives and start-up support activities (see Figure 19 and related text).

Key enabling technologies

It will be necessary to source commercially available functional food ingredients in order to enter into the functional foods market on a local basis and enable industry learning. The actor mapping process completed during Phase 1 of the Functional and Luxury Foods Project provides an extensive list of actors in the functional ingredient/food industry in Australia and target Asian countries.

An example is Valio's lactose-free technology, which is available by licensing. The licensing agreement gives access to the patented production technology, analytical methods and complete current expertise related to the production of lactose free milk. In addition, Valio supports its licensees by sharing its go-to-market knowledge and marketing communication experience⁵³. Currently this technology has been licenced in Australia to New South Wales-based MPD dairy products⁵⁴.

⁵¹ <http://qb3.org/startups/incubators>

⁵² <http://qb3.org/about/mission>

⁵³ <http://www.valio.com/solutions/valio-eila-lactose-free/valio-eila-lactose--free-for-dairy-industry/>

⁵⁴ <http://www.dairyreporter.com/Ingredients/Finnish-dairy-Valio-seals-Australian-lactose-free-milk-powder-distribution-deal>

Required infrastructure and ecosystem

Production of functional ingredients requires sophisticated research and development capability. While universities and research institutes can provide some of the infrastructure and innovation ecosystem support, what is currently missing is technology upscaling from laboratory to industrial production scale. Several countries have built this kind of capability by establishing technology institutes and applied research centres (e.g. Fraunhofer in Germany, VTT in Finland, TNO and NIZO in the Netherlands, Danish Technological Institute DTI in Denmark), regional innovation centres (e.g. Steinbeis in Germany), or manufacturing extension centres (e.g. the United States) (Table). Some of the applied research centres have been established by the industry such as the Dairy Research Institute in the United States.

This pathway requires a smart functional foods development programme which contributes to building a local ecosystem.

Table 12. Examples of research institutions in the area of food technology.

Examples of research Institutes with food technology upscaling facilities	web-site	Activities in food area
Fraunhofer (Germany) Multitechnological, food/nutrition is only small part of Fraunhofer (>23 000 employees)	https://www.fraunhofer.de/en/fields-of-research.html	Fraunhofer scientists evaluate the physiological effectiveness of special foods and food supplements. They also develop new processing methods, for instance for low-fat meat products, and research new sources of nutrition, such as lupin seeds.
CSIRO (Australia) Multitechnological, food/nutrition is only part of CSIRO (about 6500 employees)	http://www.csiro.au/	Food and farming research ranges from studying the make-up of the crops and animals to the methods and food processing technologies. Nutrition and health is one important focus area. CSIRO's food innovation centre helps food, ingredient and equipment manufacturing companies to access CSIRO's expertise, technologies and support in innovation.
TNO (The Netherlands) Multitechnological, food/nutrition is only part of TNO (about 3000 employees)	https://www.tno.nl/en/	TNO works in the areas of healthy foods, new protein sources, 3D food printing, personalisation of foods, and Food South Australia safety.
VTT (Finland) Multitechnological, food/nutrition is only part of VTT (2600 employees)	http://www.vttresearch.com/about-us	VTT develops new technologies and concepts for the food and beverage sector. The research focuses on the following topics: technologies for novel proteins and fibre ingredients, designing appealing and healthy foods and beverages, adding value to side-streams and microbiological safety. VTT combines bio and mechanical processing to develop sustainable technologies for producing ingredients from cereals, berries, pulses and various side-streams. VTT has also an analytical platform for predicting physiological functionality of food. The latest research topics include rethinking the food delivery chain and creating new solutions for promoting healthy food choices amongst consumers.
DTI (Denmark) Multitechnological, food/nutrition is only part of VTT (1055 employees)		In the area of food and packaging DTI has activities in the areas of consumer testing, product quality and shelf life, sensory analysis, food contact materials, food microbiology, HACCP, stabilisation of food ingredients and packaging. Danish Meat Research Institute is also part of DTI.

Examples of research Institutes with food technology upscaling facilities	web-site	Activities in food area
NIZO (The Netherlands) Only food research (200 employees)	http://www.nizo.com/about-nizo/nizo-in-short/	NIZO food research is a global centre in proteins, bacteria, and processing. NIZO is an independent company and one of the most advanced contract research centres in the world. NIZO bring the latest food technologies to life in their own food grade processing plant.
DIL (Germany) Only food research (170 employees)	http://www.dil-ev.de/en.html	With around 150 member companies from the food industry and related fields, the German Institute of Food Technologies (DIL) operates as a research institute working in the areas of product development, process development and analysis. Forming a bridge between science and practice, DIL supports its partners in the innovation process.

Companies in the field

A few companies in South Australia currently qualify for embarking on the pathway to develop functional foods products with local ingredient production. Wine companies especially, who can potentially produce their own functional ingredients from their own raw materials / side streams have potential here. This would necessitate collaboration with the companies to achieve the necessary critical mass. A good example here is the Matarromera Group described above.

Small companies seeking to identify their potential in the functional ingredients market must understand the market opportunity and challenges, and identifying how the new opportunity will meet and solve these. Questions to be asked include:

- What is the size of the opportunity?
- Who will buy this product? (is the target functional food or supplement producers or both?)
- Why will they buy the product?
- What need does it fulfil in a consumers life?
- How are consumers filling their need today?
- Could this new product eliminate this or will it be add on?
- Does the opportunity increase when it goes beyond domestic markets?

Scale in a country and market the size of Australia will always be a challenge given the population – this is the critical reason that businesses need to identify the bigger opportunity across domestic and export markets and spread the risk of new products.

Information about companies and their products currently in Australian and Asian markets can be found in the complementary Market Analysis report.

Pathway 3: Active, intelligent and polysensual packaging solutions

Figure 24. Group work output for Pathway 3: Active and intelligent packaging.

Pathway 3: Active and intelligent packaging

Vision: SA connected to every major packaging supplier; recognized as the most demanding food packaging buyer

Packaging solutions:

- Supply chain management & control (printed intelligence)
- Gift packs, packs for purpose – understanding perceptions → design, behavioural science, psychology, neuroscience
- Capability to specify packaging solutions
- Design thinking capability
- Sourcing of packaging
- Today:
 - Volume issues
 - Choice → assessment

Timeline:

- Agree vision between all stakeholders
- Continuity over 10 years
- Food SA + Wine industry association to take on responsibility + others
- Build networks → suppliers
- Build/develop capabilities/processes/awareness in ecosystem
- Create collaborating groups of firms

22/10/2015

4

Background

High quality packaging is a necessary requirement for both functional and luxury products. The present packaging supply is often limited to conventional packaging solutions. These fall short in communicating the supreme quality, exclusivity and sophistication of the product in both functional and luxury food categories. As identified in Phase 1 of this study, the current state of the local packaging providers in the South Australia could be improved with new approaches to packaging (refer more detailed information in the 'Technology Assessment' section of this Report).

General needs and requirements

As the present packaging supply is rather limited, there is a need to diversify towards higher quality packaging to meet specific demands. Sustainability is the main consideration related to packaging, and this is driving adoption of light-weighting and bio-based materials such as bioplastics and fibre-based packaging.

Core technological competencies should be developed in sustainable packaging by exploring connections between packaging and local industry in South Australia. This would assist in making South Australia attractive to the key suppliers and, in the long term, encouraging them to establish a local presence with design capability, some material suppliers and converters, and packaging solution providers.

The megatrend of digitalisation will also have impact on the food industry. In South Australia, digitalisation should be connected with supply chain management, and the functions of the company in the value network. Thus, key technologies would include solutions for supply chain

management, internet marketing, electronic data interchange, inventory management systems, and automated data collection systems. Intelligent packaging solutions will also eventually play an important role in the digitalisation of the food industry.

There is need to improve the adaptation and utilisation of existing active and intelligent packaging solutions available in the market which are suited to the needs of functional and luxury food products. South Australia should seek to establish a position as a testing ground for new ideas and innovation.

Potential customers and markets

The potential end customers are consumers of functional and luxury food products, both locally and globally. Intermediary clients also include specialised retailers and distribution channels for functional food. The local packaging material industry could also find new customers, especially in fast growing markets in near neighbouring countries.

Required capabilities and competencies

South Australian food and beverages companies need to develop competencies to exploit state-of-art packaging solutions. The economic scale in South Australia is probably too limited to suffice alone to create enough demand for advanced packaging solutions. A national model should be promoted.

Companies producing packages for luxury and premium products utilise different business models. In general, the closer the material supplier is to the packed product business, the more involved they usually are. For example, in the area of cans and glass/plastic bottles large multinational companies, such as Crown, Allied Glass, O-I Glass and Amcor are present, supported by packaging designers (ThreeBrand, Webb DeVlam, PET Engineering, etc.), while there are few smaller companies producing, for example, plastic films, paper and paperboard specifically for luxury packages.

Typically, large international film, carton and label converters, such as Multi Packaging Solutions for cartons, have their own design departments and a set of converting and printing processes available for such materials. Alternatively, converters are specialised in a narrower material sector, and they act as subcontractors for packaging solutions providers. Solutions providers, such as MW Luxury Packaging and HH Deluxe Packaging, typically combine design, material suppliers, (manual) finishing, and delivery around the world. Some of these companies have also focused on secondary packages (such as boxes for bottles).

As the local packaging industry cannot supply sophisticated packaging solutions, these capabilities need to be developed. The first step towards initiating national and local activities would be to promote Australian luxury and functional products through domestic and international campaigns. This would eventually result in a need for advanced packaging solutions, making Australia - and South Australia specifically - an attractive market for converting companies, certain packaging material producers, and their suppliers to invest in new production facilities and material solutions or upgrading their current facilities for packaging grades.

Such a change also provides possibilities for a move towards sustainable bio- and fibre-based packaging materials, although the volumes are not necessarily large without a similar step occurring in bulk products, supporting new technologies and/or legislation.

In addition, the proximity of Asia as a major supplier of these materials could assist this development. There are already several domestic design companies in Australia, however it could also be possible to attract international packaging solution providers to open their offices in South Australia or to establish local ones in South Australia with an adequate customer base. This could

eventually increase the use of local packaging materials, although the more labour intensive process steps will likely need to be carried out in near neighbouring countries with lower labour costs. In addition, in order to provide traceability solutions, a shared capability between the companies in the delivery chain needs to be developed.

An important aspect of luxury packaging is to create an experience that is in line with the product. In the case of luxury products, the hedonic aspects especially need to be taken into account, while the utilitarian aspects are less important. Positive hedonic influence comes from the buying of luxury goods for enjoyment and stimulation, while utilitarian goods are items bought out of necessity and don't necessarily bring joy to the consumer. In order to understand hedonic aspects of luxury foods in detail, it is important to determine the mental and visual attributes consumers associate with the luxury package in question. Experience mapping is one possible way of understanding and visualising how well consumer perception and the values of the brand owner/producer of the product connect with each other.

A possible innovation centre could also facilitate packaging-related service research, training, equipment and facility rental with technical support etc.

Key enabling technologies

In active packaging, the key technologies to explore are absorbing and scavenging systems, releasing systems, and systems where substances are grafted or immobilized onto the wall of the package. Technologies such as antioxidative and antimicrobial systems should also be explored.

Active packaging is an extension of the protection function of traditional food packaging, and is designed to contain a component that enables the release or absorption of substances into or from the packaged food, or the environment surrounding the food. Active packaging involves use of an active system that can maintain the shelf life of a product or extend it. It is based on the interaction between the molecules in packaging and the product packed. Packaging that contains absorbers (silica gel, oxygen absorbers, and odour absorbers) or releasers (preservatives, flavours, aerosols, antioxidants) fall in this category.

In intelligent packaging, the important technologies include the different types of food packaging indicators and food packaging sensors. Intelligent packaging is an extension of the communication function of traditional food packaging, and communicates information to the consumer based on its ability to sense, detect, or record changes in the product or its environment. In many cases, it incorporates electronic devices onto the packaging system. For example, the sensors on the package can record the temperature or pH on the product through the supply chain. The capability to apply RFID technology to monitor storage conditions (temperature, humidity, light) and food quality through the entire supply chain has become available. Some sensor types need to be inserted into the inner side of the package, while others can be placed outside.

RFID technologies are used in the supply chain to track and control the movement and handling of raw materials and products with great precision throughout several processes along the supply chain. RFID is grouped under the term Automatic Identification (Auto ID), together with barcodes, QR-codes, magnetic inks etc. Auto ID technologies are a relatively new method of providing information and/or controlling material flow, and are particularly suitable for large production networks such as food supply chains. Auto ID technologies do not provide qualitative or quantitative information about the product quality status; they are typically applied for purposes such as identification, automatisisation, theft prevention or counterfeit protection.

Table 13. Active and intelligent packaging functions.

Need	Solution
Shelf life extension	Active packaging. Antimicrobial packaging. Developments of integrated systems include oxygen scavengers in packaging material such as closure seal liners.
Indicators for both time and temperature abuse	Time and temperature indicators that allow indicating any changes during storage
Ability to indicate ideal temperature of the food and beverage	Thermochromic inks
Food or beverage deterioration and spoilage by oxygen	Oxygen scavenger, oxygen indicators
Microbial contamination indication	Freshness indicators and sensors
Ability to track and trace products through the supply chain	Use of RFID's and custom sensor technology to improve stock taking, product replenishment and unit price adjustment

Oxygen is known to adversely influence the microbial and flavour stability of foodstuffs such as cheese and meat products, juices, margarine, ketchup, beer, wine etc. The first oxygen scavenging systems were sachets in the packaging. Today oxygen scavenging labels such as ATCO® labels from Laboratories STANDA and Ageless® labels (Mitsubishi Gas Chemical Company, Inc.) are available. The trend in commercial applications is to incorporate oxygen scavengers to the packaging material. Examples include Cryovac® OS2000 (Sealed Air Corporation, USA), a polymer based oxygen scavenging multilayer flexible film activated by ionising radiation. RPC Bebo Plastik GmbH has launched a rigid oxygen scavenging system consisting of high barrier container made in PP/EVOH/PP for the ready meals market.

Antimicrobial packaging, particularly silver-based materials, has had success in Japan and USA. An important number of antimicrobial silver-based masterbatches are available in the market: Biomaster®, Aglon®, Irgaguard®, Surfacine®, IonPure®, d2p®, Bactiblock®. LINPAC Packaging Ltd., with Addmaster, developed antimicrobial trays and liddings to reduce the growth of pathogens such as salmonella, escherichia coli and campylobacter in fresh meat. The FoodTouch® product from Microbeguard Corp. is an antimicrobial paper that keeps perishable foods fresher longer, and works well to preserve the natural colour and texture of raw proteins (including seafood and meat). SANICO® (Laboratories STANDA) is a natamycin-based antifungal coating for sausages. Mitsubishi-Kagaku Foods Corp. has developed Wasaouro™ an antimicrobial material containing allyl isothiocyanate substance, and is available in a variety of formats (sheets, labels and films).

Time Temperature Indicators that are available in the market are based on physical, chemical, enzymatic or biological processes and include 3M Monitor Mark® (3M Company), Keep-it® (Keep-it Technologies), Fresh-Check® (Temptime Corp.), VITSAB® (VITSAB International AB), OnVu® (Freshpoint), TopCryo® (TRACEO), FreshCode® (Varcod Ltd.), Tempix® (Tempix AB). As an example, OnVu™ indicators contain a pigment that changes colour over time at temperature dependant rates. The indicator is activated by exposure to UV light to become dark blue, and the colour gradually fades with time. This system can be applied as a label or printed directly onto the package.

Integrity indicators are time indicators that provide information about how long a product has been opened. The label is activated at the moment of consumption. When the seal is broken, it triggers a timer and results in a colour change as time progresses. Some commercial examples are Timestrip®

(Timestrip Ltd.), Novas[®] Embedded Label (Insignia Technologies Ltd.), and Best-by[™] (FreshPoint Lab.).

Among the various types of gas indicators, oxygen indicators are the most common. Ageless Eye[®] tablets (Mitsubishi Gas Chemical Company, Inc.) are reversible oxygen indicators used in combination with oxygen absorbers. EMCO Packaging has launched non-reversible oxygen indicator labels. FreshPoint Lab. has presented O2Sense[™] indicator label to detect leakages in MAP packages.

Freshness indicators monitor the quality of the packed food by reacting to changes taking place in the food product during storage. Food spoilage is a complex process due to the heterogeneity of the individual material compositions and processing conditions. Changes in the concentration of substances such as glucose, organic acids, ethanol, carbon dioxide, biogenic amines, volatile nitrogen compounds or sulphuric compounds indicate microbial growth can be used as freshness indicators. It is not known whether any freshness sensor is currently commercially available.

Track and trace technologies using RFID's and sensors have the potential to reduce losses from counterfeit products, protect consumers by managing recalls more efficiently and reducing negative economic impacts, comply with food contact material regulations, and to provide relevant information to consumers in real time. These technologies are useful across multiple segments. Track and trace can be exploited in food and consumer products - and practically any product that can be sold in a deceptive or broken state. The main advantages of RFID over barcodes are that they allow remote control (because line-of-sight is usually not required), multiple items can be monitored at the same time, and they have capacity to store diverse information (origin, process parameters, commercial information, etc.) allowing a unique identification of the product.

There are a number of RFID suppliers, such as EPSILIA (Canada), RFID Enabled solutions Inc. (USA), and HRAFN Ltd. (Sweden), that have worked together with meat and fish industries to implement RFID systems. More evolved RFID systems also allow the integration of other functions into the RFID tag, such as time-temperature indicators and sensors to monitor and communicate the temperature history and quality information of the product. The combined use of RFID and sensor technology applied to the cold chain results in an improvement in supply chain management efficiency and in less waste.

Some examples of reusable TT sensor tags for the cold chain are Easy2log[®] (CAEN RFID Srl), sensor tag CS8304 (Convergence Systems Ltd.), and TempTRIP sensor tags (TempTRIP LLC). Some packaging manufacturers have incorporated RFID systems into their food boxes. Mondi Plc has presented its Intelligent Box, an RFID-enabled corrugated case that is equipped with an RFID tag at case level, enabling it to be traced throughout the entire supply chain.

Solutions based on augmented reality (AR) will also be important in developing local competencies in the luxury food segment. Augmented Reality (AR) is the technique of superimposing virtual objects in the user's view of the real world, providing a novel visualisation technology for a wide range of applications. Hence, it is a user interface technology that combines the perception of real environments with digital, virtual information. Rapid development has been taking place in this area in the past few years, and new demonstrations and commercial applications appear constantly.

The growing use of mobile devices such as smartphones and tablets are affecting people's attitudes towards constantly being online and having access to web services. Consumers are increasingly used to getting updated information based on their instant needs using these devices. In the case of luxury products, AR provides a possibility for sophisticated combinations of the physical and digital worlds.

In addition to the hedonic aspects of luxury packaging, user acceptance and readiness to use technology is an important factor to consider when bringing any novel solution to the market. There may be clear cultural differences in the way people perceive and experience the use of technology. In general, there are three main factors affecting the user acceptance of mobile services: perceived value of the service, perceived ease of use, and trust. Through involving the users/consumers in the development process of new service concepts (for example by using participatory design, co-creation models) it is possible to discover the major differences between different cultural areas and identify the most important issues in consumer attitudes in the very early stages of the development process, enabling designers to take these into account during service design.

Required infrastructure and ecosystem

- Information and communication technology service providers
- Luxury packaging design, especially for local and Asian markets
- Approval procedures and laboratory trials before commercialisation
- Research and development partnerships with research providers for packaging development
- Markets, new technologies and legislation to support bio-based materials
- Suppliers for packaging materials and special solutions, converters
- Management across supply chains and related data/routines
- A large enough sector of companies producing luxury foods

Companies in the field (active and intelligent packaging):

There is currently a vast amount of development in smart packaging technologies. The most developed and used technology is in the food and beverage industry. A non-exhaustive list of these is provided in Table 13.

Table 14. Key companies in active and intelligent packaging business.

Liquid and moisture absorbers	Sealed Air Corporation, McAirLaid Inc, Linpac Packaging
Time-temperature monitoring	3M Company, Temptime Corp., Vitsab International, Freshpoint, TRACEO, Tempix
Oxygen scavenger	Clariant Ltd, Multisorb Technologies, Standa Laboratories, Mitsubishi Gas Chemical, Sealed Air Corporation, Emco packaging systems
Oxygen monitoring	Mitsubishi Gas Chemical, Powdertech International
Ethylene scavenger	Peakfresh, RETARDER SRL, Molecular Products Limited, Evert-Fresh Corporation, Ethylene Control, Inc.
Carbon dioxide emitters	CO2 Technologies, Paper Pak Industries, Vartdal Plastindustri AS
Freshness monitoring	COX Technologies, Food Quality Sensor International, SIRA Technologies, Toxin Alert
Ripeness indicator	Ripesense Limited
Seal and leak indicators	Mitsubishi Gas Chemical, Freshpoint Lab., Insignia Technologies
RFID	Smarttrac, Confidex
Antimicrobial packaging	BASF, Linpac Packaging, Microbeguard Corp., Standa Laboratories, Mitsubishi-Kagaku Foods Corp., Life Materials Technology Ltd.
Tamper-evident indicators	3M Company
Authenticity	Sinfotech.it s.r.l.s.
Others: susceptors, steam valves	Sirane, VacPac, Avery Dennison Corp., SEALPAC GmbH

Pathway 4: Luxury food business strategy uptake and export promotion

Figure 25. Group work output for Pathway 4: Branding and differentiation.

Pathway 4: Branding and differentiation

Vision: Underpin the success of individual SA brands & to be recognised alongside other global luxury brands & destinations

Steps:

1. Understand the (luxury & functional) consumer/customer → profiling → educate producers on concepts of luxury experiences & offerings
2. Defining your appropriate brand hierarchy (by market) e.g. Australia, → Brand → Region (state largely irrelevant for Australia); language is important! All Australian food & wine & tourism is good (not just luxury)
3. Define, articulate, communicate your differentiated "offer" → the value proposition
4. Back your winners e.g. brands, regions for the greater good: inspiration, leadership, halo effect

Actors:

- PIRSA / State government / federal government – whether SA Brand is / isn't relevant in Australia
- Individual enterprises – where do you want to play?
- R&D organisations (partially functional), educational institutions

22/10/2015

5

Background

Specific export activities need to be developed within South Australian food companies to exploit opportunities in the Asian luxury food markets. The most important export targets, with already existing export activities, include: China, Hong Kong, Singapore, Japan, Malaysia, South Korea, India and Indonesia.

General needs and requirements

There is need to develop a luxury food product offering which responds to identified luxury food demand in Asia. Asian food export from South Australia could be led by fish and seafood production, followed by e.g. dairy and other farming products. Phase 1 of this study found that South Australia contributed 19% of the total value of Australian fisheries production in 2012-2013, the main luxury and premium products being Southern rock lobster and abalone. The main export products also include tuna, prawns, Southern rock lobster and abalone. For example, Japan and Hong Kong are already the major destinations for South Australian fisheries exports, accounting for 57% and 23% of the total value of exports in 2012–13.

Existing best practices include export business in live rock lobster to China, in which South Australia has already demonstrated significant competence. South Australia also has advanced export competencies in oyster farming. However, in both of these segments, the players are relatively small and fragmented.

Marketing activities need to be initiated to enter and establish channels to key markets. The specific emphasis in this export program should be to adopt best available marketing approaches for the specific needs for the luxury food market.

The pathway group work also suggests developing a cluster of luxury food producers, supported by a sophisticated export promotion ecosystem including packaging, design, cultural insight etc. to scale up trading towards 5% of food and wine in luxury category.

Potential customers and markets

The potential customers are luxury food consumers (typically high net worth individuals), corporate gift giving plus the occasional situational purchase in Asia, and selected high-end restaurants.

Required capabilities and competencies for the luxury food companies

Marketing skills including e-commerce

Knowledge of luxury food marketing channels such as prestige magazines or events is needed. In countries where e-commerce is an important element of the retail experience (such as China) luxury brands should consider their e-commerce presence when entering the market. Local social platforms and targets should align with local retail culture.

Narrative creation and 'story-making'

As noted in Phase 1 of this study, the use of experiences and meanings related to food and beverages is an effective method to create value, and widely used by experienced entrepreneurs, such as luxury wine makers. This can include elements such as economics (price, brand), environment (durability, sustainability), societal aspects (communality, ethical values), usability (quality, complexity) and personal aspects (experience, usefulness, life management), which convey new reasons for customers to use and buy things, including using e-commerce solutions.

Design expertise for high-profile packaging and labels

As the present packaging supply, and packaging and luxury branding expertise is rather limited in South Australia, there is need to diversify supply towards higher quality packaging to meet specific demands.

Cultural and historical expertise

As discussed in detail in the Functional and Luxury Project Literature Review and the 'Luxury Foods' section of this Reference Report, attitudes to luxury food consumption are often determined by the prevailing cultures and dietary tastes in each country. In China, for example, many types of luxury seafood are consumed partly because of their links with a range of Chinese cultural beliefs, such as traditional Chinese medicine. As many markets outside China (such as Singapore and Malaysia) have large Chinese populations or draw cultural cues from China (such as Korea), these Chinese cultural ideas regarding luxury foods are present in a broad range of markets. In order to be successful, luxury brands must adapt to local consumer preferences and target retail and marketing strategies to appeal to the target consumer groups.

Highly personalised customer relationship management

According to Tanya Oakey⁵⁵, luxury consumers have increasingly high expectations of what their experience with the brand should be like. Whilst previously the quality and lure of the products alone could tempt buyers, today's customers expect more. Developing an emotional attachment between the brand and the customer is vital to the survival and growth of the luxury retailer, and is

⁵⁵ http://www.cegid.co.uk/blog/clienteling-crm_luxury-success.asp

one way to retain and cultivate brand loyalty. To do this, it is important to ensure that prestigious clientele have a personalised and memorable shopping experience.

Attracting new clients, retaining loyal ones and continuously delivering a service which exceeds their ever-growing expectations can be a challenge. By keeping a carefully maintained history of purchases, preferences, likes and dislikes, companies are able to develop accurate and detailed insight to deliver a personalised service which is synonymous with flawless customer service, customer retention, and a unified and memorable brand experience.

Key enabling technologies

Anti-counterfeiting and tracing technologies

Roughly 7-10% of the global trade is in counterfeit goods, half of which is in luxury products⁵⁶. Food fraud involves, for example, wine and other spirits, milk, fish and caviar, olive oil, truffles and truffle oil, saffron, honey, cheese, ham and balsamic vinegar. Counterfeiting and tampering undermines consumers' trust in the product, leading to a loss of market share, and can even risk the health of consumers⁵⁷. Therefore effective measures are needed for the prevention of counterfeiting. These include anti-counterfeiting and tracing technologies. These have been discussed in detail in the Functional and Luxury Project Literature Review, and in the 'Food Innovation and Technology' section of this Reference Report (see also Pathway 3, above).

Consumer and behavioural science, and related scientific areas

Since consumer preferences vary in different countries, it is of utmost importance to recognise the local preferences, for example regarding packaging material, colour and finish as well as labelling information. Consumer studies, which are now beginning to utilise neuroscience research, are often performed to identify these local preferences. Marketers can now use brain imaging technologies to discover how people make decisions about products, including luxury foods, by testing the level of 'grey matter' in the brain (neuromarketing). One example is a study of wine consumption, where functional MRI scanning showed that people with greater grey matter volume in the striatum (the part of the brain involved in processing rewards) responded more easily to the marketing placebo effect. These people were more responsive to perceived rewards; if the wine is expensive it is perceived as good. Participants with a higher grey matter volume in their prefrontal cortex (the part of the brain involved in decision making, social behaviour, and personality) were also susceptible to the placebo effect, whereas those who had more grey matter in the posterior part of the insula (the part of the brain involved in sensory processing), weren't quite as easily influenced. Such people know when they taste good wine and can't easily be tricked by a price tag (Plassman et al. 2008). The scanning technologies required for neuromarketing are expensive, limiting the number of volunteers that can be involved, and the grey matter in the brain does not remain constant throughout a person's lifetime. As such, it is unlikely that neuromarketing will ever replace more traditional consumer studies; however, it can be used as an additional tool.

Required infrastructure and ecosystem

A supportive infrastructure would involve a network of trade agents in the target market countries capable of identifying potential luxury food customers.

⁵⁶ <http://www.foodproductiondaily.com/Packaging/Intelligent-label-protects-foods-against-counterfeiting-and-tampering>

⁵⁷ <http://www.prnewswire.com/news-releases/anti-counterfeit-food-packaging-market-is-expected-to-reach-625-billion-globally-by-2020---allied-market-research-505328461.html>

There is a need to train companies in dealing with technical regulations, standards, and conformity assessment procedures and labelling rules. Food companies (due to their small size) need help in interpreting and fulfilling the various overseas standards in order to succeed in exporting. Collaboration and support programs are necessary because initiating export activities remains a challenge for most small and medium sized enterprises if they need to rely only on their own capabilities.

Austrade provides useful information about export markets, grants, free trade agreements and how to expand the business outside Australia. This service is free of charge to Australian companies. Austrade also offers a range of tailored trade services supporting Australian business exporting to growth and emerging markets in Africa, Asia, the Middle East, Latin America, and Russia⁵⁸.

Among South Australian wine and cheese producers, business cases were identified which have produced premium and luxury product items successfully. A well-known example is Henschke's Hill of Grace vineyard in Eden Valley⁵⁹.

An example of successful penetration of new markets is the story of how French wine became famous in China/Asia:

The interest of the rich Chinese people for Bordeaux wines is quite recent. Before, they were much more into spirits and beers. The trade was already important in the early 2000 but it was with the vintage 2010 that things seemed to explode with +100% increase in the Chinese sales⁶⁰. The sudden interest of the Chinese for the French Grand Crus, is a collateral benefit of their global interest for the prestigious French brands (LVMH, Hermes, etc.). It is the French culture in its apparent exclusive character, they seem to be after. So the question is: why is Bordeaux more successful than any other region?

Robert Parker's system of ranking made Bordeaux wines glorious in the USA and the owners of the Bordeaux estates richer than ever. Parker succeeded better with Bordeaux than with any other region as he was welcome and supported by the owners. It was a two-way deal. Bordeaux had the chance to be the first. Parker's system of ranking is easy to understand: the grade and the price are very much correlated. So the guru of wine came to China and brought the Bordeaux wines with him. Proof of the mutual interests of Parker and China, Parker sold his newspaper to Chinese Singaporean investors⁶¹.

The most probable answer to the question of how French wines became famous in other parts of the world would be that the country-of-origin effect, together with good promotion in these markets, contributed to their success.

Why are Australian wines not perceived to be the same as French wines? The problem with Australia and other new world countries is their image as mass producers. The quality is not being questioned, Australian wine is simply perceived by English markets to be a mass produced product and the lack of exclusivity also makes these wines less attractive to the Chinese market. This is more a feeling, or a perception than a reality, but the perception is stubborn: what overseas consumers remember of

⁵⁸ <http://www.austrade.gov.au/australian>

⁵⁹ <http://henschke.com.au/vineyards/hill-of-grace>

⁶⁰ <http://www.red-obsession.com/work/>

⁶¹ <http://www.grapewallofchina.com/2012/12/11/view-from-china-robot-parker-sells-wine-advocate-stake-to-singapore-investors/>

the Australian wine industry are the big brands produced in factories the Australians call wineries. Similar facilities do exist in France but they are not as famous as Petrus, Mouton, Lafite or Haut Brion with their rather small, elitist production.

Australian (or any other country) estates would be assisted in changing the perception of their exclusivity by:

1. Choosing a qualitative region away from the big production areas.
2. Delivering hospitality at the estate of the highest standards.
3. Doing the utmost to have the wine selected in the best restaurants abroad (distribution). In addition to this, try to be associated with prestigious sportive and/or social events.
4. Develop a genuine story as the 'gene' of a unique identity for the wine. Levantine Hill is a good example⁶²:

The absence of 'old roots' is obviously a disadvantage. Very good and prestigious Californian wines, sold for \$200+ in the USA, cannot find efficient distributors in Asia. The only recognised American wine in China is Screaming Eagle.

Companies in the field

Companies in the luxury area were listed in the 'Luxury Foods' section of this Reference Report.

Luxury food brand marketing

A detailed analysis of the luxury food products (wine, chocolates, caviar, truffles, lobster, oyster, tuna, abalone, cheese and Wagyu) regarding their provenance, pricing, publicity, position, persona, personage, paucity, performance and packaging is shown in the 'Luxury Foods' section of this Reference Report.

⁶² <http://www.levantinehill.com.au/>

Pathway 5: Luxury wine driven culinary tourism

Figure 26. Group work output for Pathway 5: Food tourism for Asian consumers.

Pathway 5: Food tourism for Asian consumers

Pathway revised: Luxury food tourism experiences with food, wine, beverages at its core for consumers (incl. Asians)

Vision: SA to be recognised as Australia's leading destination for luxury food & wine experiences

1. Educate ourselves on what luxury consumers want
 - Ask affluent Asians/consumers
 - Use pool of OZ students (what would their parents like to do while here?)
 - What is SATC/ATC doing via research in this area
 - Raise our sights above what we are already seeing
 - Use imaginations to find "new" hotspots: new product/experience
2. Engage with businesses
 - who wants to be involved (not for everyone)
 - how can you collaborate with other businesses to develop the experiences
 - Partnerships/links
3. Identify the unique luxury experiences we have in SA (e.g. charter snapper fishing, Grange flights)
4. Change our mindset
 - To accept some people will pay extremely much for experiences
 - Get past what we think is exclusive, and take it up a level (e.g. will pay for a personal valet for 4 days; will charter jets/helicopters etc.)
 - Research some examples of what is happening in this space elsewhere in the world (service + products) for people money rich & time poor
5. Educate SA government on this industry being a long term proposition
6. SA to have major investment in luxury accommodation + transport + associated infrastructure

22/10/2018

5

Background

One of the opportunities for South Australia identified by this research project is the combination of luxury food products with food and wine tourism. A particular target group for this strategy would be Asian consumers.

Research has shown that tourists spend almost 40% of their budget on food when travelling. Globally, half of restaurants' revenue is generated by tourists. Cuisine and gastronomy also have a great impact on travellers' decisions when choosing their vacation destination. There is, therefore, a natural, symbiotic relationship between tourism and food which can be exploited to open new markets.

Food can be used as an effective tool to position a destination and to build its image. Enjoying food and wine, while travelling, gratifies all the human senses – visual, tactile, auditory, gustatory (taste), and olfactory (smell). Food is strongly linked with the overall vacation experience and can also serve as a gateway to understanding local culture. Perceived authenticity of local food and wine produce has the potential to enhance this experience by connecting the visitor to the heart of the region and its cultural heritage. Multiple concepts have been used in this space including food tourism/wine tourism, culinary tourism, special interest tourism, and foodways/wine routes (Shenoy 2005).

With this pathway it is important to acknowledge that the notion of 'luxury' is primarily based on experience, meaning that although the use of certain expensive luxury items could create an 'aura of luxury' around some item or practice, the luxury factor is something that primarily operates at the

register of emotional experience. Therefore, building an experience of luxury in a regional context requires specialised actions and alignment of the following factors:

1. The region should have relevant regional infrastructure and services in order to endorse the selected regional brand promise; this includes hotels that fulfil the luxury standard.
2. There should be a capability to build suitable service packages that combine several fields of activities (e.g. wine, sports, luxury hotel infrastructure and services, restaurants, scenery, local travelling) and deliver at level of regional brand promise.
3. Consideration and planning needs to be given to creating an holistic experience that could suit many luxury tastes, including traditional luxury (such as use of global luxury products) and also more experimental luxury experiences, such as adventure travelling. For example, Holohan and Remaud (2014) have argued in their study of the Bordeaux wine region that utilisation of an eco-friendly lifestyle, including eco-friendly products, contributes positively to the experience of overall luxury among the tourists in the region of Bordeaux.

General targets

The general target approaches for this pathway could include development of a comprehensive offering for combined luxury food and wine tourism in South Australia, covering all aspects of the service experience including travel, accommodation, food and wine, other activities such as culture, entertainment etc. According to a recent empirical study, 12 categories of experience are identified with culinary tourism including food and beverages (Minihan 2014):

1. Learning and knowledge: testing, tasting, training etc.
2. Physical setting: mood, ambience etc.
3. Entertainment and local culture: music, local culture, art etc.
4. Food / beverage quality: freshness, consistency etc.
5. Quantity
6. Variety: menu flavours etc.
7. Backstage access: brewery tours etc.
8. Senses beyond taste: visual sense
9. Sustainability
10. Target market
11. Differentiation: locally owned, location, design, identity etc.
12. Social media presence / technology: marketing etc.

This list highlights the comprehensiveness of culinary tourism experiences in covering the multiple aspects needed to provide superior service.

As noted in Phase 1 of this study, food tourism is a growing market, comprising travellers seeking the authenticity of the places they visit through food. The Eat Local SA program for consumers and premium wine and food tours serve as a good basis for further development of South Australia's food tourism and promotion of South Australia as a luxury food region.

Enhanced promotion of South Australia as a luxury food and wine destination could expand the inbound tourism opportunity. It is crucial to acknowledge that tourists seeking luxury experience are not a homogeneous group, except in the sense that they are ready to pay big sums of money for memorable experiences.

The initial focus for South Australia should be given culinary tourism, including wine tourism (see Karim and Chi 2010). For example, Beames (2003) has argued there are possibilities in the Australian wine industry, but several bottlenecks have hindered development to date. These include: the current cottage industry mentality of wine tourism, the lack of inter-industry cooperation between the wine industry and the tourism industry, creating an overall tourist experience rather than seeing wine tourism as cellar door sales, local planning and development consent issues, lack of investment funds, and lack of available data, information and research (Beames 2003: 207).

One overall solution for the bottlenecks identified by Beames (2003) would be to develop experience economy in the context of wine tourism, as suggested by Quadri-Fellitti and Fiore (2012). They propose the use of 4E strategy utilised in experience economy studies. The “Es” here stand for: entertainment, education, esthetic and escapist (see Figure 27). What is important in this context is that luxury experience should be understood as series of differentiated experiences that are captured by the 4Es model. Thus, when building a luxury wine and food tourism strategy for South Australia, the 4Es should be considered: there are luxury tourists that seek luxury in a more traditional sense, but there are also tourists that seek a combination of traditional luxury and unique experiences.

Figure 27. 4E model of experience economy in the context of wine tourism (adapted from Quadri-Fellitti and Fiore 2012:8).

<p style="text-align: center;">Entertainment <i>Tourists are engaged by performance.</i></p> <ul style="list-style-type: none"> • Cellar concerts, music in vineyard • Wine blending demonstrations • Farm & food demonstrations • Museum & heritage site visits 	<p style="text-align: center;">Education <i>Tourists enhance their knowledge or skills.</i></p> <ul style="list-style-type: none"> • Wine tasting & seminars • Culinary-wine pairing events • Home wine making seminars • Cooking & craft making classes
<p style="text-align: center;">Esthetics <i>Tourists are enriched by sensual environments.</i></p> <ul style="list-style-type: none"> • Consuming the “winescape” • Enjoying unique lodging (B&B) and wines • Driving rural roads lined with vineyards • Art & craft fairs at wineries 	<p style="text-align: center;">Escapist <i>Tourists become engrossed by participating in a different time of place.</i></p> <ul style="list-style-type: none"> • Vineyard hiking, cycling tours • Hot air ballooning over vineyards • Vineyard tour by horse & carriage • Harvesting grapes, riding a grape picker

Espousing the feeling of luxury is always a combination of different ideas. Thus, it not just wine or a particular food that brings the tourists to a destination, but the overall combination of different factors. For example, Carmichael (2005) has found that the experience of the local landscape is of particular importance for wine tourists. Bruwer and Alant (2009) have found in an empirical study that the most important single factor that endorses the wine experience is the region’s scenery. Other contributing factors are friendly people and their hospitality, overall ambience and the diversity of wine estates in the region. They conclude that these results point to the fact that wine tourists seek an overall hedonic experience.

This pathway discussion group suggested that South Australia could adopt a wider strategy of culinary tourism, including wine and food experiences. Culinary tourism can be defined as a form of “tourism where an opportunity for memorable food and drink experiences contribute significantly to travel motivation and behaviour” (Wong 2006, cited in Harrington and Ottenbacher 2010).

In addition, a study by Kivela and Crofts (2006: 354) empirically shows “that gastronomy plays a major role in the way tourists experience the destination, and indicate that *some travellers would return to the same destination to savour its unique gastronomy*” (emphasis added). The notion of uniqueness is critical here. The luxury experience is significantly based on the *feeling of uniqueness*, not of luxury that is available everywhere and for everyone. Uniqueness should be the keyword when planning a strategy for the South Australia, not the generic notion of global brand luxury. In this sense the culinary tourism can be perceived as a service package for the regional branding of South Australia as a “unique and differentiated culinary region”.

One perspective for building a differentiated, unique and experimental regional strategy in culinary tourism is shown in Gyimóthy and Mykletun’s (2009) study of the Voss region in Norway. This region has formed a novel strategy for building their regional brand, focusing on branding the region as a source of “meal adventures” in the field of heritage food.

In this case, the crux of the experience is a dish called “smalahove” (a salted, dried, smoked and cooked sheep head) that authors describe as “scary food”. Based on feedback from tourists, the region has built a strategy around a local heritage food and “meal adventures”, and the researchers found that it has contributed positively to the regional brand. This strategy seems to work especially in the more remote rural settings. Therefore, one part of the luxury experience in South Australia could also be built around local specialities, that is, certain dishes or habits. These kinds of local experiences should complement the overall luxury experience, and make it more varied for the heterogeneous luxury tourists seeking differentiated luxury experiences.

South Australia currently lacks a critical piece of infrastructure, namely luxury hotels and accommodation. Hotels are a critical component in the luxury experience chain, and it is likely that the current standard of hotels, and related services, do not currently comply with the expectations of the luxury-seeking customer.

Steps to be complete in the mid-term include: creation of unified definitions for products, building stronger understanding and utilisation of the cultural heritage, development of relevant infrastructure and related services, intensified co-operation among industry stakeholders (producers, hotels, travel agents etc.), and ensuring the sustainability and the maintenance of high quality services and products. A related mid-term target would be to create new service products for health and wellbeing tourism. A long term target is the development of South Australia and its sub-regions (e.g. wine areas) as recognised destinations for food and wine tourism.

Potential customers and markets

The potential customers are high net worth individuals in Asia who are willing to explore food and wine in the origin of its production. Consumers of luxury products can be segmented by making a distinction between “über wealthy”, “mass elite”, and “medium luxury” groups (Hallott 2013).

The über wealthy group comprises the world’s financial elite with a minimum annual income of \$1million. The mass elite consist of major businesspeople, officials, and heirs of capital whose wealth is based predominantly on stocks, shares and property. The third group, medium luxury, are high salary workers and affluent middle class whose luxury consumption is more typically based on credit.

The conventional segmentation of potential customers for luxury products assumes a rather linear relationship between the wealth of the individual and his/her consumption pattern. More recently, a pattern of hybridisation has been observed among the consumers closer to the mid income range. These ‘hybrid consumers’ are willing to trade up and purchase luxury products if these are perceived to offer experience and gain higher status amongst their peers (Leppanen & Gronroos 2009). One

potential customer group for luxury tourism and hospitality can thus be mid-income individuals with a desire to experience a once in a lifetime opportunity.

Japan and Australia have traditionally been the sources for highest numbers of luxury tourists in the Asia-Pacific region. More recently, large emerging markets, most notably China and India, have been increasing rapidly. According to one market intelligence estimate, there are 8,300 individuals in China with CNY 1 billion or more in assets in 2014 (Hurun Report & ILTM Asia 2014). The majority of these high net worth individuals are residents of the largest metropolitan areas - Beijing, Shanghai, Guangzhou and Shenzhen. For these wealthy Chinese, travel is the preferred leisure activity for their average 18-22 annual vacation days. Wine tasting is among the top ten most popular activities with 10% of the Chinese rich showing preference to it. Other leisure activities which can be combined with a tourism offering are fishing (8%) and yachting/sailing (4%). The sports preferred by wealthy Chinese are swimming (37%), golf (23%) and yoga (22%).

Potential revenue streams in 3–5 years

In three to five years' time, the biggest revenue streams will come from Asian customers with a willingness to consume sophisticated, high-priced services in South Australia.

Required capabilities and competencies

- Travel and accommodation services. Attracting luxury travellers requires provision of premium accommodation and travel services. Currently there are only a few facilities in South Australia which qualify for the highest category of service level in luxury hotels and premium villa rental.
- Food and wine services at vineyards and restaurants.
- Food and wine events. Events such as wine and food festivals provide opportunities for local communities to establish a destination identity as they can 'promote the importance of local tourism resources to the outside world'.
- Other activities (e.g. culture, entertainment, sports)
- Social media. Among potential Chinese luxury tourist customers, online social media, particularly micro-messaging and micro-blogging, is the most popular source of information, with more than half of respondents to this survey expressing a preference for this channel. TV and newspapers follow only in the second and third place (Hurun Report & ILTM Asia 2014).
- Marketing and media. One potential channel to boost the attraction of South Australia as a destination for culinary tourism is through Australian cooking programmes and reality TV contests (e.g. Master Chef Australia) which are relatively widely broadcast in many countries.

Key enabling technologies

- Media and marketing technologies
- Online media, social media tools
- Smart logistics

Required infrastructure and ecosystem

Luxury tourism services comprise three main categories which all are needed to provide an exclusive experience to a customer (Howarth HTL 2011).

Accommodation

- Classic luxury hotels (e.g. The Pierre in NYC, The Ritz in Paris)
- Boutique or designer hotels (The Bulgari in Milan)

- Destination hotels with exceptional surroundings (Monasterio in Cuzco)
- Resorts and spas: beach hotels, golf hotels, mountain hotels, lodges and retreats
- Vacation-ownership properties and self-catering villas

Transportation

- Air, including private charter flights and helicopter chartering
- Rail, both for travelling between destinations with most providers offering first class carriages, or as part of the holiday itself (e.g. Orient Express)
- Water, with luxury cruises a growing luxury segment
- Road, transportation between home and destination ranging from limousine services and valet parking to executive car rentals

Experience and activities

- Tours: art, history and shopping are key themes that drive the organisation of travel
- Outdoors: sailing, skiing, adventure and wildlife are special-interest outdoor activities that are becoming increasingly popular in luxury travel

Companies in the field

- Wine producers
- Restaurants
- Exclusive accommodation providers: e.g. Kangaroo Beach Lodges, Southern Ocean Lodge, Sea Dragon Lodge

Functional Foods

This section of the Reference Report collates the work undertaken through the project on functional foods, including the PESTLE analysis and tables of main actors in specific markets. The context for this work is described in the Reference Report sections covering the value chain analysis, company assessment, market analysis (see also separate reports and Functional and Luxury Project Literature Review), technology assessment and pathway development group work.

NOTES:

1. Some sections of the initial phases of the project combine analyses for both functional and luxury foods. Check the lists of tables and figures for this Reference Report to locate this information.
2. Some sections of information already included elsewhere in this report are reproduced here where they provide context or essential detail required for interpretation of the information provided.

Introduction

In Phase 1 of this project, the South Australian companies interviewed were found to produce a limited amount of strictly defined functional foods, but have a large range of different healthy and health promoting products, which may or may not have technically added or removed components.

Table A1: Functional foods in South Australia.

Products		Value Chain Participants			
		Trade agents / Importers/ Distributors	Ingredient Manufacturers	Food Manufacturers	Retailers
Functional Ingredients	PUFA Ingredients	Forever living products (FLP)	Solar Eggs, Unilever, Stonyfield Farm, Al Rawabi Dairy, Saputo, Valle, Aldi, Foodland, Target, Vandemoortele Izegem, Alcampo, Gay Lea, Gloria Jeans		N/A
	Probiotics	BettaLife Distributors, Born organics, Parmalat, Fleurieu Milk & Yoghurt Company, B-D Farm Paris Creek, Probiotec		AVO Trading Pty Ltd	
	Prebiotics	BettaLife Distributors, Born organics, Parmalat, Fleurieu Milk & Yoghurt Company, B-D Farm Paris Creek, Probiotec		AVO Trading Pty Ltd	
	Carotenoids			NTS Health, Specialty FoodsGo Vita, West Lakes Healthy Life	
	Aloe Vera Extract	Forever living products (FLP),Organic Aloe Vera, Ten Acre Trading, Priority Health		NTS Health, Specialty FoodsGo Vita, West Lakes Healthy Life	
	Polyphenols and Flavonoids	Forever living products		NTS Health, Specialty Foods, Go Vita, West Lakes Healthy Life	
	Indigenous Plant Extracts	Tumbeela Native Bushfoods, Perry's Lemon Myrtle Store, Footside Farm, Chuulangun Aboriginal Corporation (working with University of South Australia),ITEK Ventures, Galeru Pty Ltd			
Products		Value Chain Participants			

		Trade agents / Importers/ Distributors	Ingredient Manufacturers	Food Manufacturers	Retailers	Food Service
Anti-allergenic Foods	Gluten-Free Foods	Rilka's Real Foods, 1-2-3 Gluten Free, Healthy Life, Rainbow Tree, Health Elements Walkerville, Go Vita - Ingle Farm, Go Vita - Fairview Green, College of Mind Body and Spirit, Butch's Smallgoods, Copperpot, Golden North Ice Cream, Heidelberg Cakes			Just GF shop, Walkerville Meat Store, Goodies and Grains, Foodland	Enzos at Home, Press, Swedish Tarts, Maiz and Mezcal, Lifestyle Bakery
	Lactose Free Foods	Lidells, Slape and Sons, Go Vita - Ingle Farm, Go Vita - Fairview Green, College of Mind Body and Spirit, Butch's Smallgoods, Copperpot, Golden North Ice Cream, Heidelberg Cakes			Yumi's Gluten & Dairy Free, Foodland, Coles, Woolworths, IGA, Supa IGA	N/A
	Other anti-allergen foods	Rilka's Real Foods, 1-2-3 Gluten Free, Healthy Life, Rainbow Tree, Health Elements Walkerville, Go Vita - Ingle Farm, Go Vita - Fairview Green, College of Mind Body and Spirit, Butch's Smallgoods, Copperpot, Golden North Ice Cream, Heidelberg Cakes, Slape and sons			Yumi's Gluten & Dairy Free, Foodland, Coles, Woolworths, IGA, Supa IGA	

Opportunities in functional food

The key opportunities in functional food markets are driven by growing living standards, increasing health awareness, increasing health care expenditures, aging populations, and the increased incidence of medical disorders such as metabolic syndrome.

The main functional food opportunities are identified as:

- Food ingredients, such as dairy based ingredients (e.g. proteins, calcium, vitamin D)
- Free-from products (lactose and gluten free)
- By-products of wine processing (polyphenols and flavonoids)
- Photochemical and plant extracts (carotenoids from algae, indigenous plant extracts and aloe vera extracts)

The functional food opportunities are listed in Table A2.

In addition, opportunities for functional food ingredients in non-food applications, such as in (natural) cosmetics, are worth investigating further. Successful examples of utilising high value plant-based ingredients include Jurlique (<http://www.jurlique.com.au/>) and Lumene (<http://www.lumene.com/>). Some of the mentioned examples may not be currently in the focus of South Australian businesses, but given the future-oriented nature of the research, they are mentioned here as they show examples of global growth potential or radical new opportunities.

Collaboration with universities, research organisations and associations could further strengthen the functional food production. For example, Dairy Australia assists manufacturers to understand science on how and why to produce functional dairy foods.

The Functional and Luxury Project Literature Review identified that Australia in general, and South Australia in particular, is regarded as a key player in the food industry in the region. This is because,

historically, Australia has developed itself into a large export-oriented agricultural sector, with strong growth in food, beverage and commodity exports to Asia. Also, Australia’s connections through geographic proximity and trade, and investment and cultural links to the fast growing Asia-Pacific region, offer cost effective service compared to competitors in Europe and North America.

Both these conditions favour South Australia’s position to develop the functional food sector. Building on the current situation, South Australia can be a stable and reliable long-term supplier of fresh produce offering counter-seasonal availability in the Asia-Pacific region.

Table A2. Functional Food Opportunities.

Opportunity area by ingredient	Health Benefit	Comments
Poly-unsaturated fatty acids (PUFAs)	Cardiovascular health, brain health, general health	South Australia’s large aquaculture industry ^{63 64} is a prime sourcing point to provide marine based fish oil to the industry. The region also produces sizeable quantities of flax for development of the vegetarian omega-3 space. ⁶⁵ However DSM controls the global market for omega-3 products and is an aggressive competitor.
Dairy based ingredients- dairy proteins, bioactive peptides, milk oligosaccharides, calcium, vitamin D ⁶⁶	Digestive health, bone health, weight management, blood pressure	Downstream processing of South Australia’s dairy exports provides a large market opportunity for functional dairy ingredients such as proteins and peptides. Dairy companies such as Fonterra (NZ) are revamping their dairy ingredients business to offer fortified dairy products.
Probiotics (health promoting microbes)	Digestive health, immune health	Most probiotic products are produced by dairy industry (e.g. yoghurts, drinks). However yoghurt, the primary end use segment, is an aggressively competitive market with most traditional food manufacturers also competing. Product differentiation will be key for probiotics. There is today an increasing trend for non-dairy probiotic foods (e.g. cereal based, fruit/vegetable juices etc.)
Prebiotic and other fibres (prebiotics are fibres that specifically promote the growth of certain gut microbes)	Digestive health, immune health	South Australia has a large grain industry ⁶⁷ which is a key source of resistant starch for dietary fibre. There would be potential to produce also other cereal fibre products. Jerusalem artichoke is one key source of prebiotics. However the prebiotic market is also witnessing an influx of new raw material sources, e.g. avocado extract and (Manuka) honey to

⁶³Department of Agriculture. (2012). *Australian food statistics 2012–13*. Department of Agriculture.

⁶⁴Regional Development Australia. (2013). *Sustainable Food and Wine Project Discussion Paper 6 – Seafood & Aquaculture*. Regional Development Australia.

⁶⁵PIRSA. (n.d.). *A History of Agriculture in South Australia*. Retrieved May 7, 2015, from http://www.pir.sa.gov.au/aghistor/minor_crops

⁶⁶Regional Development Australia. (2013). *Sustainable Food and Wine Project Discussion Paper 4 - Dairy*. Regional Development Australia.

⁶⁷Regional Development Australia. (2013). *Sustainable Food and Wine Project Discussion Paper 2 - Grain*. Regional Development Australia.

Opportunity area by ingredient	Health Benefit	Comments
		compete with the ethnic prebiotic trend. Aggressive competition will be observed.
Aloe Vera extract	Digestive health, cardiovascular health, immune health, bone health	South Australia is a key Aloe Vera producer and could benefit from growing demand for Aloe Vera beverages globally. ⁶⁸
Soy based-derivatives		No cultivation of soy in South Australia but downstream processing using existing technology is an option on importing soy from other states.
Physterols	Digestive health, cardiovascular health, immune health	Utilise the canola oil industry to develop phytosterol extraction capability.
Carotenoids		South Australia has a variety of agricultural sources of carotenoids and in addition has a growing algal carotenoid production industry
Polyphenols and flavonoids (aside from those in Soy)		Large wine industry provides key raw material source for polyphenols and flavonoids in addition to the presence of these products in other fruits and vegetables grown in the region.
Polysaccharidic fibres (beta-glucan)		Small oat producing industry could be used as a raw material source for beta-glucan production
Indigenous plant extracts *)	Antioxidants, cardiovascular health, immune health, micronutrient supplementation, bone health	<p>Australia possesses a wide expanse of indigenous ingredients with potential capabilities and existing small scale production of functional food extracts. These ingredients vary from Lemon Myrtle, typically used as a flavourant but with high sources of dietary calcium (possible bone health drinks) to Anise myrtle with high lutein concentrations (eye health potential).</p> <p>The success of this opportunity depends on the development of research for the local industry to world standards. These include methods such as:</p> <ol style="list-style-type: none"> 1. Developing the technology needed to grow Australian plants commercially in SA 2. Creating an analytical program to identify the active ingredients of South Australian plants 3. Developing a breeding program to increase the active ingredients of plants 4. Conducting clinical trials to prove the efficacy of these ingredients to improve health outcomes

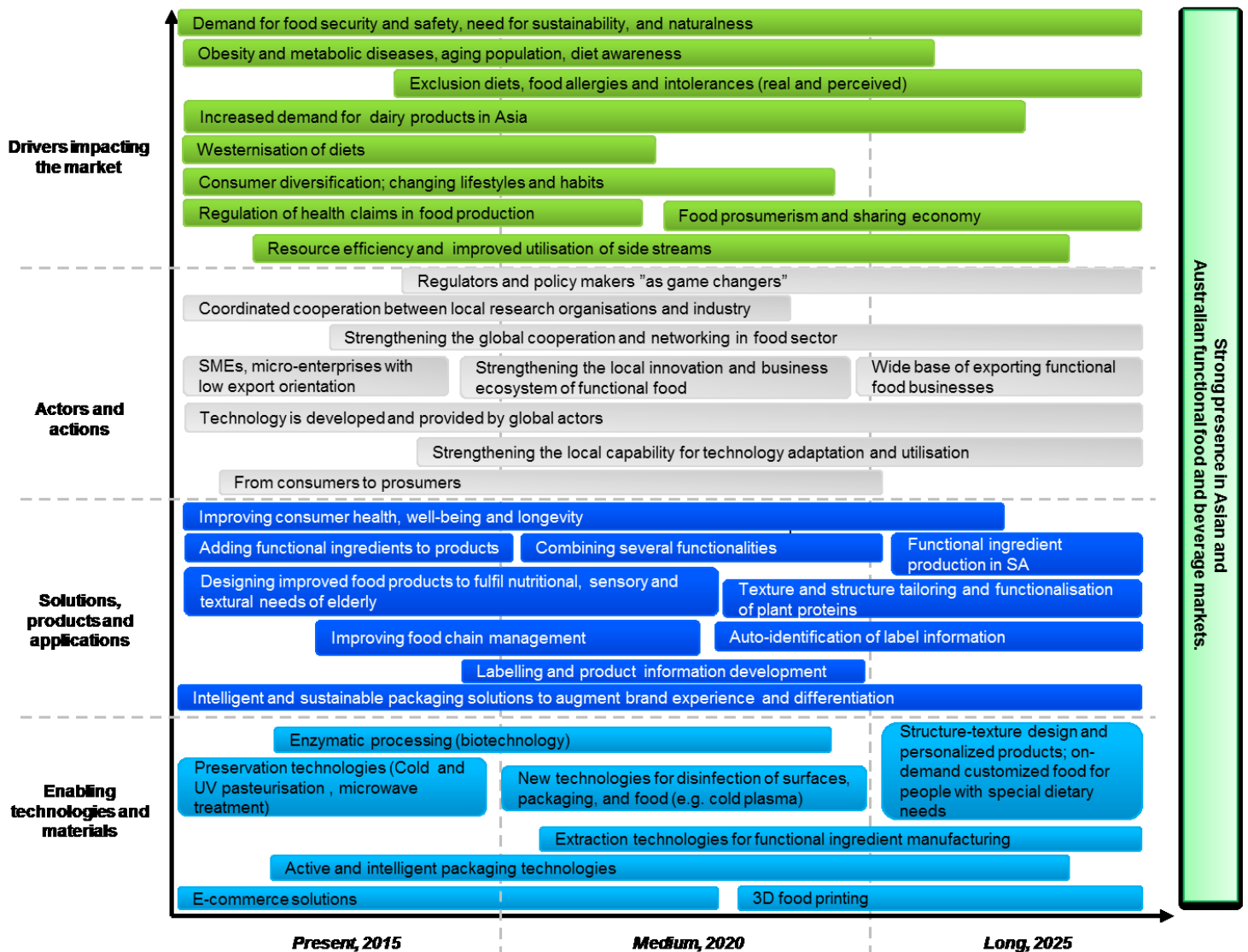
⁶⁸Regional Development Australia. (2013). *Sustainable Food and Wine Project Discussion Paper 3 - Horticulture*. Regional Development Australia.

*) e.g. Lemon Myrtle, Anise Myrtle, Tasmanian Pepperberry, Queensland Davidson's Plum, Bush Tomato, Wattleseed, Quandong, Australian Desert Lime, Kakadu Plum, Lemon Aspen, Riberry.

Roadmap for functional food

The preliminary functional food roadmap is presented in Figure A1. Food industry development is heavily driven by changing consumer needs, lifestyles, trends and food preferences. Drivers, trends and changing markets are presented in the top level of the roadmaps. One portrayal of food trends for 2015 is found in Figure A2 on the following page.

Figure A2. Preliminary roadmap for functional food.



Trends

With the help of food innovation and technology, different groups with special nutritional needs can be better served; for example, the aging population is one of the quickest growing consumer groups all over the world. This progression is especially strong in Japan where the proportion of seniors in the population is the greatest among the OECD countries (OECD, 2014). The amount of food eaten often diminishes along with aging, but there should be enough energy, protein, fibre and vitamins (especially vitamin D) even in small food portions. The means to enrich the nutrient

content of a meal without increasing the portion size can be done, for example, by fortifying meals with good quality fibres (e.g. pea or oat fibre) and protein concentrates and fats (Heiniö et al., 2014). Seniors also consider good food packaging to be packaging that is easy to open without tools (Heiniö et al., 2014) – here packaging development and innovation plays a crucial role (see also the ‘Packaging’ section of this Reference Report).

Figure A2. Ten important food trends in 2015 (modified from Mellentin, 2014).



More current global trends impacting food industry are listed in *Food Technology* journal by the Institute of Food Technologists (Sloan, 2015⁶⁹) and by Baum & Whiteman (2015):

Demand for fresh food

Nearly nine in 10 adults (87%) feel that fresh foods are healthier, and 80% believe that they are tastier; 78% of consumers are making a significant effort to eat more fresh versus processed foods (Technomic, 2014a).

Over the past 10 years, consumption of fresh foods grew 20% to more than 100 billion ‘eatings’ per year. Shoppers are buying more fresh ingredients, up 10% versus three years ago (FMI, 2014). Shoppers also like to cook more from scratch. Consumers increasingly link fresh foods to specific nutritional attributes; 75% of ‘millennials’ associate meat with protein and iron; 62%, with energy; and 53%, with building physical strength (FMI, 2015).

Changing lifestyles and eating habits

Changes in lifestyles, eating patterns, and demographics are creating new rules for marketing and packaging and are motivating new food product purchases.

⁶⁹ Statistical references in this section are indirect sources from Sloan, 2015.

Today, more and more eating occasions are alone. Even in multi-person households, 39% of eating occasions are solo (Hartman, 2013). Even if people like fresh food and cooking, the family meal continues to erode. Only 27% of family meals include children.

However, in 28% of families, the family members will eat the same meal for dinner even if they each eat alone and at different times (Hartman, 2013). Developing food products for consumers to take to eat away from home is another fast-emerging opportunity. In 2014, 23% of consumers brought lunch from home, and 8% brought breakfast (FMI, 2014).

The motivation for each specific snack and mini-meal occasion represents a new series of market differentiators for the explosive snack and on-the-go meal sector. Yoghurt, bakery snacks, bars, dairy products, and fruit-based smoothies are the top morning snacks; salty snacks, snack nuts, chocolate candy, crackers, and cookies are popular in the afternoon (Wyatt, 2014).

Health is an important snack selection factor for half (50%) of adults (Technomic, 2014b). Refrigerated juices/drinks, smoothies, yoghurt, nutrition bars, trail mixes, specialty nut butters, and popcorn were among the fastest-growing healthy snacks in 2013 (Wyatt, 2014). Nearly half of consumers (45%) look for snacks that go beyond basic nutrition (Wyatt, 2014). One in five people buy snacks for an energy boost or to improve their mood; 17% do so to manage weight (Nielsen, 2015). Therefore the functional food industry has lots of opportunities in snack development.

Exclusion diets

Consumers are experimenting with alternative eating styles. In 2014, one third of adults tried a specialty regimen, while 8% tried gluten-free, 7% tried lactose-free, 6% tried raw/living foods, 5% tried dairy-free, and 5% tried a juice cleanse (FMI, 2014).

Eggs are one of the most popular meat alternatives, prepared by 78% of consumers, 61% serve beans, lentils, or legumes, 28% serve veggie burgers, 28% serve quinoa/other whole grains, 18% serve seeds/nuts, and 14% serve tofu or tempeh (FMI, 2015). Seventeen percent of adults are making some effort to follow a partially vegetarian diet; those aged 18–24 are most likely to do so. The number of consumers who avoid all animal products is also growing.

In 2014, 44% of adults felt gluten-free foods were healthier, down from 60% in 2012 (Technomic, 2014a). Gluten-free products currently account for less than 1% of total bakery sales (IDDBA, 2015). Food restrictions, intolerances or allergies have a lot of influence on food choices for one in 10 shoppers (Packaged Facts, 2014a). Food allergies in children are on the rise; 4.1 million kids under the age of 17 suffer from diagnosed food allergies. Milk, peanuts, tree nuts, eggs, fish, crustacean shellfish, wheat, and soy remain the “big 8” allergens (U.S. Dept. of Health and Human Services, 2013). Food intolerance was the second-fastest-growing global positioning for functional foods and beverages (Euromonitor, 2014).

Natural food

Consumers want more local foods and beverages, more natural foods, and more minimally processed foods with a minimal amount of preservatives.

For example, natural sweeteners (e.g., agave, honey, concentrated fruit juice, and maple syrup) are among the hot culinary ingredients for 2015 (NRA, 2014). Sustainability is also a significant issue, for example in seafood, and the seafood industry’s focus on seafood sustainability has been growing for more than a decade. Oysters are among the biggest trends in current luxury food domain; Baum & Whiteman (2015) argue that oysters are currently being rediscovered and products being

modernised. Trendsetters eat oysters with lemongrass cocktail sauce, kimchi or exotic dressings such as chorizo butter.

Whole food

When ingredients that deliver healthy whole food nutrition match up with cutting-edge culinary trends, the results are interesting. Food businesses could take more advantage of the added nutritional benefits when featuring fruits, vegetables, grains, nuts, legumes, or seeds.

While gluten-free has drawn attention to digestive issues, its biggest long term benefit may be the attention it has brought to ancient, ethnic, and alternative whole grains and flours. Fibre and whole grain are among the most sought after food ingredients, and shoppers want to switch to healthier bread, healthier pasta and healthier crackers (FMI, 2014).

Similarly, non-wheat noodles and pasta (e.g., quinoa, rice, or buckwheat) and non-wheat flours (e.g. peanut, millet, barley, and rice) are in the top list of side dish culinary trends. High protein nuts and seeds are also making significant nutritional contributions to a wide variety of products, ranging from cereal and oatmeal to bars and beverages.

Ready meals

Consumers spend less time preparing meals than they have previously. Meals that stretch the meat component (e.g., pasta, soup, casseroles) are the key products within this trend. Younger shoppers are also more likely to have increased their consumption of ethnic dishes, and marinated and value-added meats (FMI, 2015).

Take-and-bake fresh pizzas and assemble-at-home bakery products are still very hot trends (IDDBA, 2015), but consumers are also paying more attention to nutrition of their meals. Offering more flavoured basics (e.g. pasta, butter) that replace the need for a variety of spices is another significant trend.

Dieting and weight watching

More and more consumers are watching their diet for general health reasons, to lose weight, to limit, fat, sugar, sodium, etc., to prevent future medical issues or to treat a current medical condition, and for a real or perceived food allergy or intolerance (Packaged Facts, 2014).

For example in the U.S., 66 million adults are trying to lose weight and 31.7 million are trying to maintain their weight. Simultaneously, vitamin D, vitamin C, calcium, omega-3s, and B vitamins top the list of nutrients consumers are making a significant effort to consume. Potassium, magnesium, choline, fibre, prebiotics, and iron are the hot 'up-and-coming' nutritionals. Fortified with vitamins/minerals are among the 'must have' beverage attributes for 2015 (Jacobsen, 2015). There is also growing interest in more heavily fortified and 'complete' meal replacement foods and drinks. These trends emphasise the widening opportunities for functional foods.

Increasing use of technology

Baum & Whiteman (2015) choose technology to be the food trend of the year 2015 and beyond. Especially in restaurants, we're immersed in 'front-facing technology' or 'guest-facing technology': all sorts of devices and programs that interface directly with the consumer. Businesses experiment, for example, with tablets, electronic wallets and smartphones. Convenience and speed are obvious benefits.

However, the real drivers are, firstly, new generations of customers who want to customise everything in sight, and secondly, increasing labour costs tied to health care and living wage advocacy. When labour gets too expensive, previously unaffordable technology can become more

attractive. On the more radical front, by using wearable technology such as Google Glass or Microsoft HoloLens face recognition software, restaurants, hospitality venues and food shops can provide their customers with new experiences and personalised service.

As noted in the technology assessment, digitalisation affects the whole value chain of food business, from raw materials to product development, processing, packaging, logistics, distribution, marketing and sales. Digitalisation helps to manage the enterprise more efficiently (e.g. PwC, 2011), it creates market opportunities for food companies by connecting them with digitally empowered customers and by improving understanding of needs of consumers in emerging markets, and enables value chain transformation.

Prosumerism

Prosumers are today's leading influencers and market drivers⁷⁰. Prosumerism refers to the phenomenon that today's consumer is no longer a 'passive market', instead he or she can become involved in the design and manufacture of products, so products could be made to individual specification.

This shift from consumers to prosumers is already happening in many market areas, including food (Gunellus, 2010; Troye et al., 2012). Beyond their own economic impact, prosumers are important because they influence the brand choices and consumption behaviours of others.

Prosumerism has links to mass customisation, in which everybody is in effect a member of a niche market; something Internet e-commerce is encouraging through cutting out the middleman between maker and buyer⁷¹. 3D printing is also among the enabling technologies of prosumer and mass customisation movement.

In the context of wider socioeconomic development, prosumerism is a part of the 'sharing economy' (see Dervodeja et al. 2013), a socio-economic system that is built around the sharing of human and physical resources which actualises in peer to peer transactions, in leasing and sharing business models, and in changes in consumer behaviour.

Private sector innovation and start-up companies have an important role in building the sharing economy as brokers and facilitators between peers; they allow consumers to fulfil new roles and tasks that are normally conducted by businesses. The trend of business models for sharing and leasing has several implications. The trend anticipates:

- a) the lowering costs of products, especially luxury and rarely used products
- b) the reduction of risks and responsibilities of customers compared to ownership
- c) increasing importance of customer service (e.g. the capability to maintain and repair products) - food is said to be the next frontier for the sharing economy (Kamenez, 2013)

The impacts of these factors are most tangible in the case of food waste. Globally, 30 to 50% of all food produced is lost or wasted between crop and plate—that's between 1.2 and 2 billion tons. The consumer-side food surplus could be an opportunity for the new sharing economy; innovative start-ups are already helping consumers get rid of unused, but still edible food.

For example (Kamenez, 2013), Ampleharvest.org connects home gardeners with food pantries and has given away more than 20 million tons of produce, while Casserole is a site currently operating in

⁷⁰ Prosumer report, <http://prosumer-report.com/sharing-economy/>, accessed 27.8.2015.

⁷¹ Entrepreneurial Insights, Feb 15, 2015, <http://www.entrepreneurial-insights.com/mass-customization-what-why-how/>, accessed 27.8.2015.

two towns in the county of Surrey, England, and allows home cooks to give away extra portions of a meal they are cooking. So far the Casserole site is serving a number of elderly people (like peer to peer Meals on Wheels). Foodsharing is a German site that allows individuals, retailers, farmers, and restaurants to post and give away unused food; Le Loca is an app that allows restaurants with unused seats (and unused portions of lasagne) to offer steep last-minute discounts to eager diners.

Regulation

For the functional food industry, regulation is one of the key drivers. Regulation both protects consumers and promotes innovation and ensures fair competition. In the context of this study it impacts especially on nutrition and health claims of functional food.

When food business operators market their products, they wish to be able to highlight the particular beneficial effects of the products in relation to health and nutrition on the product label or in advertising. Rules on nutrition and health claims vary in different countries, for example European Union established its legal framework in 2007⁷². Regulation applies, for example, to nutrition claims such as 'low fat', 'high fibre' and to health claims such as 'Vitamin D is needed for the development of bone'. The objective of these rules is to ensure that any claim made on a food's labelling, presentation or advertising is clear, accurate and based on scientific evidence.

In Australia, a new standard to regulate nutrition content claims and health claims on food labels and in advertisements became law in 2013. Food businesses had to comply with the new standard⁷³ from 18 January 2016.

Understanding and complying with the regulations in Asian target markets requires expertise and, in many countries in recent years, the regulation framework has undergone substantial changes. For example, in Japan, the FOSHU (Foods for Specific Health Uses) regime has been strict and often deemed costly – in 2015-2016 it is undergoing wide changes that will open up the market and increase competition.

Actors and actions

Actors and actions are found in the middle level of roadmap (Figure A1). Currently, less than 10% of South Australian food companies operate in the functional food domain (see the 'Industry Analysis' section of this Reference Report) and their products represent mainly the standard functional food such as oats, juices with vitamins, added calcium or gluten-free foods, and high quality and premium products with some luxury elements.

The key objective for current actors is to create more value added products from local raw materials and increase both local and national market presence and in Asian export markets.

Most of the technology and equipment used in South Australia comes from overseas and global technology providers continue to be the main actors in technology development. Both limited funds and limited local know-how have restricted the spreading of new food technologies and innovations in this State, and the key objective related to technology is to strengthen local capabilities in technology utilisation.

Consumers, as active food ecosystem actors, will play an important role in the future. As noted above, consumers are becoming prosumers who influence and lead future markets. 'Foodies' –

⁷² European Commission, 2015, http://ec.europa.eu/food/safety/labelling_nutrition/claims/index_en.htm, accessed 27.8.2015.

⁷³ Standard 1.2.7 - Nutrition, Health and Related Claims, <https://www.comlaw.gov.au/Series/F2013L00054>, accessed 27.8.2015.

people with a particular interest in food and beverages – are already an important movement shaping the frontiers of both specialty and mainstream foods. People generally enjoy talking about new or interesting foods, watching cooking shows, purchasing specialty foods for everyday home meals, and trying new menu items in restaurants (Sloan, 2013). The main objectives for consumers include both improving their health, well-being and longevity (functional) and experiences and accomplishment (luxury).

Solutions, product and applications in functional food

Generally, the development of functional food with physiological beneficial effects contributes to the societal challenges related to health, demographic change and wellbeing. In South Australia, in the short term, this basically refers to adding functional ingredients to products. In the long term, manufacturing functional ingredients is an opportunity, but only as a secondary target.

Main products include functional and lifestyle foods to meet diversifying requirements of consumers. The scope for such products and solutions is to develop functional foods aimed at meeting diversifying dietary requirements of different age groups, life styles and health conditions. This can be boosted, by combining several functionalities in one food product for example, such as proper textures, high nutritional quality and ease of use in the case of savoury foods, and having the capability to improve health, well-being and longevity (European Commission, 2014). In addition, functional food can positively influence various physiological pathways related to stress reduction (Hamer et al., 2005) or cognitive functions of human brains.

However, there are specific technical and industrial challenges, resulting mainly from gaps in technological capacities. To strengthen the capacity in this domain, attention should be paid to (modified from European Commission, 2014):

- Improving food products to fulfil nutritional, sensory and textural needs of the elderly and other special consumer groups.
- Development of food structures with physiological beneficial effects.
- Development of tailor-made products to support the 'healthy' gut microbiota.
- Improving effects of diet/dietary constituents in delaying/preventing the decline of cognitive functions in the aging human brain.
- Improving the understanding of the variation in human metabolic energy efficiency.
- Improving understanding on the role of diet, for example the effect of the mother's diet in pregnancy on the outcome of offspring, treatment of low-grade inflammation, drug delivery, etc.
- Development of food processing technologies for functionality and nutrient security.
- Development of logistics and e-commerce solutions needed for differentiated lifestyle food products.
-

Food packaging innovations and solutions target extending product shelf life, enhancing consumer convenience, and ensuring product safety and sustainability.

Enabling technologies for functional food

Enabling technologies, shown in the preliminary roadmap for functional foods (Figure A1) were assessed in Phase 2 of the project. In summary, the functional food segment is dependent on advanced manufacturing, advanced materials and industrial biotechnology, which may help in introducing more desirable traits in food by altering the food's structure or nutrients content (e.g. the tailored addition of components such as antioxidants at defined nano-scale quantities through the use of nano-emulsions, nano-composites, etc.) (European Commission, 2014).

Food processing technologies are needed for higher quality products, improved product safety, and longer shelf life (e.g. Non-thermal preservation technologies such as High Pressure Processing (HPP) and Pulsed Electric Field (PEF)). Biotechnology helps to deal with emerging challenges, including those arising from climate change, pressure on global food supplies and the management of pests and diseases, (for example, reducing chemical use).

In addition, specified functional ingredient production technologies, such as extraction, are needed in order to manufacture ingredients for functional food and widen South Australia’s capacity for operating in the functional food value chain. However, manufacturing functional ingredients is not seen as a main opportunity for South Australian food industry.

Market assessments for functional food

The following tables provide detailed assessments of the factors affecting the functional food market segment in specific markets: China, Hong Kong, Singapore, Japan, Malaysia, and South Korea.

China

The following analyses comprise:

- PESTLE for Functional Food in China
- Functional Food Actors in China

PESTLE analysis: Functional food in China

Functional food	PESTLE Analysis					
	Political	Economic	Socio-cultural	Technical	Legal	Environmental
PUFA Ingredients	<p>Stable government with an increasing focus on anti-corruption drives.</p> <p>Growing interest in outward FDI (foreign direct investment) to foster economic ties with the West.</p>	<p>Increasing affluence and disposable income of the Chinese population.</p> <p>GDP (gross domestic product) in 2013 grew at 7.7 %.</p> <p>6 % of GDP is spent on treating diseases driving rising expenditure on healthcare costs.</p>	<p>Large traditional fish consuming market finds it easy to accept the taste of omega-3 products.</p> <p>Population growing at 0.5 %.</p>	<p>Primarily based on fish oil concentration and extraction.</p> <p>Comparatively low IP protection available.</p> <p>Most international manufacturers co-brand to increase ingredient knowledge and prevent duplication.</p>	<p>Omega-3 ingredients have been approved for use as a novel food ingredient in food, beverages and infant formula.</p> <p>Adherence to the national standard for ingredient labelling.</p> <p>Launched omega-3 RDI's in 2014 for adults.</p>	<p>Increasing fears over lack of sustainable farming and inefficient oil extraction.</p>

Functional food	PESTLE Analysis					
	Political	Economic	Socio-cultural	Technical	Legal	Environmental
Probiotics and prebiotics	As above	As above	<p>Growing dairy consumption driving increasing demand for value added dairy products.</p> <p>Digestive health diseases affect over 22 % of the population.</p>	<p>Dependence on imported dairy reduces capability to develop its own products. Possess a large inulin source.</p> <p>Tends to duplicate technologies developed in Japan (which is the world leading country in probiotics).</p> <p>IP protection is sketchy and many copycat products are known to exist.</p>	Health benefits are currently unproven and sales are typically driven by word of mouth.	No major environmental concerns.
Carotenoids	As above	As above	<p>Increasing focus on antioxidant benefits and its potential health benefits drives interest in carotenoids .</p>	<p>Limited capability to develop product due to high levels of global competition.</p> <p>Tends to duplicate technologies.</p> <p>IP protection is sketchy and many copycat products are known to exist.</p>	No approved health claims in China resulting again in perceived value of products.	No major environmental concerns.
Aloe Vera Extract	As above	As above	<p>Aloe Vera is considered indigenous to China (though traditionally an African plant) and is popular in traditional medicine.</p>	<p>Large Aloe Vera production results in capability to produce locally.</p> <p>However lack of product differentiation will result in price competition.</p>	No approved health claims in China resulting again in perceived value of products.	No major environmental concerns.

Functional food	PESTLE Analysis					
	Political	Economic	Socio-cultural	Technical	Legal	Environmental
Polyphenols and Flavonoids	As above	As above	The “Chinese paradox” talks about green tea antioxidants being responsible for lower cancer rates in China in spite of a high number of smokers.	Large production results in capability to produce locally. Lack of product differentiation will result in price competition.	No approved health claims in China resulting again in perceived value of products.	No major environmental concerns.
Indigenous Plant Extracts	As above	As above	40% of products are aimed at traditional medicine allowing for a population that is open to trying ethnic fortified food.	No real technology understanding. Potential to be a large consumer market for traditional extracts.	No approved health claims in China resulting again in perceived value of products.	No major environmental concerns.
Gluten-Free Foods	As above	As above	Low awareness of gluten free results in it being consumed mainly by the ex-pat population and by high income Chinese as a health food. Celiac disease is rare in China. ⁷⁴	No real consumer or technology understanding. Incidence of celiac disease is too low to induce volume based growth.		

⁷⁴ Cummins & Roberts-Thompson, 2009.

Functional food	PESTLE Analysis					
	Political	Economic	Socio-cultural	Technical	Legal	Environmental
Lactose Free Foods	As above	As above	Up to 90% of Chinese people (depending on the region) are lactose malabsorbers with various levels of intolerance symptoms ⁷⁵ ; alternatives are sought after.	Existence of many dairy substitutes in the traditional sector; Growing demand for dairy alternatives.	No widely-known health claims in China resulting again in perceived value of products.	No major environmental concerns
Anti-allergenic foods	As above	As above	Little to no social awareness on anti-allergen foods.	No real technology or consumer understanding.	No widely-approved health claims in China resulting again in perceived value of products.	No major environmental concerns

⁷⁵ Wang et al. 1984.

Functional food actors in China

Value Chain Actors of Functional Food in China					
Products	Trade agents / Importers/ Distributors	Ingredient Manufacturers	Food Manufacturers	Retailers	Food Service
PUFA Ingredients	Qingdao Samuels Industrial and Commercial Company, Ltd (imports Martek DHA for use in Feihe Dairy, Mengniu Dairy products), Hubei Fuxing Biotechnology, Ruihua Hexim International (Ocean Nutritions exclusive distributor selling to companies such as Wilmar China for cooking oil fortification), Neptune Technologies & Bioresources (local sales office)	Luhua Biomarine (Shandong) Co., Ltd, Huatai Biopharm, Inc, Shanghai Fully Biomedical Technology Co. Ltd, CA HealthCare Inc., Fujian Coland Enterprises Co Ltd, Guangdong Runke Bioengineering Co Ltd, Hebei Haiyuan Health Biological Science and Technology Co. Ltd, Jiangsu Auqi Marine Biotechnology Co. Ltd, Shandong Keruier Biological Products Co, Sinomega Biotech Engineering Co Ltd, Wuxi Xunda Marine Biological Products Co. Ltd., Zhejiang Shenzhou Marine Bio-Tech Co Ltd	Wilmar China, Canton American Flower Lounge Livestock Company (CAFL), Lark Dairies, Feihe Dairy, Yashili International Holdings Ltd	N/A	
Prebiotics	Sethic China (Orafti), Shandong Yuchenghuanyu Group, Shandong Tianlvyan, Shandong Duqing, Shenzhen Neptunus Bioengineering Co. Ltd, New Francisco Biotechnology Corporation (NFBC)	Jiangmen Quantum Hi-tech, Shandong Baolingbao, Yunnan Tianyuan, Yunnan New Francisco, Guangxi Huaaoli, Shangdong Longli, Shanxi Yishengyuan, Qinhai Weide Bio-tech, Jiangxi Jingcheng Tangchun, Jiangsu Liangfeng Fods, Shandong Tianmei Bio-tech	Mengniu Dairy Company, Yili Group Bright Dairy, Beijing Sanyuan Food Co. Ltd., Harbin Baiai Technology Co. Ltd., Shandong Longlive Biotechnology Public Co. Ltd., Kuaijishan Shaoxing Wine Co. Ltd.	Carrefour China, Wal-Mart China, Tesco China, China Resource Vanguard Co. Ltd, Lianhua Trading Group, 7-Eleven China, Lawson's China, City Shop Supermarket, Ole stores, Beijing Hualian Supermarket	
Probiotics	NBTY China, GNC China, Guangzhou Biostime Inc (along with Lallemand), Asia United (China) Medical Co. Limited (Biogaia)	<i>Culture producers:</i> DuPont China, Chr. Hansen China, Lallemand China, Harbin Meihua Biotechnology Co., GenMont Biotech Incorporation, Sinobio Technology (Shanghai) Co., Ltd. <i>Mainly supplement producers:</i> TSI Group Ltd, China-Biotics, Inc, Ltd, Hunan Kohl Biotechnology Co., Ltd, Sabinsa China (also synbiotic; combination of pro- and prebiotics)	Bright Dairy and Food, Guangzhou Biostime Inc (along with Lallemand), Inner Mongolia Mengniu Dairy Corporation, Inner Mongolia Yili Industrial Group Co., Ltd, Groupe Danone, Yakult China, Beijing Sanyuan Foods Co. Ltd, Hunan Taizina Dairy Co. Ltd, Weichuan China, Hangzhou Wahaha Group Co. Ltd., Guangxi Huangshi Dairy Co. Ltd., Guangzhou Zhujiang Meiluduo Drink Co. Ltd., Nanton Hongmei Dairy Co. Ltd.	Carrefour China, Wal-Mart China, Tesco China, China Resource Vanguard Co. Ltd, Lianhua Trading Group, 7-Eleven China, Lawson's China, City Shop Supermarket, Ole stores, Beijing Hualian Supermarket	N/A

Value Chain Actors of Functional Food in China					
Products	Trade agents / Importers/ Distributors	Ingredient Manufacturers	Food Manufacturers	Retailers	Food Service
Carotenoids	Xiamen Shengbao Trading Co. Ltd, Wuhan Yuancheng Gongchuang Technology Co. Ltd, Qingdao Sunrise Biotechnology Co. Ltd., Anhui Sino-Maple Import & Export Co., Ltd, Foodchem International Corporation, Maypro Industries, TSI Health Sciences	Zhejiang Medicine Co. Ltd., Xinchang Pharmaceutical Factory, Xinjiang Shengminghong Hongsuf Flower Development Co. Ltd, Zhejiang NHU Co. Ltd., Wuhan Stars Modern Bioengineering Co. Ltd., Inner Mongolia Lantai Industrial Co. Ltd, Bioengineering Branch Corporation IAAfud Industry (Zhuhai) Co. Ltd, LycoRed China	Hangzhou Wahaha Group, Want Want Holdings, Inner Mongolia Yili Industrial Group Co Ltd, Uni-President Enterprises Corp, Yangshengtang Co Ltd, China Culiangwang Beverages Holdings Ltd	N/A	
Aloe Vera Extract	Baoji Haoxiang Bio-Technology Co. Ltd., Changsha Nutra-Y Biotechnology Co. Ltd., Daxinganling Lingonberry Boreal Biotech Co. Ltd., Kingherbs Limited Lingonberry Group, FoodChem international	Wanlu Biology Company, Aloecorp China Co. Ltd, Yunnan Yuanjiang Evergreen Biological (Group) Co. Ltd, Guangzhou Yipintang biological detoxification Co. Ltd, Fujian Changle Jianyou Aloe Products Co. Ltd, Hainan Zhongchen Biological Engineering Co, Baoji Haoxiang Bio-technology Co. Ltd.	N/A		
Polyphenols and Flavonoids	DKSH China, China Sichuan Mingshan Haobo Biotech, Changde Busun Group, Baoji Haoxiang Bio-Technology Co. Ltd., Changsha Nutra-Y Biotechnology Co., Ltd., Daxinganling Lingonberry Boreal Biotech Co., Ltd., Kingherbs Limited, Lingonberry Group, FoodChem international	Naturex China, Ajinomoto OmniChem Natural Specialties China, Frutarom China - Shanghai, Tianjin Jianfeng Natural Products Co. Ltd (JF Naturals), Xian Haotian Bio-engineering Technology Co. Ltd, Sabinsa China, Huzhou Rongkai Foliage Extract Co. Ltd, Taiyo International, Yuyao Huidelong Biological co.Ltd.	Hangzhou Wahaha Group Want Want Holdings Inner Mongolia Yili Industrial Group Co Ltd, Uni-President Enterprises Corp, Yangshengtang Co Ltd, China Culiangwang Beverages Holdings Ltd	N/A	
Indigenous Plant Extracts	Currently no major sales but potential to use the plant extract suppliers (polyphenols and Aloe Vera to distribute indigenous extracts. Demand however will be mainly in the end product space initially.				
Gluten-Free Foods	Hutchison China Meditech Ltd, Xile Lier Co. Ltd, Shanghai Uniac Industrial Co., Ltd, Holy Flame International trade Ltd, China Realong Int'l Limited	BIOFarm, PEDON GROUP China, Gusto Fine Foods, Strictly Cookies, Mondelez China (Enjoy life foods), General Mills China, Amy's Kitchen china, Heinz China	LePIN stores, Jenny Lou's, April Gourmet, Cityshop, City Super, Fields China, Fresh Mart, Ole, Carrefour China, Wal-Mart China, Tesco China, China Resource Vanguard Co. Ltd, Lianhua Trading Group, 7-Eleven China, Lawson's China, City Shop Supermarket, Beijing Hualian Supermarket		Bastiaan Bakery May's Deli, Sprout lifestyle, Crowne Plaza, Hilton, Holiday Inn,

Value Chain Actors of Functional Food in China					
Products	Trade agents / Importers/ Distributors	Ingredient Manufacturers	Food Manufacturers	Retailers	Food Service
					Langham, Park Hyatt, Ritz-Carlton, Shangri-La, Sheraton
Lactose Free Foods	The Good Carb Food Company, Wuzhou Bingquan Industrial Shareholding Co. Ltd, Yeo Hiap Seng	Valio China, DSM Food specialities, Danone China, Yili Industrial Group Ltd, DuPont China, Rich Products Corporation, Vitasoy international Holdings, VV Group, Yang Xiecheng Co ltd, Soyspring Ltd, Want Want holdings	Cityshop, City Super, Fields China, Fresh Mart, Ole, Carrefour China, Wal-Mart China, Tesco China, China Resource Vanguard Co. Ltd, Lianhua Trading Group, 7-Eleven China, Lawson's China, City Shop Supermarket, Beijing Hualian Supermarket, Yihaodian, Tmall		Yong He, Starbucks China, Yum Brands, Costa Coffee China, Pacific Coffee Company, UBC Coffee China
Anti-allergen foods	Hutchison China Meditech Ltd, Xile Lier Co. Ltd, Shanghai Uniac Industrial Co. Ltd, Holy Flame International trade Ltd, China Realong Int'l Limited	BIOFarm, PEDON GROUP China, Gusto Fine Foods, Strictly Cookies, Mondelez China (Enjoy life foods), General Mills China, Amy's Kitchen China, Heinz China	Cityshop, City Super, Fields China, Fresh Mart, Ole, Carrefour China, Wal-Mart China, Tesco China, China Resource Vanguard Co. Ltd, Lianhua Trading Group, 7-Eleven China, Lawson's China, City Shop Supermarket, Beijing Hualian Supermarket, Yihaodian, Tmall		N/A

Hong Kong

The following analyses comprise:

- PESTLE for Functional Food in Hong Kong
- Functional Food Actors in Hong Kong

PESTLE analysis: Functional food in Hong Kong

Products	PESTLE Analysis					
	Political	Economic	Socio-cultural	Technological	Environmental	Legal
PUFA Ingredients	Mass protests in Hong Kong for democratisation of election threaten to disrupt its reputation as a haven for global investment	Hong Kong continues to be a top-rated economy in the world, although its economic freedom score declined by 0.5 point since 2014. It still remains as one of the most open economies for international trade and investment	Health awareness is on the rise in Hong Kong and this has fuelled the growth of health and wellness in the country. Hong Kong is one of the top spenders by household consumption on health ingredients such as omega-3.	Limited technical expertise present in the company for production of supplements containing PUFA.	No major environmental concerns	If products contain medicine or claim to have medicinal properties, then they are required to be registered as Pharmaceutical products. Rules also prohibit advertising claims that a product has curative or preventive effects. Manufacturers and sellers have to ensure that the food is fit for human consumption and comply with statutory requirements.
Probiotic	As above	As above	Health awareness is on the rise in Hong Kong and this has fuelled the growth of health and wellness in the country. Hong Kong is one of the top spenders by household consumption on healthy ingredients.	Market leaders in probiotics have presence in Hong Kong thus contributing to the technological capability of the country to produce probiotics.	As above	As above

Products	PESTLE Analysis					
	Political	Economic	Socio-cultural	Technological	Environmental	Legal
Prebiotic	As above	As above	As above	Limited technical expertise present in the company for production of supplements containing prebiotic	As above	As above
Carotenoids	As above	As above	As above	Nascent field in Hong Kong with companies like Lycogac involved in carotenoid extraction. Depends mostly on imported products from USA.	None-applicable	As above
Aloe Vera Extract	None-applicable	As above	Health awareness is on the rise in Hong Kong and this has fuelled the growth of health and wellness in the country. Aloe Vera based beverages have a good presence in the region.	No significant presence of domestic aloe vera extraction companies. Imports aloe vera based products from other countries.	None-applicable	As above
Polyphenols and Flavonoids	As above	As above	See probiotic	Limited technical expertise present in the company for domestic production of supplements containing polyphenols and flavonoids	No major environmental concerns	As above
Indigenous Plant Extracts	As above	As above	None-applicable	No significant domestic production found in Hong Kong	None-applicable	As above

Products	PESTLE Analysis					
	Political	Economic	Socio-cultural	Technological	Environmental	Legal
Anti-allergenic foods	As above	As above	Health awareness has contributed to more sales for health and wellness foods in Hong Kong.	Depends on imports for catering to the anti-allergenic food needs of the people	None-applicable	As above
Gluten Free	As above	None-applicable	A very recent trend in Hong Kong. Sales have been on the rise since last few years mostly due to increasing avoidance of carbohydrates in diets. Celiac disease probably rare as in China.	Support imports from around the world to provide consumers with high class gluten-free products	None-applicable	As above
Lactose Free	As above	None-applicable	In Hong Kong, lactose malabsorption is common like in China. Sales of lactose free products have been on the rise since last few years mostly due to increasing awareness of health issues.	Limited technical expertise present in the company for domestic production of food which is lactose-free	None-applicable	As above

Functional food actors in Hong Kong

PRODUCTS		Funcational Food Actors in Hong Kong				
		Trade agents / Importers	Ingredient Manufacturers	Food Manufacturers	Retailers	Food Service
Functional Ingredients	PUFA Ingredients	Merit Trading Co, aXimed HK Ltd, GNB Sourcing Co, Catalo Natural Health Foods Ltd, Rejuveno	Smiley Win (HK), Holding Ltd.	Catalo Natural, Health Foods Ltd, Usana Hong Kong Ltd, Rejuveno	Catalo Natural Health Foods Ltd	
	Prebiotic	Zeonglobal Ltd, Global Wellness Logistics Ltd	Optibac Probiotics	Aptamil (Germany), Optibac Probiotics		
	Probiotic	Merit Trading Co, Linberg's Limited, Global Wellness Logistics Ltd	Danisco, Chr Hansen, BioGaia, Cell biotech, Optibac Probiotics	Mead Johnson, Nutrition (Hong Kong) Ltd, HiPP, Hong Kong Yakult Co Ltd, Nestle Hong Kong Ltd	PARKnSHOP Wellcome	
	Carotenoids	RLSS Company Ltd	Solaray (USA), Nature's Life, BASF (USA), Lycogac International (HK)	Solaray (USA), Nature's Life, BASF (USA)		
	Aloe Vera Extract	Herbal-Extract-Supplier Co. Ltd, SPI West Port Group, Rokon Group Limited	Weldon Bio-Tech Co. Ltd., Herbal-Extract-Supplier Co. Ltd	OKF Corp (Korea), Alo (USA), Herbalife (Hong Kong)	King Golden Development Company Limited	Hong Kong Kim, Garry Restaurant
	Polyphenols and Flavonoids	Gold Fame Int'l Enterprises Co, Dentsu Development Co, aXimed HK Ltd, Reshine International Industry Co. Ltd, Hongkong Lenicc Co., Ltd.	Reshine International Industry Co. Ltd	Dr. Health Company Ltd, Yun Sheng (Hong Kong) Health, International Co Ltd, Usana Hong Kong Ltd	PARKnSHOP, Wellcome	
Free-from Foods	Anti-allergenic foods	Little Giant		Dr. Schär (Italy)	Corner Block Green Gourmet	

PRODUCTS		Funcational Food Actors in Hong Kong				
		Trade agents / Importers	Ingredient Manufacturers	Food Manufacturers	Retailers	Food Service
	Gluten Free	Hong Kong and Shanghai Wine and Spirits Company, Perry Commerce Limited, Organic Experience management Group		King Arthur Flour (USA), Nature's Path (USA), Orgran (Australia), Dr. Schär (Italy)	city'super Jasons - Food & Living, PARKnSHOP , Just Green, Little Giant, Green Gourmet	Life Café The Awakening Café Little Burro Posto Pubblico Grassroots Pantry
	Lactose Free	Apis Cerana Limited		Happy Cow, Dairy Farm Co. Ltd, GreenVitamin	PARKnSHOP , Just GREEN	Four Seasons Hotel

Singapore

The following analyses comprise:

- PESTLE for Functional Food in Singapore
- Functional Food Actors in Hong Kong

PESTLE analysis: Functional food in Singapore

	Political	Economic	Socio-cultural	Technological	Legal	Environmental
PUFA Ingredients	Health Promotion Board (HPB) in Singapore launched the Finest Food Programme in 2011, a one-stop resource hub to equip industry players venturing into the functional food market with the necessary knowledge and skill	Increasing wealth and a busier lifestyle has led to many Singaporean seeking health supplements and nutritional components to their daily meals, to stay on top of their recommended intakes. Many of these products are sold through multi-level marketing schemes. Large supermarkets and hypermarkets have begun to increase shelf space for organic/ health products thus increasing consumer acceptance of these products. Online procurement of these products is an increasing trend in this market. Consumers tend place a premium based on country of origin, with Australia, North America and Europe considered premium locations. There is an growing trend towards co-locating food service and food retail outlets specialising in health/organic foods.	The most popular association with formulated Omega-3 products is in infant formula, dairy products and eggs. <i>Probiotic</i> The strength of market leading brands (Yakult and Vitagen) has established a market for probiotics. Formula feeding is common; Infant formulas are typically enriched with probiotics <i>Prebiotic</i> Prebiotics such as Inulin and FOS are not as widely understood in terms of their health benefits. Given the high fibre content in Singaporean diets, the perceived need for dietary fibre as a formulated ingredient is low. Formula feeding is common; Infant formulas are typically enriched with prebiotics Prebiotics enjoy greater visibility in the health supplement markets, which should have a positive spill over effect into the mass consumer market.	Dominated by Multinationals, with mature formulation capabilities (micro encapsulations) Dominated by Multinationals, with mature formulation capabilities A*STAR's Genome Institute of Singapore (GIS) and Nutricia Research (Danone) have joined forces to investigate the health benefits of prebiotics, probiotics and synbiotics.	All health claims / nutrient function claims are regulated by the Ministry of Health which has detailed guidelines.	None Applicable
Probiotics & Prebiotics	The Health Promotion Board (HPB) also provides grants worth more than \$10,000 to Singapore's functional foods industry, which can be used by food manufacturers to tap the expertise of food scientists and turn ideas into market realities.					

	Political	Economic	Socio-cultural	Technological	Legal	Environmental
Carotenoids			Fairly under developed market. Significant scope for consumer education.	None Applicable		
Aloe Vera Extract			Typically consumed through beverages. Aloe Vera used in personal care is far more developed than its use in F&B formulated products.	None Applicable		
Polyphenol & Flavonoids			High penetration of green tea products in Singapore, the acceptance of polyphenols is very high. However polyphenol is not marketed as an active ingredient.	None Applicable		
Indigenous Plant Extracts	None Applicable	There are no existing dynamics for Australia indigenous plant extracts, but should they be introduced, they are likely to compete with domestic/traditional plant extracts such as ginseng/sansam roots etc.				None Applicable
Gluten-Free Food	None Applicable	None Applicable	Gluten-free consumers constitute a very small minority in Singapore. Recent attention is driven more by consumers seeking a healthier, low-carb diet than a medical condition, except in the case of certain migrant populations.	These products are not widely available in Singapore except through natural/organic retailers.	None Applicable	None Applicable
Lactose-Free Food	None Applicable	None Applicable	Lactose-free consumers constitute a very small minority in Singapore, although the rate of mild to moderate lactose intolerance is likely to be very high. It is possible that the reason for the under developed lactose free food market in this market is due to lack of awareness of lactose intolerance.			None Applicable
Anti-allergenic Foods	None Applicable	None Applicable	None Applicable			None Applicable

Functional food actors in Singapore

PRODUCTS	PUFA Ingredients	Probiotics and Prebiotics	Carotenoids	Aloe Vera Extract	Polyphenols and Flavonoids	Indigenous Plant Extracts	Anti-allergenic foods	Gluten Free	Lactose Free
Trade agents / Importers	Interstates Market (NTUC FairPrice), Angliss, Dairy Farm Group	<i>Probiotic</i> Interstates Market (NTUC FairPrice), Angliss, MEIDI-YA <i>Prebiotic</i> Interstates Market (NTUC FairPrice), MEIDI-YA, Brenntag	Interstates Market (NTUC FairPrice), MEIDI-YA, GBA Global	Interstates Market (NTUC FairPrice), Sheng Sheng F&B	Interstates Market (NTUC FairPrice), MEIDI-YA, Sheng Sheng F&B		Interstates Market (NTUC FairPrice), Origins Healthcare	Interstates Market (NTUC FairPrice), Origins Healthcare	Interstates Market (NTUC FairPrice), Gan Teck Kar Investments, Ban Choon Marketing, Ben Foods (QAF), MEIDI-YA, Sheng Sheng F&B, Unfood International
Food Companies	Abbott (Similac), Fraser and Neave, Nestle (Nan, S26), Seng Choon, Chew's Group, Gardenia (QAF)	<i>Probiotic</i> Malaysia Dairy Industries (Vitagen), Abbott (Similac) Nestle (Nan, S26) Mead Johnson (Enfagrow) <i>Prebiotic</i> Abbott (Similac) Mead Johnson (Enfagrow)	Pokka Corporation . Abbott (Similac)	Malaysia Dairy Industries (Marigold), Pokka Corporation	Pokka Corporation				Fraser and Neave
Retailers	NTUC FairPrice, Sheng Siong, Shop 'n Save, Giant, Cold Storage, Watsons, Nature's Glory, Zenxin Organic Food	<i>Probiotic</i> NTUC, GNC Live Well, MEIDI-YA Supermarket, Giant <i>Prebiotic</i> NTUC FairPrice, GNC Live Well,	NTUC FairPrice, Nutrimax Organic Store, MEIDI-YA Supermarket	NTUC FairPrice, Nature's Glory, Zenxin Organic Food, Nutrimax Organic Store	NTUC FairPrice, Four Seasons Organic Market, MEIDI-YA Supermarket, Cold Storage		NTUC FairPrice, Brown Rice Paradise, Nature's Glory, Zenxin Organic Food, Eat Organic	NTUC FairPrice, Brown Rice Paradise, Nature's Glory, NHF, Lula's Cupboard, SuperNature, Nature's Glory,	NTUC FairPrice, Brown Rice Paradise, Nature's Glory, Zenxin Organic Food, Four Seasons Organic Market,

PRODUCTS	PUFA Ingredients	Probiotics and Prebiotics	Carotenoids	Aloe Vera Extract	Polyphenols and Flavonoids	Indigenous Plant Extracts	Anti-allergenic foods	Gluten Free	Lactose Free
		Zenxin Organic Food, MEIDI-YA Supermarket, Giant, Nutrimax Organic Store						Zenxin Organic Food, Eat Organic	Nutrimax Organic Store, MEIDI-YA Supermarket
Food Service							Delcie's, Veganburger	Jonathan's, Glee Kitchen, Delcie's, Veganburger	Delcie's, Veganburger

Japan

The following analyses comprise:

- PESTLE for Functional Food in Japan
- Functional Food Actors in Japan

PESTLE for functional food in Japan

Functional Food	PESTLE Analysis					
	Political	Economic	Socio-cultural	Technical	Legal	Environmental
PUFA Ingredients	<p>Stable government with an increasing focus on aging population and austerity measures.</p> <p>Growing interest in outward FDI (foreign direct investment) to buoy struggling local economy.</p>	<p>Shrinking of the workforce due to aging population placing heavy burden on the economy.</p> <p>Austerity measures driving consumers to focus increasingly on quality over quantity.</p> <p>10 % of GDP is spent on treating diseases driving rising expenditure on healthcare costs.</p>	<p>Over 25% of the population is over 65 years of age.</p> <p>Large traditional fish consuming market finds it easy to accept the taste of omega-3 products.</p> <p>Population growing at -0.5 %.</p>	<p>Primarily based on fish oil concentration and extraction.</p> <p>Comparatively high IP protection available.</p>	All products with health claims need to be FOSHU approved.	Increasing fears over lack of sustainable farming and inefficient oil extraction.
Probiotics and Prebiotics	As above	As above	<p>Over 25% of the population is over 65 years of age.</p> <p>Population focussing on digestive health.</p>	Birthplace of probiotics and certain prebiotics (milk oligosaccharides that promote the growth of bifidobacteria; targeting infants) with large focus on IP protection.	As above	No major environmental concerns.
Carotenoids	As above.	As above	<p>Over 25% of the population is over 65 years of age.</p> <p>Increasing focus on antioxidant benefits and its potential health benefits drives</p>	Limited capability to develop product due to high levels of global competition	As above	No major environmental concerns.

Functional Food	PESTLE Analysis					
	Political	Economic	Socio-cultural	Technical	Legal	Environmental
			interest in carotenoids.			
Aloe Vera Extract	As above	As above	Over 25% of the population is over 65 years of age. Aloe Vera is considered indigenous to Japan. Over 60 % of Japanese Aloe Vera products are yoghurts.	Large Aloe Vera production results in capability to produce locally. Commoditised market due to abundance of local products.	As above	No major environmental concerns
Polyphenols and Flavonoids	As above	As above	Over 25% of the population is over 65 years of age. Focus on green tea antioxidants being responsible for lower cancer rates in spite of a high number of smokers.	Large production results in capability to produce locally. However aggressive price wars result in high focus on IP protection and validation.	As above	No major environmental concerns
Indigenous Plant Extracts	As above	As above	Market that is extremely accepting of indigenous and ethnic medicine.	No real technology understanding. Potential to be a large consumer market for traditional extracts.	As above	No major environmental concerns
Gluten-Free Foods	As above	As above	Low awareness of gluten free results in it being consumed mainly by the ex-pat population and by high income Chinese as a health food. Celiac disease is rare in Japan. ⁷⁶	No real consumer or technology understanding. Incidence of celiac disease is currently too low to witness volume based growth.	As above	No major environmental concerns

⁷⁶ Cummins & Roberts-Thompson, 2009.

Functional Food	PESTLE Analysis					
	Political	Economic	Socio-cultural	Technical	Legal	Environmental
Lactose Free Foods	As above	As above	Established lactose free /dairy alternative industry that is witnessing growing demand from both the weight management as well as lactose intolerant populace.	Existence of many dairy substitutes in the traditional sector. Growing demand for dairy alternatives.	As above	No major environmental concerns
Anti-allergenic foods	As above	As above	Little to no social awareness on anti-allergen food.	Focus is mainly on the children's nutrition sector.	As above	No major environmental concerns

Functional food actors in Japan

Products	Functional food actors in Japan			
	Trade agents / Importers/ Distributors	Ingredient and Food Manufacturers	Retailers	Food Service
PUFA Ingredients	Pivotal Scientific, San-Ei Gen F.F.I. Inc.	Fluxome Ingredients, DuPont Nutrition, Maruha Nichiro Foods, Bizen Chemical	N/A	N/A
Probiotics	Ajinomoto (distributor for Danone), OMNL Japan, Nippon access, Biogaia Japan, Valio Japan	Yakult, Meiji Dairy, Morinaga Dairy, Danone Japan, Takanashi Milk products, Nestle Japan, House Wellness, Chr Hansen Japan, DuPont Nutrition, Amino Up, Snow Brand Milk	Lawson's Japan, 7-Eleven Japan, Aeon supermarkets, H2O retailing, Ito-Yokado, UNY, Life supermarkets, Maruetsu retail, Max Value retail	
Prebiotics	Ryusendo Co, ANB Japan Co. Ltd, DKSH Japan K.K, Tokyo, Higuchi Inc, Mitsui Sugar Co., Ltd, Matsutani Chemical Industry Co., Ltd, Lallemand Japan, Probi Japan	Yakult Honsha, Meiji Dairies, Snow Brand Milk Products, Show Sangyo, Matsutani, Ajinomoto Japan, Suntory Japan, Nihon Shokuhin Kako Co	Lawson's Japan, 7-Eleven Japan, Aeon supermarkets, H2O retailing, Ito-Yokado, UNY, Life supermarkets, Maruetsu retail, Max Value retail	
Carotenoids	San-Ei Gen F.F.I. Inc, Algatech Japan, Marubeni Corporation, TSI Health Sciences, ET Horn Japan	Fuji Chemical, Otsuka Pharmaceuticals, Asahi Kaisei, Ajinomoto Nutrition, Suntory Beverages	As above	
Aloe Vera Extract	EssensWorld Japan, Nippon Forever Living Products, Naturally Plus Co. Ltd.	Meiji Dairy, Morinaga Dairy, Danone Japan, Takanashi Milk products, Nestle Japan, House Wellness, Fremo Japan	As above	
Polyphenols and Flavonoids	San-Ei Gen F.F.I. Inc, Algatech Japan, Marubeni Corporation, TSI Health Sciences, ET Horn Japan, Naturex Japan, Koyo Japan, Ensoul Co. Ltd, ASK Intercity Co., Ltd, Seikodo Ishida Co Ltd, Kyoritsu Bussan Co Ltd	Fuji Chemical, Otsuka Pharmaceuticals, Asahi Kaisei, Ajinomoto Nutrition, Suntory Beverages, Maruzen Corporation, Takeda Japan, Taiyu Kagaku Corporation, Chr Hansen Japan, Meiji Dairy, Kagome, Ocean Spray Nutrition Japan, Ajinomoto Omnicem Specialities	As above	
Indigenous Plant Extracts	Currently no major sales but potential to use the plant extract suppliers (polyphenols and Aloe Vera to distribute indigenous extracts- demand however will be mainly in the end product space initially)			
Gluten-Free Foods	San-J Japan, FBC Japan, Elpeto Products, Nippon Access	Tengu Natural Foods, Yamabuki Shiro, Seika Foods, Kikkoman Corporation, Wel.Pac Japan	Family Mart, Lawson's Japan, 7-Eleven Japan, Aeon supermarkets, H ₂ O retailing, Ito-Yokado, UNY, Life supermarkets, Maruetsu retail, Max Value retail	Sukiya Japan, Matsuya Japan, Yoshinoya Japan

Products	Functional food actors in Japan			
	Trade agents / Importers/ Distributors	Ingredient and Food Manufacturers	Retailers	Food Service
Lactose Free Foods	Vitasoy Japan, Bute Island Foods Japan, Marusanai Co Ltd, Parthenon Foods	Saniku Foods, Asahi Foods, Kikkoman Corporation, Meiraku Group, Kagome Health, Sokensha Co Ltd, Glico Beverages, Mitoku Company, Marusanai Co Ltd	Family Mart, Lawson's Japan, 7-Eleven Japan, Aeon supermarkets, H ₂ O retailing, Ito-Yokado, UNY, Life supermarkets, Maruetsu retail, Max Value retail, Nissin World Delicatessen	Starbucks Japan, Yum Brands, Costa Coffee Japan
Anti-allergen foods	San-J Japan, FBC Japan, Elpeto Products, Nippon Access	Saniku Foods, Asahi Foods, Kikkoman Corporation, Meiraku Group, Kagome Health, Sokensha Co Ltd, Glico Beverages, Mitoku Company, Marusanai Co Ltd	Family Mart, Lawson's Japan, 7-Eleven Japan, Aeon supermarkets, H ₂ O retailing, Ito-Yokado, UNY, Life supermarkets, Maruetsu retail, Max Value retail	N/A

Malaysia

The following analyses comprise:

- PESTLE for Functional Food in Malaysia
- Functional Food Actors in Malaysia

PESTLE for functional food in Malaysia

Products	Political	Economic	Socio-cultural	Technological	Legal	Environmental
PUFA Ingredients	None Applicable	The general food and beverage market in Malaysia is estimated at RM30 billion. Trade sources estimated functional foods consist about 40 % of total processed and retail packed food and drinks markets.	The most popular association with formulated Omega-3 products is in infant formula, dairy products and eggs.	Dominated by Multinationals, with mature formulation capabilities (micro encapsulations)	All health claims / nutrient function claims are regulated by the Ministry of Health which has detailed guidelines.	None Applicable
Probiotics & Prebiotics	None Applicable	Functional foods and drinks surface in the local market during 1990s when local producers and ASEAN-based multinational food companies competed to introduce new product lines to create new niches, capitalising on the emerging health trends at that time and market expansion. Many of these products are sold through multi-level marketing schemes. Large supermarkets and hypermarkets have begun to increase shelf space for organic/ health products thus increasing consumer acceptance of these products.	<i>Probiotics</i> The strength of market leading brands (Yakult and Vitagen) has established a market for probiotics. <i>Prebiotics</i> Prebiotics such as Inulin and FOS are not as widely understood in terms of their health benefits. Given the high fibre content in Malaysian diets, the perceived need for dietary fibre as a formulated ingredient is low. Prebiotics enjoy greater visibility in the health supplement markets, which should have a positive spill over effect into the mass consumer market.	Dominated by Multinationals, with mature formulation capabilities.		None Applicable
Carotenoids	None Applicable	Online procurement of these products is an increasing trend in this market. Consumers tend to place a premium based on country of	Fairly under developed market. Significant scope for consumer education.	None Applicable		None Applicable

Products	Political	Economic	Socio-cultural	Technological	Legal	Environmental
Aloe Vera Extract	None Applicable	origin, with Australia, North America and Europe considered premium locations. There is a growing trend towards co-locating food service and food retail outlets specialising in health/organic foods.	Typically consumed through beverages. Aloe Vera used in personal care is far more developed than its use in food and beverage.	None Applicable		None Applicable
Polyphenol & Flavonoids	None Applicable		High penetration of green tea products in Malaysia; the acceptance of polyphenols is very high. However polyphenol is not marketed as an active ingredient.	None Applicable		None Applicable
Indigenous Plant Extracts	None Applicable	There are no existing dynamics for Australian indigenous plant extracts, but should they be introduced, they are likely to compete with domestic/traditional plant extracts such as ginseng/sansam roots etc.				None Applicable
Gluten-Free Food	None Applicable	Increasing wealth and a busier lifestyle has led to many urban Malaysians seeking health supplements and nutritional components to their daily meals, to stay on top of their recommended intakes.	Gluten-free consumers constitute a very small minority in Malaysia. Recent attention is driven more by consumers seeking a healthier, low-carb diet than a medical condition. Celiac disease is probably at the same level as in China. ⁷⁷	These products are not widely available in Malaysia except through natural/organic retailers.		None Applicable
Lactose-Free Food	None Applicable		Although liquid milk is commonly consumed in Malaysia ⁷⁸ , lactose-free consumers constitute currently a very small minority in Malaysia. About 90% of Malaysian are lactose mal-absorbers. ⁷⁹			

⁷⁷ Cummins & Robert-Thompson, 2009.

⁷⁸ New Sarawak Tribune, 2013. <http://www.newsarawaktribune.com/news/6441/Malaysias-dairy-consumption-to-grow-3-5-pct-annually-within-three-years/>

⁷⁹ Asmawi et al. 2006.

Products	Political	Economic	Socio-cultural	Technological	Legal	Environmental
Anti-allergenic Foods	None Applicable		None Applicable			

Functional food actors in Malaysia

PRODUCTS	PUFA Ingredients	Probiotics and Prebiotics	Carotenoids	Aloe Vera Extract	Polyphenols and Flavinoids	Indigenous Plant Extracts	Other anti-allergenic foods	Gluten Free	Lactose Free
Trade agents / Importers	Dairy Farm Group, DPO Malaysia	<i>Probiotics</i> Danisco, DPO Malaysia <i>Prebiotics</i> Danisco, Horeca Foods, DPO Malaysia	Carotech, GBA Global	Blue Oasis (Why not?)	Biotropics Malaysia, Eiple (Juan Ho Marketing), Hai-O, DPO Malaysia		Dairy Farm Group	Dairy Farm Group	Dairy Farm Group Gan Teck Kar Foods, Country Farm Organics
Manufacturers	Dutch Lady Milk (Nutriplan), Nestlé Malaysia (Cerelac), Fraser and Neave, BiO-LiFE, AIM Food Manufacturing, LTK Omega Plus, QL Poultry Farms, QL Eggs, Lam Soon, Gardenia (QAF)	<i>Probiotics</i> Dutch Lady Milk (Dutch lady), Malaysia Milk Sendirian Berhad (Vitagen), Yakult Malaysia, Danone Dumex Malaysia (Dumex), Nestle (Cerelac), QD Herbs, Mamee-Double Decker (Nutrigen) <i>Prebiotics</i> Dutch Lady Milk (Friso Gold), Danone Dumex Malaysia (Dumex), Nestle (Cerelac), QD Herbs	QD Herbs Pokka Corporation, JC Chang Group (Carotino)	Pokka Corporation	Pokka Corporation	Qzen Plantations		Yuen Chun	AIM Food Manufacturing, Vegeta Manufacturing, PPMS, Lam Soon
Retailers	Soukai, Dairy Farm Group (Giant,	<i>Probiotics</i> Dairy Farm Group	EcoGreen Organic	JustLife, Blue Oasis	Hai-O		Dairy Farm Group (Giant,	NHF (Natural Health Farm),	Dairy Farm Group (Giant, Cold

PRODUCTS	PUFA Ingredients	Probiotics and Prebiotics	Carotenoids	Aloe Vera Extract	Polyphenols and Flavinoids	Indigenous Plant Extracts	Other anti-allergenic foods	Gluten Free	Lactose Free
	Cold Storage, Hero), Aeon Big, The Store, Jaya Grocer, NSK Trade City, Presto, JustLife	(Giant, Cold Storage, Hero), Aeon Big, The Store, Jaya Grocer, NSK Trade City, BMS Organics, Woods Macrobiotics <i>Prebiotic</i> Dairy Farm Group (Giant, Cold Storage, Hero), GNC Live Well, Aeon Big, The Store, Jaya Grocer, NSK Trade City		(Why not?), GNC Live Well, Lo Hong Ka			Cold Storage), Aeon Big, The Store, Jaya Grocer, Hero, Presto, BMS Organics	Dairy Farm Group (Giant, Cold Storage, Hero), Aeon Big, The Store, Jaya Grocer, Presto, BMS Organics, Little Green Planet, Country Farm Organics, JustLife, Rakuten	Storage, Hero), Aeon Big, The Store, Jaya Grocer, Presto, BMS Organics, Little Green Planet, Country Farm Organics, JustLife
Food Service			EcoGreen Organic				BMS Organics (Be LOHAS), The Origin Café & Restaurant	BMS Organics (Be LOHAS)	BMS Organics (Be LOHAS)

South Korea

The following analyses comprise:

- PESTLE for Functional Food in South Korea
- Functional Food Actors in South Korea

PESTLE for functional food in South Korea

Product	PESTLE Analysis					
	Political	Economic	Socio-cultural	Technological	Legal	Environmental
PUFA Ingredients	Korea has been ranked 5th in the world for 'ease of doing business' according to the World Bank Group, encompassing factors such as 'trading across borders' (where Korea ranks third); It continues to open up its market to foreign exporters with numerous bilateral, strategic economic partnerships and Free Trade Agreements.	Increasing wealth and a busier lifestyle has led to many Koreans seeking health supplements and nutritional components to their daily meals, to stay on top of their recommended intakes.	Korean consumers are highly health conscious, and Omega-3 is a common ingredient that forms part of the staple health supplements that many consume. This is evident in the sheer number of nutrition companies producing/retailing omega-3 products in Korea, and it is easy to find consumer reviews on the most popular products.	Korea has a number of globally recognised manufacturers /developers operating in the region, and partnerships between major global players and domestic companies.	Ingredients, safety and standards are reviewed by the Korean Food and Drug Administration (KFDA). They must adhere to the Food Hygiene Act, Health/Functional Foods Act, Enforcement Rule of Health/Functional Foods Act, Health/Functional Food Code, Regulation on Approval of Functional Ingredients for Health/Functional Foods, Labelling Standard for Health/Functional Foods, Regulations on Recognition of Raw Materials or Ingredients of Health/Functional foods, Regulations on Imported Health/Functional Food Notification and Inspection Procedure.	None Applicable
Probiotics	As above		Probiotics are highly commonplace in Korea, with several giants such as Yakult Korea producing several product lines. Korean consumers are highly health conscious and are prepared to spend their disposable income providing premium care for themselves and their children. As such, there are even product lines specifically catering	Cellbiotech is a leading global probiotics company based in Korea. There is a special focus towards developing probiotic strains particularly tailored to cater to the functional requirements of Asian/Korean consumers.		None Applicable

Product	PESTLE Analysis					
	Political	Economic	Socio-cultural	Technological	Legal	Environmental
			<p>to children of various age groups. The busy lifestyles, long work hours, and subsequent rise in lifestyle diseases have resulted in significant awareness and concern around preventing such health issues. Koreans are no strangers to using food for medicinal purposes with roots in Asian/Oriental medicine practices, and thus functional foods/ingredients are widely commonplace. Particularly in the area of probiotics, Korean diets commonly consist of fermented side dishes rich in lactic acid bacteria, such as Kimchi. These have opened further avenues for development, with companies developing probiotics for use in food preparation for common household dishes in Korea.</p>	<p>These companies recognise that probiotics must be sensitive to the dietary behaviours, genetic characteristics and biology of the consumers which can vary drastically between countries and cultures, and thus probiotic ingredients and products marketed to Korea focus on differentiated/refined functionality for its Korean consumers.</p>		

Product	PESTLE Analysis					
	Political	Economic	Socio-cultural	Technological	Legal	Environmental
Prebiotics	As above		<p>Given the ubiquity and popularity of probiotics in Korea, prebiotics experience a synergetic boost amongst consumers, who recognise prebiotics as ‘food for probiotics’ or as enhancers to amplify the functional benefits of probiotics. Therefore, prebiotics are often purchased in conjunction with probiotics as supplements or as part of a compound product mixing both pre- and probiotics (‘synbiotics’).</p> <p><i>See also probiotics (regarding general attitudes towards functional foods).</i></p>			
Carotenoids	As above		<p><i>See prebiotics (regarding general attitudes towards functional foods).</i></p>	<p>Korea has a number of globally recognised manufacturers /developers operating in the region, and partnerships between major global players and domestic companies.</p>		None Applicable
Aloe Vera Extract	As above		As above	As above		None Applicable
Polyphenol & Flavonoids	As above		As above	As above		None Applicable

Product	PESTLE Analysis					
	Political	Economic	Socio-cultural	Technological	Legal	Environmental
Indigenous Plant Extracts	None Applicable	There are no existing dynamics for Australian indigenous plant extracts, but should they be introduced, they are likely to compete with domestic/traditional plant extracts such as ginseng/sansam roots etc.			Sustainable cultivation remains to be the key concern for producing regions. Indigenous plant harvests must be sustainable and yet the yield must be high enough to satisfy demand volumes.	
Gluten-Free Food	See PUFA	Increasing wealth and a busier lifestyle has led to many Koreans seeking healthy options for their daily meals	Gluten-free consumers constitute a very small minority in Korea. Recent attention is driven more by consumers seeking a healthier, low-carb diet than a medical condition. Celiac disease is likely rare in Korea. ⁸⁰	There have been no major focuses in this area in Korea.	Ingredients, safety and standards are reviewed by the Korean Food and Drug Administration (KFDA). They must adhere to the Food Hygiene Act,	None Applicable
Lactose-Free Food	As above		Lactose-free consumers constitute a very small minority in Korea. Lactose malabsorption is common in South Korea (even 90% according to a website ⁸¹).	Whilst major companies such as Maeil Dairies release products such as lactose-free milk, these are a small part of their wider product range and are not found to be the major technological focuses of most industries in Korea.	Health/Functional Foods Act, Enforcement Rule of Health/Functional Foods Act, Health/Functional Food Code, Regulation on Approval of	
Anti-allergenic Foods	As above		There are no significant dynamics specifically catering to anti-allergenic food in Korea. However, given the widespread concerns around		Functional Ingredients for Health /Functional Foods, Labelling Standard	

⁸⁰ Cumming & Roberts-Thompson, 2009.

⁸¹ <http://www.moofreechocolates.com/wiki/global-lactose-intolerance-statistics>

Product	PESTLE Analysis					
	Political	Economic	Socio-cultural	Technological	Legal	Environmental
			eczema and skincare, there has been good interest in food products that are reported to be inert and good for the skin, such as nutri-cosmetics.		for Health/Functional Foods, Regulations on Recognition of Raw Materials or Ingredients of Health/Functional foods, Regulations on Imported Health/Functional Food Notification and Inspection Procedure.	

Functional food actors in South Korea

Products	Functional food actors in South Korea					
	Trade agents / Importers / Distributors	Ingredient Manufacturers	Food Manufacturers	Retailers	Food Service	
PUFA Ingredients	Sechang International, Nutrilite (Amway), Vixxol, SeoWoo Korea, Ins, Health Love, WH Global, PDH Natural, SH Company, L'SK, LKara, Omega House, ChoHyang, JinMyung BioCare, YouHan Life Sciences, Enzo Korea, Sungwoo Interchem, Gaya F&B, CNC Communication, Medics Korea, SangAh FD, Global X-Care, CollageKorea, GreenPharm, Naturalimix Korea, PDH Natural, BioGaia, Brands Holdings, Oronia Global, SJ Holdings, Medincare, Ottogi, Hanmi Life Sciences, TongLife, Kwangmyeong Pharmaceuticals, The Bagel, Alvins, E mart, CY BioSolutions, Synergy INT, Suheung Capsule, Green Store, Daelim Corporations, Sambong Commercial, Origin Korea, ON Farm, Health Coach, Beetopia, Natural House, Natural Immix Korea, Natural One, SM Wholesale, KJ Holdings, Inner Nature, Hana Farm, JS Global, Bee Health Korea, Baeckjung International, Dain Natural, ANC Nutrition, Semo, Gaya F&B, Neways Korea, Global X-Care, FD Lab, Somix, BR Food, KSH Pharm, PNP Holdings, AlJin International, On Food, All Green TNG, Jupiter International, Central Trading, AUSKOR Korea, BTC Bionics, FF Trading, KM Trading, Top Point	BASF SE, Croda Korea Chemical International, Enzymotec, Il Dong Pharmaceuticals, Epax, Sungwoo Interchem Corp., Nordic Naturals, BlackMores, Minami Nutrition, Melaleuca of Korea, USANA Health Sciences, Hanmi Pharmaceutical, Suheung Capsule, Novarex (Rex biotech), Nutrilite (Amway), BTC (Bionics to the Core), Lysi hf, DSM, Prime Health, Body Vite Industries, Naturscent Canada, F&D Laboratories, Raon Life, PDH Natural, Nature Perfect, Wininng Laboratories, Nutra-life Health & Fitness (NZ), Natural Life Nutrition, Brookside Bio-nutraceutical, DSM Nutritional Products, Essential Pharmaceutical, Vita Naturals, Enzo Health, Harmex Super Natural Health Products, EPAX AS, Barlean's Organic Oils, Hankintatukku OY, Bio Tech Nature, Global Science Nutritionals, RBK Nutraceuticals, ACANDA Biotechnologies, Origins Bio Canada, Naturalimmix Health, Valeo Natural Products, Minami Health, Valeo Natural Products, Minami Nutrition,	Naturence, Amway Korea, CJ Corp, Daesang, Lotte, Pulmuone, Melaleuca of Korea, USANA Health Sciences, Hanmi Pharmaceutical, Nordic Naturals, Suheung Capsule, Novarex (Rex biotech), Nutrilite (Amway), Il Dong Pharmaceuticals, Minami Nutrition, Lysi hf, Nutrivital, Blooms, Herbs of Gold, Naturescare, Nature's Way, Rainbow Nature, Mothernest, Melrose, Thompson, Goodhealth, Microgenics, Chong Kun Dang Pharmaceutical etc., DSM, Prime Health, Body Vite Industries, Naturscent Canada, F&D Laboratories, Raon Life, PDH Natural, Nature Perfect, Wininng Laboratories, Nutra-life Health & Fitness (NZ), Natural Life Nutrition, Brookside Bio-nutraceutical, DSM Nutritional Products, Essential Pharmaceutical, Vita Naturals, Enzo Health, Harmex Super Natural Health Products, EPAX AS, Barlean's Organic Oils, Hankintatukku OY, Bio Tech Nature, Global Science Nutritionals, RBK Nutraceuticals, ACANDA Biotechnologies, Origins Bio Canada, Naturalimmix Health, Valeo Natural Products, Minami Nutrition, Viva Natural Source, TNC, BEPS Biopharm, Pharmavite,	Amway, Naturence, Amway Korea, CJ Corp, Daesang, Lotte, Pulmuone, Melaleuca of Korea, USANA Health Sciences, Hanmi Pharmaceutical, Nordic Naturals, Suheung Capsule, Novarex (Rex biotech), Nutrilite (Amway), Il Dong Pharmaceuticals, Minami Nutrition, Lysi hf, Nutrivital, Blooms, Herbs of Gold, Naturescare, Nature's Way, Rainbow Nature, Mothernest, Melrose, Thompson, Goodhealth, Microgenics, Chong Kun Dang Pharmaceutical	PUFA products such as Omega-3 are highly popular in Korea and are frequently sold through the numerous pharmacies in Korea, such as Woori Pharmacy, Green Pharmacy, Health Pharmacy, etc., as OTC (over the counter) health supplements.	N/A

Products	Functional food actors in South Korea				
	Trade agents / Importers / Distributors	Ingredient Manufacturers	Food Manufacturers	Retailers	Food Service
	International, Bwell Coms, Dream Leader, Green Store, Nutri Biotech, DongWon F&B, YS Health, Joun Health, Dongil Pharmtec, New Zealand Origin, HNH Life Korea, ZIA International, Health Ocean Korea, Alaska & Alpha Korea, DongHo Pharm, Nature Story, Vitamedics, Pharmanuco, JinSung Corporation, Hanamail, SeJung Bio, BK Bio, New Medical, Florence, KNC Bridge Korea, OK Lab, USA Medical, Pharmbio Korea, ESI, JM Biotech, HNN Corporation, WIGNA Korea, MNS Commercial, Hutem, Ohyun Pharma Corporation, Nature Vision Korea, Kyung Dong Pharmaceuticals, CTC Bio, Alpha Corp, Good Health Korea, Nature's Family Korea, Chicago Health Korea, UniMedi, Hi Pharms, Bex Pharm, KenKou Korea, 3H Life, Smile Life, First Pharm, DHP Korea, CJ, Morinda, Say Pharm, 4 Life Research Korea, EMF, Insarang, Fortune Pharm Korea, Hwall Pharmaceuticals, Natural Plus, JK Pharm, Vital Pharmaceuticals, Asahi Godo, Mother's Pharm Won Poong Pharmaceuticals, Enzo Health Korea, KSC, Ju Yeong NS, Asia pharm, Kyani Korea, Sanofi Korea, Well Genics, WoongJin Tutuluv, Leafway Korea, Comvita Korea, Health Balance, Bukook Esther Formula, RKM Tech, SungWoo Inter Chem, Nature's Laboratory, Natural 365, Handol	Viva Natural Source, TNC, BEPS Biopharm, Pharmavite, Triton Pharmaceutical, Alpha Laboratories (NZ), CAtalent Australia, Meditree Nutrition, BASF A/S, ADH Health Products, Nutralab Canda, Nature's Choice Health Products, Premier Nutrients, DHY Nutrition, Nutrina Biotech, Factor Nature, Natural Sign, Premium Natural One Products, Nutrifynn Caps, Honson Ingredients, Organic Technologies, GMP Pharmaceuticals, Nippon Suisan Kaisha, Pure & Simple, J&D Bio Life Science, NewFoundLand Health Food, Advanced Laboratories, Sankyo, Pharma-Rex, Pharmekal Health Product, Mapletree Nutrition, Somix Health, Naturalize Health, Setalg SABrookside Bio-Nutraceutical, Doctor's Choice, NIC Health, Lonza, Unichem International, Robinson Pharma, Ferngrove Pharmaceuticals, SPES SA, General Nutrition Corp, YS Health Corp, KD Pharma Bexbach GMBH, Health World, Irwin Naturals, HNH Life Australia, Honorspharm, Rapha Biotech, AllGreen, Alaska Spring, Medion Pharm, Brudy Nutrition Corp, YS Health Corp, KD Pharma Bexbach GMBH, Health World, Irwin Naturals, HNH Life Australia, Honorspharm, Rapha Biotech, AllGreen, Alaska Spring, Medion Pharm, Brudy	Triton Pharmaceutical, Alpha Laboratories (NZ), CAtalent Australia, Meditree Nutrition, BASF A/S, ADH Health Products, Nutralab Canda, Nature's Choice Health Products, Premier Nutrients, DHY Nutrition, Nutrina Biotech, Factor Nature, Natural Sign, Premium Natural One Products, Nutrifynn Caps, Honson Ingredients, Organic Technologies, GMP Pharmaceuticals, Nippon Suisan Kaisha, Pure & Simple, J&D Bio Life Science, NewFoundLand Health Food, Advanced Laboratories, Sankyo, Pharma-Rex, Pharmekal Health Product, Mapletree Nutrition, Somix Health, Naturalize Health, Setalg SABrookside Bio-Nutraceutical, Doctor's Choice, NIC Health, Lonza, Unichem International, Robinson Pharma, Ferngrove Pharmaceuticals, SPES SA, General Nutrition Corp, YS Health Corp, KD Pharma Bexbach GMBH, Health World, Irwin Naturals, HNH Life Australia, Honorspharm, Rapha Biotech, AllGreen, Alaska Spring, Medion Pharm, Brudy Technology, AFC HD AMS Life Science, Biosearch SA, Ayanda AS AVD, Captek Softgel Int'l, Life Bloom, Natrol, Wigna Pharmaceuticals, Uni-Caps, Lyzen Nutrition, Nuera Nutraceutical, Proudex Australia, Naturevision, Fullfill Nature, Proherb Lab,		

Products	Functional food actors in South Korea				
	Trade agents / Importers / Distributors	Ingredient Manufacturers	Food Manufacturers	Retailers	Food Service
	<p>C&C, Ace Pharm, SH Company, Swiss Herbal Korea, Bio Intro, Tree Mate, Lotte Food, USANA Health Sciences Korea, Melaleuca International, Solgar, JL PHarmies, Dong Gook Pharmaceuticals, Beetopia, Collage Korea, MIA Nutra, Lohaspia, KU Natures Pharm, Synergy Worldwide Korea, Unicity Korea, Costco Australian Made</p>	<p>Technology, AFC HD AMS Life Science, Biosearch SA, Ayanda AS AVD, Captek Softgel Int'l, Life Bloom, Natrol, Wigna Pharmaceuticals, Uni-Caps, Lyzen Nutrition, Nuera Nutraceutical, Proudex Australia, Naturevision, Fullfill Nature, Proherb Lab, Golden Omega, Croda Europe, Good Health Korea, Naturadd Nutrition, Acanda, NIC, Vitapure Nutrition, Sancilio, Blackmores, Maison Pharm, Bill Beauty & Health Product, Sunsho Pharmaceutical, PMUPharm, B&A Health Products, Metagenics, RBK Nutraceuticals, Douglas Laboratories, Phoenix Nutra, Avalon Biopharm, Oneel Corp, Xiamen Huison Biotech, Health Garden, Pharmapack Tech, Sanofi-Aventis Consumer Healthcare, Comvita NZ, Four Season Pharma, Melaleuca, Originates, Axellus AS, Rainbos & Nature, Sini Australia,</p> <p>Many of these companies also produce end-use form consumables, such as omega-3 capsules, as well as the raw ingredient extracts for commercial use.</p>	<p>Golden Omega, Croda Europe, Good Health Korea, Naturadd Nutrition, Acanda, NIC, Vitapure Nutrition, Sancilio, Blackmores, Maison Pharm, Bill Beauty & Health Product, Sunsho Pharmaceutical, PMUPharm, B&A Health Products, Metagenics, RBK Nutraceuticals, Douglas Laboratories, Phoenix Nutra, Avalon Biopharm, Oneel Corp, Xiamen Huison Biotech, Health Garden, Pharmapack Tech, Sanofi-Aventis Consumer Healthcare, Comvita NZ, Four Season Pharma, Melaleuca, Originates, Axellus AS, Rainbos & Nature, Sini Australia,</p> <p>Also used as ingredients for healthy snack product lines by major food companies such as CJ Corp and Lotte Confectionary.</p>		

Products	Functional food actors in South Korea				
	Trade agents / Importers / Distributors	Ingredient Manufacturers	Food Manufacturers	Retailers	Food Service
Probiotics	<p>Vixxol, OnFood, SeungMyung Wholesale, Aimiso, Health House, TaeHwa Chemical, Natural365, OriginKorea, BKBio, ONFarm, Evercell, SongEun Wholesale, Maeil Dairies, HanJung, CityBio, DongIl PharmTech, Malaleuca International Korea, Korea Herbal Life,</p> <p>Trade /Import / Distributor networks are diverse and oftentimes the same companies as the ingredient manufacturers, food manufacturers or even retailers – The value chain is highly integrated.</p>	<p>Danisco, Chr. Hansen, BioGaia, Cellbiotech (and its subsidiary brand, Duolac), Morinaga, Lallemand-Institut Rosell, BioRhythm, The Nutra, Naturalize Health, Pro Pac Labs, Melaleuca, SunRider Manufacturing, CTC International, Nature Pharm Product, Kenbi, Herb & Vita Nutraceutical, Nutrition Sources, Vitalabs, Nature's Choice, Nature's Life Nutrition, DHY Nutrition Canada, BioNutrin, Sacco, THT</p>	<p>Duolac (Cellbiotech), Namyang Dairy Products, Maeil Dairies, Seoul Dairy Cooperative, Yakult Korea, MDS Korea, BioRhythm, The Nutra.</p> <p>It is worth noting that probiotics are specific to the dietary behaviours and genetic makeup of the consumers, and thus optimized products are often sensitive and customized to its target population's biology and dietary culture. In Korea, there is also a high consumption of probiotic foods in staple dishes (often fermented) such as Kimchi, resulting in companies such as Biorhythm, who specialize in probiotic ingredients for Kimchi.</p>	<p>Lotte Mart, Hyundai Mart, Emart, Shinsegae Mart, HomePlus. Also frequently sold through the numerous pharmacies in Korea, such as Woori Pharmacy, Green Pharmacy, Health Pharmacy, etc., as OTC (over the counter) health food products. Most manufacturers also sell directly via their online stores.</p>	
Prebiotics	<p>Bexpharm, Yuhan, Finlandia,</p> <p>Trade /Import / Distributor networks are diverse and oftentimes the same companies as the ingredient manufacturers, food manufacturers or even retailers – The value chain is highly integrated.</p>	<p>Sigma-Tau Pharmaceuticals, Bexpharm Korea, Dupont-Danisco, Klaire Labs, YuYu Healthcare, Dr. Synbio, Novarex, Duolac,</p> <p>Prebiotics are well-known as 'food for probiotics' and the two are often compounded as 'synbiotics' in Korea. Therefore, many of the above probiotic manufacturers also produce prebiotic or synbiotic products.</p>	<p>Sigma-Tau Pharmaceuticals, Bexpharm Korea, Dupont-Danisco, Klaire Labs, YuYu Healthcare, Dr. Synbio, Novarex</p>	<p>Drug H, Finlandia, Raim Tree, Joun Health, Vitamin ABC, Hamsoa Mall, Chunho, Frequently sold through the numerous pharmacies in Korea, such as Woori Pharmacy, Green Pharmacy, Health Pharmacy, etc., as OTC (over the counter) health food products. Most manufacturers also sell directly via their online stores.</p>	
Carotenoids	<p>Vixxol, Amway Korea, Synergy Worldwide Korea, UniCity Korea, CollageKorea, OhRyun Trade, DreamLeader, Lotte Confectionery (Health Business),</p>	<p>DSM, Chr. Hansen, Nature's Bounty, Reonin, Deseret Laboratories International, Natures Family Australia, General Nutrition</p>	<p>DSM, Chr. Hansen, Nature's Bounty, Reonin, Deseret Laboratories International, Natures Family Australia, General Nutrition Corp, Xi'an SanJiang Bio-Engineering, RBK</p>		

Products	Functional food actors in South Korea				
	Trade agents / Importers / Distributors	Ingredient Manufacturers	Food Manufacturers	Retailers	Food Service
	STB Global, Orga Whole Food	Corp, Xi'an SanJiang Bio-Engineering, RBK Nutraceuticals, Nutritional Laboratories International, Nutramed, Synergy Worldwide, Access Business Group, Allied Biotech	Nutraceuticals, Nutritional Laboratories International, Nutramed, Synergy Worldwide, Access Business Group		
Aloe Vera Extract	Novarex, NatureTech, Cosmax Bio, TOF, Duksu Trade, NokSibCho Aloe, Sungwoo Interchem, NutriBioTech, Hangaram GF, Hwail Pharmaceutical, BTC, Family Products, Mirae BioTech, Forever Korea, Tricom Trade, WoongJin Food, Maiim, PanAsia Marketing, JuYeong NS,	Noksibcho Aloe, Guhjae Aloe Farm, Kim Jeong Moon Aloe, Univera, Green Chem, African Aloe, Hilltop Gardens, Aloe Vera of California, Aloe Valley Farms, Health Natural Solution, Aloecorp de mexico, Aloe Jaumave, Improve USA, Xian HD Phytochemistry, Agromayal Botanica, A&A Aloe, Hainan Aloecorp, Aloe Vera of America, Aloe Vera International, Yunnan Evergreen Biological Corporation, Sun City Botanicals, Bio Organic Concepts, Afrigetics Botanicals, Acetar Bio-tech, Florida Food Products, Oricesos Espcciales de Zabila etc. Like other functional ingredient manufacturers, there is a high overlap between the ingredient	Univera (formerly Nam Yang Aloe), Jung Moon Aloe, Nnoksibcho, Guhjae Aloe Farm, Newland Aloe, Kim Jeong Moon Aloe, Maiim, Green Chem, African Aloe, Hilltop Gardens, Aloe Vera of California, Aloe Valley Farms, Health Natural Solution, Aloecorp de mexico, Aloe Jaumave, Improve USA, Xian HD Phytochemistry, Agromayal Botanica, A&A Aloe, Hainan Aloecorp, Aloe Vera of America, Aloe Vera International, Yunnan Evergreen Biological Corporation, Sun City Botanicals, Bio Organic Concepts, Terry Laboratories, Afrigetics Botanicals, Acetar Bio-tech, Florida Food Products, Procesos Espcciales de Zabila		

Products	Functional food actors in South Korea				
	Trade agents / Importers / Distributors	Ingredient Manufacturers	Food Manufacturers	Retailers	Food Service
		manufacturers and the food manufacturers, where Aloe Vera extractors also commonly produce end-user form products.			
Polyphenols and Flavonoids	<p>Ju Yeong NS, Sung Jin Global, Sam Jung Flavor</p> <p>Trade /Import / Distributor networks are complex, with polyphenol and flavonoids extracted from a variety of fruits and vegetables for numerous end products. Extract traders/importers/distributors are oftentimes the same company that extracts them or manufactures them into their final product – highly integrated value chains exist.</p>	<p>USANA Health Sciences, Naturex, Ajinomoto OmniChem Natural Specialities, Frutarom, Chr Hansen, DSM, Dupont-Danisco, Martin Bauer Group, Plantextrakt,</p>	<p>USANA Health Sciences, Naturex, Ajinomoto OmniChem Natural Specialities, Frutarom,</p> <p>Also used as ingredients for healthy snack product lines by major food companies such as CJ Corp and Lotte Confectionery.</p>	<p>Complex and ubiquitous retail routes, given the sheer variety of end-products including polyphenols. Specialised supplements are frequently sold through the numerous pharmacies in Korea, such as Woori Pharmacy, Green Pharmacy, Health Pharmacy, etc., as OTC (over the counter) health supplements. Also sold as part of an end-product when used as ingredients for healthy snack foods by companies such as Lotte Confectionery or CJ Corp, in convenience stores such as Family Mart or supermarkets such as Lotte, Hyundai, Shinsegae Marts.</p>	
Indigenous Plant Extracts	Currently no major sales but potential to use the plant extract suppliers (polyphenols and Aloe Vera to distribute indigenous extracts- demand however will be mainly in the end product space initially)				
Gluten-Free Foods	No specific importer/trader/distributor for gluten-free food.	<p>OURHOME, Nongshim, Pulmuone, Samyook, Yummy Earth</p> <p>Few, if any companies in Korea are specific to the manufacture of gluten-free food products, which is a nascent trend in Korea.</p>	<p>OURHOME, Nongshim, Pulmuone, Samyook, Yummy Earth</p> <p>Few, if any companies in Korea are specific to the manufacture of gluten-free food products, which is a nascent trend in Korea.</p>	<p>iHerb, Lotte Mart, Hyundai Mart, Emart, Shinsegae Mart, HomePlus, Orga Whole Foods</p> <p>With the exception of iHerb, there do not seem to be any retail outlets specialized towards gluten-free products. However, gluten-free, wheat-free products can be found in most major supermarket chains.</p>	<p>There do not seem to be any specialised food services towards gluten-free (GF) consumers. However, there are GF menu items in most food services, in which such consumers should avoid common</p>

Products	Functional food actors in South Korea				
	Trade agents / Importers / Distributors	Ingredient Manufacturers	Food Manufacturers	Retailers	Food Service
					Korean ingredients such as soy and barley.
Lactose Free Foods	No specific importer/trader/distributor for lactose-free food.	Maeil Dairies, Petit Ami, Few, if any companies in Korea are specific and limited to the manufacture of lactose-free food products. Maeil Dairies produce a “Easy to digest milk” which is lactose free; Petit Ami are manufacturers of gluten-free baked goods.	Maeil Dairies, Petit Ami, Few, if any companies in Korea are specific and limited to the manufacture of lactose-free food products. Maeil Dairies produce a “Easy to digest milk” which is lactose free; Petit Ami are manufacturers of gluten-free baked goods.	Petit Ami, Lotte Mart, Hyundai Mart, Emart, Shinsegae Mart, HomePlus. There do not seem to be any retail outlets specialized towards lactose-free products. However, lactose/dairy-free products can be found in most major supermarket chains.	
Anti-allergen foods	No specific importer/trader/distributor for anti-allergenic food.			Lotte Mart, Hyundai Mart, Emart, Shinsegae Mart, HomePlus There do not seem to be any retail outlets specialized towards anti-allergenic products.	

Luxury Foods

This section of the Reference Report collates the work specific to luxury foods undertaken through the research project, including the PESTLE analysis and tables of main actors in specific markets. The context for this work is described in the Reference Report sections describing the value chain analysis, company assessment, assessment, market analysis (see also separate reports and Functional and Luxury Project Literature Review), technology assessment and pathway development group work.

NOTES:

1. Some sections of the initial phases of the project combine analyses for both functional and luxury foods. Check the lists of tables and figures for this Reference Report to locate this information.
2. Some sections of information already included elsewhere in this report are reproduced here where they provide context or essential detail required for interpretation of the information provided.

Introduction

Luxury food production among the local food and beverage companies is quite limited. For example, the recognised luxury potential of South Australia seafood is limited because of the scarcity of the local seafood resources and the small size of the domestic seafood processing sector (DAFF, 2012). The main luxury and premium products in this category are Southern rock lobster and abalone.

The luxury food and beverage industries in South Australia have some important assets, such as the green and clean image, strong brands and strong brand loyalty, for example among wines, and products with increasing demand and huge potential for export to Europe and Asia (such as truffles, cheese, chocolate), and optimal climate conditions for certain products (e.g. seafood).

Table B1 below lists luxury foods, however this list is not necessarily exhaustive; premium products can be found in almost all food categories in South Australia, and in some cases these could ultimately evolve into luxury products. Future work to be done could include helping premium products to evolve to future luxury products in many different food and beverage groups beyond currently globally recognised, traditional luxury foods such as truffles or caviar.

As noted elsewhere in this report, it is important to note that the definition of luxury food is quite subjective. In South Australia, it is appropriate to use a broad interpretation of the high-end food market, including categories such as premium, super-premium and luxury. It is also important not to have too strict definitions and borders for such food groups since, ultimately, the goal of the industry and the Government is to see all those categories grow, and in some cases products that are not currently defined as luxury may have the ability to be so in the future.

In view of the dynamic growth in the luxury market and the availability of luxury goods to a wider range of consumers than ever before, it is important to further study the changing consumption models and changes in the way consumers define luxury. In a global context, it is critically important for luxury researchers and marketers to understand why consumers buy luxury, what they believe luxury is, and how their perception of luxury value impacts their buying behaviour (see Wiedmann et al., 2007).

Table B1: Luxury Foods in South Australia.

Products		Value Chain Participants			
		Trade agents / Importers/Wholesalers /Distributors	Food Manufacturers	Retailers	Food Service
Horticulture	Truffles	Woodford Truffles SA, Atlas Continental Foods, Mushroom Man		Adelaide Central Market.	Hilton Adelaide, Stamford Adelaide, Mercure Hotels
Others	Luxury Chocolates	Haighs, Willunga's Four Winds		Koko Black's, Steven ter Horst, Bracegirdle's, Chocolate No 5, ChocoMe	
Alcoholic Beverages	Red Wine	Riverland Food & Wine (RDA), Bird in Hand, Coriole Vineyards, D'Arenberg, Gemtree Wines, Penfolds, The Lane, Pernod Ricard-Orlando Wines, Seppeltsfield Wines Pty Ltd, Bekkers Wines, Rockford's, SA Wine Industry Association		East End Cellars, Dan Murphy's, Vintage Cellars ,Fine Wine Merchant, Treasury Wine Estates	Hilton Adelaide, Stamford Adelaide, Mercure Hotels
	Distilled Spirits	Southern Coast Distillers, Horndale Distillery and Wine Cellars		East End Cellars, Dan Murphy's, Vintage Cellars, Fine Wine Merchant, Treasury Wine Estates,	Roy Murphy's, Hilton Adelaide, Stamford Adelaide, Mercure Hotels
Red Meat	Wagyu Beef	Mayura Station		Hawthorne meat store, Feast! Fine Foods,The Meat Market, Adelaide Central Market	Hilton Adelaide, Stamford Adelaide, Mercure Hotels
Seafood	Southern Bluefin Tuna	Tony's Tuna International P/L, Sarin Tuna, Southern Waters Marine P/L MORI SEAFOODS, Cleanseas Aquaculture (Tuna) SEKOL		Jimmy Elias & Son PTY LTD, Safcol, Sarin Group – Fishing, Southern Waters Marine Products, The Fresh Fish Place, Austar Seafood Warehouse	Hilton Adelaide, Stamford Adelaide, Mercure Hotels
	Abalone	Western Abalone Processors, Southseas Abalone		Jimmy Elias & Son PTY LTD, Safcol, Sarin Group – Fishing, Southern Waters Marine Products, The Fresh Fish Place, Austar Seafood Warehouse	Hilton Adelaide, Stamford Adelaide, Mercure Hotels
	Rock Lobster	Stanke Ociana Seafoods, South Australian Lobster Company, Southern Waters Marine Products, Southern Ocean Rock, Lobster Pty Ltd, Ferguson Australia, The Fish Factory, Sky		Jimmy Elias & Son PTY LTD, Safcol, Sarin Group – Fishing, Southern Waters Marine Products, The Fresh Fish Place, Austar Seafood Warehouse	Hilton Adelaide, Stamford Adelaide,

Products	Value Chain Participants			
	Trade agents / Importers/Wholesalers /Distributors	Food Manufacturers	Retailers	Food Service
	Seafood, Williams Seafoods, Ngāi Tahu Seafood Australia Pty Ltd			Mercure Hotels
Sturgeon Caviar	Gourmet Life™, Angelakis Bros, Ferguson Australia Pty Ltd, International Oysters & Seafood		Jimmy Elias & Son PTY LTD, Safcol, Sarin Group – Fishing, Southern Waters Marine Products, The Fresh Fish Place, Austar Seafood Warehouse	Hilton Adelaide, Stamford Adelaide, Mercure Hotels
Oysters	Ferguson Australia Pty Ltd, Pristine Oyster Farm, Pure Coffin Bay Oysters, ANGEL OYSTERS, BST Oyster Supplies, Streaky Bay Marine Products Pty Ltd, Natural Oysters, International Oysters & Seafood BST Oyster Supplies, Seafood Exporters, Seamaster, Fishing Supplies, Port Lincoln Prison Industries SA, Cameron of Tasmania, Shellfish Culture Limited, Geordy River Aquaculture. SEAPA, Wychitella Holdings Pty Ltd		The Oyster Farm Shop, Coles, Woolworths, Hill seafood, Streaky bay seafood, Anassis Seafoods, Southern Yorke Oysters	Hilton Adelaide, Stamford Adelaide, Mercure Hotels

Opportunities in luxury food

The main luxury food opportunities, identified in the Functional and Luxury Project Literature Review and in the company interviews for this study include chocolate, red wine, truffles, Wagyu beef, and selected seafood such as abalone, Southern rock lobster, oysters and caviar. These are presented in Table B2 below.

Other than caviar, these luxury foods are already produced to some extent in South Australia. Strengthening the existing capabilities in production, marketing and exporting, and improving understanding of customer demands are crucial steps in seizing these opportunities.

Table B2. Luxury Food Opportunities.

Opportunity Area	Comments
Luxury chocolates	<p>Dominated by European brands (Lindt, Godiva, etc.). SA has local capability (Haighs is one of Australia's leading premium chocolatiers). Traceability is important.</p> <p>Actor examples:</p> <ul style="list-style-type: none"> • AE Haighs – SA based manufacturer and retailer with 14 stores in SA • Theobroma – Food of the Gods, franchise network of 17 stores in Australia, with number 18 soon to open • Hills 100 – owns Koko Black, a retailer specialising in artisan chocolates and hot beverages and desserts with 12 stores⁸²
Red wine	<p>Dominated by European brands (especially Bordeaux). South Australia is home to several premium red winemakers, including Treasury Wine Estates. Opportunities in branding. Traceability is important.</p> <p>Actor examples:</p> <ul style="list-style-type: none"> • Rockford Wines, top-end luxury boutique wines from SA • Penfolds – subsidiary of Treasury Wine Estates • Henschke – family owned SA based winery • SA has several active wine zones: Clare Valley, Barossa Valley, Eden Valley, Langhorne Creek, Adelaide Hills, Padthaway, McLaren Valen, Coonawarra, Riverland.
Lobster	<p>SA already has a significant export business in live rock lobster to China.</p> <p>Actor examples:</p> <ul style="list-style-type: none"> • Production of Southern Rock Lobster relatively fragmented with nine processors of wild lobster in SA⁸³.
Truffles	<p>Limited existing cultivation in SA. Complementary to European production through seasonality.</p> <p>Actor examples:</p> <ul style="list-style-type: none"> • Approximately 160 separate truffle growers in Australia, largest is Truffle & Wine Company (WA).⁸⁴ Australian Truffle growers association argues that the industry is growing. (http://trufflegrowers.com.au/growing-truffles/) • In SA truffle growing has been established; the Australian Truffle Growers Association lists a couple of independent, small scale operators.
Abalone	<p>Existing wild caught abalone fishery in SA and several abalone aquaculture farms, both greenlip and blacklip abalone. Value from differentiation, traceability and premium quality.</p> <p>Actor examples:</p> <ul style="list-style-type: none"> • Largest abalone farms in Australia are GSW (WA), KIAB and SAMAB (SA)⁸⁵ • SA: Western Abalone Processors

⁸² IBIS World, Speciality Chocolate Stores in Australia, 2014.

⁸³ <http://www.sarlac.com.au/suppliers>

⁸⁴ <http://truffleandwine.com.au/about-truffle-and-wine>

⁸⁵ Cook, 2014.

Opportunity Area	Comments
Oyster	Existing oyster farming and export business. Actor examples: <ul style="list-style-type: none"> • South Australian Oyster Growers Association (SAOGA) members including e.g. Pristine Oysters and MORI Seafood.
Wagyu Beef	Existing Wagyu beef industry in Australia, and in SA. Possibilities in upscaling production in SA. Actor examples: <ul style="list-style-type: none"> • Several feedlots and commercial breeders including AA Co, JBS, Mort & Co, de Bruin group

Packaging for luxury foods

As noted elsewhere in this report, packaging is an integral element in luxury foods. In addition to the hedonic elements of packaging for luxury foods, tamper-evident and tamper-resistant packaging innovations can provide a means to combat counterfeit products and protect a luxury food brand image in competitive Asian markets.

The following table describes packaging cues for the luxury market⁸⁶.

Table B3. Aspects of luxury packaging

Luxury packaging cues	Examples
Pack interaction	Delaying instant gratification, through user initiated discovery of the details and functionality behind a layered unveiling process can lead to stronger brand impressions. Pop-up constructions, pull tabs, unexpected uses of materials; plush suedes, smooth tyveks, ribbon closures, box toppers, or tissues.
Audible (sounds that the packaging makes)	Each sound provides the opportunity to fine tune the perceived value of the packaging design, and therefore the brand. Creaking hinges, crinkling cellophane, slide of two piece rigid boxes (low pitch if heavy weight board is used), cracking of blister packs (high pitched), etc.
Olfactive (smell)	The fragrant frontier is currently being employed to provide layered brand identification and recognition across many retail environments. (It needs to be carefully assessed if and how this can be utilised in the context of luxury foods).
Haptic (Relating to the sense of touch, in particular relating to the perception and manipulation of objects using the senses of touch and proprioception)	Luxury can be recognised through both touch and the number of hand positions required to interact with packaging. The sharply folded 90° angles on boxes or bags, the smooth bevel of a perfume bottle, all communicate something at every touch point. Sharp folds and ease of use speak to quality and craftsmanship, both virtues of luxury.
Tactile (connected with the sense of touch)	Tactile design features are able to create brand-defining cues. A classic tactile cue to luxury is pairing an all-over embossed uncoated paper with a sculpted metallic or high-gloss hot-stamp. The finish and tactile contrast presented by many top prestige retailers follow this classic rule.
Closures	Satin ribbon closures as the point of entry create a luxe in-home product unveiling experience. Custom moulded snap closures can also add visual weight to differentiate keepsake from throw-away packaging. Commodity products are packed with a secure, in-store, and on-shelf at-a-glance experience. Luxury products require the exact opposite, a well-designed layered unveiling process to build suspense up to the final reveal in the user's personal environment.
Contrast finishes	Light interacts with materials and finishes differently. Packaging material stock should be smooth and crisp, consistent in color, and evenly distributing light across the sheet without

⁸⁶ <http://www.thedieline.com/blog/2014/3/12/opinion-series-top-10-luxury-packaging-cues>

	imperfections regardless of texture. Matte sheets can be contrasted with gloss UV, or foil hot stamps to make a crisp impression to reflect lighting in any given environment.
Heritage	From custom papers, and fabrics, to stock materials with custom processes, luxury and prestige is a matter of restraint, not excess. The complete opposite of flaunting logos, prestige brands instead focus on projecting a look and feel rooted in the brand's heritage visually communicating their story.
Anticipation	Creating mystery, romance, and elevating suspense utilising a well orchestrated unveiling process walks the fine line between luxury, and over-packaging. The idea of opening a box and revealing the final product immediately, leaves much to be desired. As a standard practice we prefer to add a moment of pause once the pack is opened, to create a sense of anticipation followed by a translucent layer to softly reveal the product below prior to delivering that final a-ha moment.
Quality control	No matter how well your design communicates luxury on screen or in photographs, the tangible mass produced package is what has to deliver the goods. Understanding how climate impacts materials and print processes at every stage of production through final user interaction is critical to understanding luxury packaging. Humidity is the most often overlooked element in packaging design. Are materials from a humid environment being imported to a dry climate or vice versa? This critical understanding of quality control at every stage is what can make or break the sense of luxury as presented by packaging.

Roadmap for luxury foods

This section of the Reference Report outlines VTT's proposed roadmap to enable South Australia to graduate from specific food sectors into luxury and lifestyle businesses.

There are a number of critical issues that need to be addressed in this process:

- South Australia and the luxury food business
- The fragmented and oligopolistic nature of the subsectors which can compete and innovate to create a cluster in the luxury food industry in South Australia
- Detailed analysis of the subsectors that have managed historically to trade up and comparing them with potential companies in the food industry that can innovate along the value chain
- Short, medium and long term strategic plans to transform these industries into high growth, highly profitable industries

South Australia and the luxury food business

The Functional and Luxury Foods Project Literature Review identified that Australia in general, and South Australia in particular, is regarded as a key player in the food industry in the region.

Historically, Australia has developed itself into a large export-oriented agricultural sector, with strong growth in food, beverage and commodity exports to Asia. Also, Australia's connections through geographic proximity and trade, and investment and cultural links to the fast growing Asia-Pacific region, offer cost effective service compared to competitors in Europe and North America.

Both these conditions favour South Australia's position to develop the luxury food sector. Building on the current situation, South Australia can be a stable and reliable long-term supplier of fresh produce offering counter-seasonal availability in the Asia-Pacific region.

In addition, the state's diverse climatic conditions and abundance of natural resource allows varied production systems, including small specialist farms for niche products. These niche products can be developed further into luxury food categories (see product-focused roadmaps below).

Table B4. A reputation for quality food.

Attribute	Australia	Malaysia	US	China	France	Brazil	Canada
Safe	39	17	34	13	31	19	36
Sustainable	31	15	19	13	20	21	25
Healty	30	13	21	12	22	18	26
High quality	37	14	41	12	42	18	34
Expensive	21	10	39	8	41	18	24
Good taste	27	18	28	20	30	27	24

Source: Reputation Institute, 3 September 2013.

Australia has an excellent quality reputation for safe, sustainable and healthy foods, supported by a transparent food chain and highly effective regulation that is required to build and sustain any type of luxury heritage.

It is also worth noting that the Literature Review also identified some luxury subsectors which can be organised and developed as luxury food sector.

As the Functional and Luxury Foods Project Literature Review has shown, Australia, and South Australia in particular, have robust and well-endowed research institutions and companies that are renowned for excellence in agriculture and food research and development. This creates opportunities for partnerships, particularly for investors with commercialisation expertise.

There is a willingness to embrace new technologies and manufacturing processes to increase productivity, and a growing recognition of the need for international partnerships, industry consolidation and reconfiguration of supply chains to achieve globally competitive economies of scale in the functional food industry that can be easily extended to the luxury food sector (see Table B5).

Table B5. Free Trade Agreements (FTAs) between Australia and other countries⁸⁷.

FTAs in force	<ul style="list-style-type: none"> • ASEAN-Australia-New Zealand FTA • Australia-Chile FTA • Australia-New Zealand Closer Economic Relations • Australia-United States FTA • Malaysia-Australia FTA • Singapore-Australia FTA • Thailand-Australia FTA
FTAs signed (but not yet in force)	<ul style="list-style-type: none"> • Korea-Australia FTA
FTAs concluded (but not yet in force)	<ul style="list-style-type: none"> • Japan-Australia Economic Partnership Agreement
FTAs under negotiation	<ul style="list-style-type: none"> • Australia-China FTA • Australia-Gulf Cooperation Council (GCC) FTA • Australia-India Comprehensive Economic Cooperation Agreement • Indonesia-Australia Comprehensive Economic Partnership Agreement • Pacific Agreement on Closer Economic Relations (PACER) Plus • Regional Comprehensive Economic Partnership (RCEP) • Trade in Services Agreement (TiSA) • Trans-Pacific Partnership Agreement (TPP)

As noted in the previous section, there is expertise and strength in human health and nutrition research, as well as in robust regulatory protection with consistent standards in quarantine, food safety and food labelling. VTT believes South Australia is well positioned to build, develop and sustain a luxury food subsector, with its renowned premium food and wine, beef, seafood amongst other products. This ecosystem is further enhanced by institutions such as Waite Institute⁸⁸, South

⁸⁷ <http://dfat.gov.au/trade/agreements/pages/trade-agreements.aspx>, accessed 15.10.2015

⁸⁸ Has the largest cluster of agricultural researchers in Australia,

Australian Research and Development Institute (SARDI)⁸⁹, Cooperative Research Centre (CRC)⁹⁰, Australian Seafood CRC⁹¹, South Australia⁹², High Integrity Australian Pork, South Australia⁹³, and Rural Research and Development Corporations (Rural RDCs)⁹⁴ which will help to develop and nurture the oligopolies of the subsectors identified in the Literature Review and support food businesses through the initial phase of completion and innovation to create a cluster in the luxury food industry.

Subsectors of luxury food

The luxury food industry as identified from the Functional and Luxury Project Literature Review consists of six subsectors. They are:

- Wine
- Chocolate
- Seafood (abalone, lobster, oyster, tuna, caviar)
- Truffles
- Cheese
- Wagyu beef

These subsectors follow the VTT definition of luxury foods, which states that:

“Luxury foods can be defined as categories of food that are scarce and rare to source, are painstakingly prepared with care, of consistently quality, often endorsed by the high-end clientele and restaurants in different geographies, follows cultural cues, purchasing power parity, tastes, habits and historical evolution of people of a particular country that are linked to wellness, indulgence, ethnicity and high perceived value.”

As luxury foods are also related to cultural cues, purchasing power parity, tastes, habits and historical evolution of people of a particular country, the definition of this sector needs to consider these elements. Features such as wellness, indulgence, ethnicity, value and convenience that demonstrate the cultural sensitivity of different geographies to this list.

Depending on the price and exclusivity in different geographies, indulgence and value will define the nature of the luxury food in particular geographies. For example, several products in this category

⁸⁹ SARDI is the South Australian Government’s principal research institute, where scientists work to position Australia’s agricultural, food, aquatic and bioscience industries as internationally competitive and ecologically sustainable. SARDI addresses these priorities, as well as barriers to growth, through programs assessing challenges such as food security, resource and climate adaptation, biosecurity and enabling technologies.

⁹⁰ CRC program supports the adoption and commercialisation of research through financial support for end-user-driven research collaborations.

⁹¹ Australian Seafood Cooperative Research Center was closed on 30th of June 2015
<http://www.seafoodcrc.com/>

⁹² Established in 2007, allocated A\$35.5 million over seven years for research

⁹³ Established in 2011, has received A\$19.9 million over eight years

⁹⁴ Rural RDCs are partnerships between the Australian Government and industry. They aim to provide industry with the innovation and productivity tools to compete in global markets.

are produced in a way that supports the local, small to medium-sized farmers, promote eco-friendly farming processes and/or support world causes such as the use of locally grown crops (including those grown on community supported agricultural farms), heritage and heirloom crops and sustainable foods.

An example of this is the Slow Food movement⁹⁵, which gained momentum with the signing of a manifesto in Paris in 1989. The aim of this movement is to protect the pleasure of the table from the homogenization of modern fast food and life. Through a variety of initiatives, Slow Food promotes gastronomic culture, develops taste education, conserves agricultural biodiversity and protects traditional foods at risk of extinction.

Another example is gourmet or specialty foods (generally considered to be high quality foods) that are perfectly prepared and artfully presented. They usually include exotic, rare or unique ingredients. Specialty products range from smoked salmon, caviar, herb-infused olive oils and imported cheeses to dessert sauces, unique desserts and candies. The top selling specialty foods include beverages, dairy products (excluding cheese), cheese, condiments, and nuts / seeds / trail mix³⁸.

Other examples include artisan foods of high quality, and handcrafted food products, usually made in small batches. The artisans' focus is on their craft and commitment to quality. They are dedicated to their work and to the care of their animals and the land. Examples include cheeses, breads, jams, sauces, natural and organic meat, heirloom vegetables and handmade chocolate.

Specialty meats, such as kangaroo, elk, buffalo, crocodile, Wagyu beef, and organic free range beef are also examples of these foods. Specialty meats are growing in popularity around the US⁹⁶.

Another example could be what has come to be termed 'extreme cuisine'. Believed to be pioneered by Ferran Adria, a Spanish chef, whose restaurant El Bulli became a destination for foodies all over the world⁹⁷, extreme cuisine is a multi-sensory dining experience where taste, texture and technique are pushed to their limits.

The above discussion of the definition leads VTT to believe that, though food in general is highly responsive to local culture, due to the phenomena of rarity and exclusivity of special food items such as particular wines or Wagyu beef, they would still be considered as luxury foods. Some geographic areas won't have access to these foods due to the taste or price, while other markets would love them for the same reason. As different geographic areas will evolve over time, the luxury foods will disseminate – as we have witnessed in the wine industry in recent years.

For example, China consumes more wine than most countries in the world⁹⁸. To cater to this consumption, Moet and Hennessey launched a sparkling white wine called Chandon that is not produced in the champagne region of France, but produced in India and China for these markets.

In Australia, Victoria has more wineries and regions, New South Wales more zones, and Western Australia has the largest single zone, but South Australia is known as the wine State. South Australia has 44% of the nation's vineyards, is responsible for 47% of the annual crush and makes

⁹⁵ [NOTE: The Slow Food movement was first established in Italy in 1986.]

⁹⁶ <http://productcenter.msu.edu/uploads/files/Specialty%20Food%20Products%20Report.pdf>, accessed 15.10.2015.

⁹⁷ <https://en.wikipedia.org/wiki/ElBulli>, accessed 15.10.2015

⁹⁸ <http://www.wsj.com/articles/whos-driving-world-wine-consumption-1422461583>, accessed 15.10.2015

48% of the annual wine output (it is a net buyer of grapes and bulk wine from the other states). Thus wine as a subsector can rightly be developed to be a luxury good from South Australia.

Opportunities also exist for chocolate. Australia is the seventh biggest chocolate consuming nation (consumption 10.8 lbs per capita after Switzerland, Germany, Ireland and the United Kingdom, Norway, and Sweden⁹⁹). Larger manufacturers are keen to get a market share of this burgeoning sector but, without the personal story required to sell such products, it can be a long haul.

A way forward in this subsector may be to acquire artisan brands and market them as separate entities. This is a niche strategy which has to be properly developed. Large producers with high economies of scale make life hard for surviving smaller, boutique, artisan brands. Australian cities have experienced a boom in the number of high-end chocolatiers and specialised chocolate shops, such as Laurent Meric's Cacao Fine Chocolate and David Medlow Chocolates. Thus this subsector may be of interest to investors.

In recent years, world seafood consumption has risen and overall production has also increased¹⁰⁰. However, wild-caught production has remained stable, suggesting that wild-catch fisheries have reached their maximal potential. Aquaculture has therefore become increasingly important in meeting local and global demand for seafood.

In addition to high quality wild-caught and farmed production, Australia offers the latest technology and processes, sophisticated management and modern catching regimes, world class harvest and postharvest technologies and innovations. Australian aquaculture and fisheries products and expertise are in international demand. In 2012–13, South Australia was the largest exporter of edible fisheries products in value terms at \$266 million. It was followed by Victoria (\$138 million), Tasmania (\$132 million) and Queensland (\$131 million)¹⁰¹. Australia exports over 60% of its abalone, mainly to Hong Kong, China and Japan. In volume terms, Tasmania accounted for 55% of Australia's total abalone production and is one of the largest abalone fisheries in the world. Besides Tasmania, abalone is primarily harvested in Victoria and South Australia.

For other seafood subsectors, key species groups such as southern Bluefin tuna (aquaculture), southern rock lobster (wild catch), prawns (wild catch), abalone (wild catch), and oysters (aquaculture) can be developed as luxury foods. The gross value of fisheries production in South Australia rose by 1% (\$3 million), from \$437 million in 2011–12 to \$441 million in 2012–13. The aquaculture sector accounted for the largest proportion of this value, making up \$243 million (55%) of the state's total production value. Wild-catch production was valued slightly lower, at \$198 million, accounting for the remaining 45% of the state's total fisheries value.

Truffles are a relatively new crop in Australia¹⁰². Plantings, known as truffières (truffle orchards) began in the 1990s in Tasmania and Western Australia, with the first truffles being harvested in 1999.

Truffières are now established and producing in Victoria, New South Wales, the ACT (Australian Capital Territory), South Australia and Southern Queensland. Australia is now the world's fourth largest truffle producing country. To commemorate this achievement, Melbourne and Victoria's regions hosted and celebrated a major new truffle festival – Truffle Melbourne – in 2014.

⁹⁹ <http://www.statista.com/topics/1638/chocolate-industry/>, accessed 9.9.2015.

¹⁰⁰ <http://www.fao.org/fishery/statistics/global-consumption/en>, accessed 15.10.2105.

¹⁰¹ http://frdc.com.au/research/Final_Reports/2010-208-DLD.pdf, accessed 15.10.2015.

¹⁰² <http://trufflegrowers.com.au/growing-truffles/>, accessed 15.10.2105

The major export market opportunities for Australia include Europe, Asia and North America due to the counter-seasonal supply advantage. Aside from the traditional European markets, it is estimated¹⁰³ that the market demand in Japan and South-East Asia is approximately 10-15 tonnes per annum and the United States less than ten tonnes per annum. Based upon these estimates, the Asian markets may have the potential to provide Australian growers with a large and valuable market for many years.

Estimates of market demand for Australian truffles are difficult to source. However, prices for Australian exported truffles from the Hazel Hill truffière have been reported as achieving wholesale prices of USD\$1,500-3,000 per kg (approximately A\$1,600-3,300 per kg) (Malajczuk and Amaranthus 2007). Australia's reputation as a truffle exporter is at an important stage of development, as many markets are not familiar with Australian-grown truffles.

Australia is the fourth largest exporter of dairy in the world, accounting for 7% of world trade, and this subsector directly employs 43,000 people¹⁰⁴. Greater China accounts for over 16% of Australia's total dairy exports and is Australia's largest market by both volume and value.

In 2013/14, South Australia produced around 515 million litres of milk, accounting for approximately 6% of national milk output. South Australian milk has a record of high component values in terms of butterfat and protein - crucial to economical manufacture and processing into dairy products. The state's industry has a long history of high productivity and quality dairy produce.

South Australia's milk has a record of high component values in terms of butterfat and protein - crucial to economical manufacture and processing into dairy products. The state's producers also lead the industry when it comes to milk quality, which adds to its value in terms of product shelf life and versatility to a processor.

Wagyu is a generic term that means 'Japanese or Japanese style cattle'. It refers to the entirety of the nation's breeds, especially from a group of Japanese breeds¹⁰⁵ revered for an incredibly high level of fat marbling. Kobe beef, on the other hand, comes from the Tajima-gyu breed – and by law, only from that breed. However, not all Wagyu cattle are Japanese – in fact, only a small proportion are. Over the past 10 years, farmers in Australia, the US and the UK have been picking up on the trend for super-luxury meat and setting up herds of their own. Thus South Australia can develop this brand, which could be similar to Kobe beef in terms of taste and price.

Each of these markets can be considered to be oligopolies for South Australia in the luxury food domain. The following section of this Reference Report collates the detailed analysis and proposed roadmaps for each of the identified subsectors, and also includes the PESTLE analysis and summary of actors in specific markets for luxury foods: China, Hong Kong, Singapore, Japan, Malaysia and South Korea.

¹⁰³ <https://rirdc.infoservices.com.au/downloads/08-124>, accessed 9.9. 2015.

¹⁰⁴ <http://www.austrade.gov.au/International/Invest/Investor-Updates/2014/australian-dairy-attracts-chinese-interest>, accessed 15.10.2015.

¹⁰⁵ Japanese cattle consist of four breeds: Japanese Black, Japanese Brown, Japanese Poll, and Japanese Shorthorn. Ox-like in structure, these breeds are bred for field work. Tajima-Gyu: The cow that Kobe beef comes from which is classified as a Japanese Black breed. Kokusan-Gyu: Refers to cattle which are raised domestically in Japan. Regardless of the country or breed, cattle are classified as "Kokusan-Gyu" if they have spent more than half of their life in Japan.

These analyses include examples of potential companies in the food industry that can innovate on the value chain in terms of branding and packaging.

Wine

As noted in the above discussion, despite other states having more wineries and regions, zones or larger single zones, South Australia is still 'the wine state', with 44% of the nation's vineyards, 47% of the annual crush and 48% of the annual wine output¹⁰⁶.

This was not always the case. In 1889, at the height of Victoria's production (before the onset of phylloxera), South Australia produced 2.29 million litres compared with Victoria's 7.1 million litres. Federation (which removed state duties) and the progressive opening of the Riverland areas along the Murray River led to an all-time high share of 80% by South Australia in 1946. By the 1980s South Australia's contribution to the national make varied between 58% and 65%, depending on the vagaries of vintage.

The top five wine companies of Australia by total revenue, ranked in decreasing order (consecutively from 2010-14) are: Treasury Wine Estates, Pernod Ricard Winemakers, Accolade Wines, Casella Wines and Australian Vintage. These five companies are also the largest producers by sales of branded wines¹⁰⁷.

However, some of the finest wines for different regions, according to Langton's Vintage Ratings, are Henschke Hill of Grace of Eden Valley and Penfolds Grange of South Australia, Hunter Valley Semillon and Shiraz of New South Wales, Eden Valley Riesling and Barossa Valley Shiraz of South Australia, Chardonnay and Shiraz from Northern Tasmania and the Margaret River, and Pemberton Pinot Noir of West Australia.

South Australia has distinct wine regions, often grouped together. Adelaide is referred as the wine capital of Australia, with over 200 cellar doors. Wine producing regions with international repute include Adelaide and Adelaide Plains, The Adelaide Hills, Barossa Valley (including Eden Valley), Clare Valley, Fleurieu Peninsula (including McLaren Vale, Langhorne Creek, Currency Creek and Southern Fleurieu), Kangaroo Island, Limestone Coast (including Coonawarra, Padthaway, Mount Benson and Wrattenbully), The Riverland, and Southern Flinders Ranges.¹⁰⁸

Opportunity landscape to trade-up

Strengths:

- High disposable incomes of Australian consumers affect growth towards middle to high range wines.
- Industry is supported by an open and willing government, such as by the trade agreements specific to Japan, South Korea and China, that will boost future growth.
- Strong brand loyalty exists among consumers of Australian wines.
- Australian wine regions have the benefit of being considered as one of the finest, vibrant and heritage regions as of today.

¹⁰⁶ <http://www.winecompanion.com.au/wineries/south-australia>, accessed 15.10.2015.

¹⁰⁷ www.winebiz.com.au, accessed 9.9.2015.

¹⁰⁸ <http://www.southaustralia.com/food-and-wine/wine-regions.aspx?rs=b%7cAU%7cAU>, accessed 10.10.2015

Weaknesses:

- Current Australian wine industry is plagued by oversupply, uneconomic fruit supply; difficulty is achieving economies of scale resulting in declining profitability.
- Fragmentation of the industry prevents it from responding quickly especially when distributors are highly concentrated further reducing threat to winemakers.

Opportunities:

- Tax improvement policies like abolition of WET (Wine Equalization Tax), might reduce uneconomic supply of fruits and improve profitability.
- New country of origin labelling laws will positively affect brand value of Australian wines while discouraging competition.
- Mergers and acquisitions in the industry will help in achieving consolidation of the wine industry thus improving scalability, adaptability and resilience.

Threats:

- A volatile Australian dollar affects export/ import markets.
- Effects of recent tax regimes such as WET rebate abolition will change the industry dynamics.
- Increasing health concerns of consumers will affect alcohol consumption in the future.
- Rising competition from new low-cost wine producers, especially in South East Asia, poses high competitiveness in the future.

Industry Analysis

Buyer Power

The Australian wine market is concentrated on only a few retailers, which gives them power over growers and winemakers. In the current scenario, oversupply of grapes and winemaking capacity exacerbates this effect. Switching cost of consumers is low, which means consumers can easily pick another product, especially in a widely differentiated market (main buyers include specialist retailers, department stores. etc.). Thus, buyer power is high to moderate.

Supplier Power

Winemakers and producers are struggling with high capacity and oversupply, following dampening of their expectation of strong export growth. Because they are fragmented and comprise numerous small independent players, the supplier power is reduced further. Wine producers cannot substitute raw materials (primarily grapes), which weakens their position. Thus, supplier power is low-moderate.

Substitutes

Health concerns among consumers will affect alcohol consumption. Wine can be substituted by other alcoholic drinks as well (beer, spirits etc.). Other factors include the rising cost of maintaining shelf life (storage), low cost of switching, changing consumer preference, dependence on grape quality variation (crop availability). Innovative products like fortified water, natural fruit juices and

others can catch consumer preferences, which are very fickle. As a result of these factors, the threat from substitutes is considered to be moderate.

New entrants to the market

Barriers to entry, such as high capital investment, legislation concerns, changes in taxation norms, low profitability niche segmentation, and high levels of differentiation in existing products ensures that the threat of new entrants remains weak. Flat to low domestic growth and rising competition in the export market from new countries further weakens this threat.

Degree of rivalry

Price and volume pressure on the wine producers, increasing competition from emerging wine producers such as New Zealand, rising wine imports due to consumer hunger for international brands, evolving palates and preferences, mediocre sales projections (2014-18), consolidated distribution players (retailers that are supermarkets), strict government regulations, and slow demand in mature markets have extensively increased rivalry among existing players. Thus the degree of rivalry is high.

However, though rivalry is high in the wine industry, the low threat from new entrants, and moderate supplier, buyer power and substitutes ensures the wine industry remains an attractive industry through the period 2014-18.

Roadmap for Luxury Food (Wines)



Figure B1. Roadmap for wine as a luxury food

Luxury brand marketing for wine

Provenance

Region/Terroir/Ancient wine making history becomes part of the experience: for example Henschke tracing back to its first generation in wine-making in single vineyard wines, naming of wines by d'Arenberg for the kind of fungal disease that affects the grapes only in Mourvedre region.

Pricing

Overpricing can be used as a strategy to raise value in the luxury market, dependent on factors such as variety, growth season, taste, and maturation techniques. Above the \$50 bottle price point, price becomes independent from production costs.

Publicity

An association with art, dining, celebrity chefs, tours and wine tastings to complement the experience of the wine can become part of publicity efforts. For example, building on the momentum of its launch the previous year, Campo Viejo's 'Streets of Colour' campaign went truly global in 2014, expanding into new regions including Miami (wall painting), Oslo (school art contest), Dublin (local urban artists and tapas) and Toronto.

Position

Some relevant positioning techniques include retailing of wine in certain formats of stores such as delicatessens and speciality stores, or wines available in only certain restaurants, or that has to be ordered or purchased specifically from the vineyard and direct selling.

Persona

Building personality traits that reflect the wine brand/ taste/ terroir/region through association to history/historical events/historic people and/or to contemporary art forms/ music/artists and/or reflecting the winemakers/farmer's own personality on to the wine. For example, true to its penchant for art, in 2013, Perrier-Jouët unveiled the 'InBloom Fresh Box' case, the result of its collaboration with Benjamin Graindorge, an up and coming French designer.

In Shanghai, Royal Salute's 'Alchemy' exhibition of sculpture, film, food and music celebrated the brand's special artistry through a series of immersive spaces, each representing one of the brand's signature blends.

Personage, or brand DNA

Brands look for their personage from their owners/ founders/ creators/ winemakers that define the ancestry of the brand.

Characterised by its historical attachment to Art Nouveau, the House Perrier Jouet has remained faithful to its fundamentals, showcasing on the bottles of its Belle Époque cuvée the famous anemones created by Emile Gallé in 1902 – a motif inspired by Japanese floral prints and designs. They represent a key element of the new Perrier-Jouët Grand Brut design, launched in autumn 2013. This reaffirms the champagne house's style, which has long been associated with artistic creation and artisanal craft.

Paucity

Penfolds Grange is an example of the use of paucity. Grange is made each year in very limited quantities (in some years less than 3,000 dozen) from a certain style of ripe, intensely-flavoured fruit grown on Penfolds' own vineyards and bought from independent growers. Because Penfolds picks and chooses, with absolute ruthlessness, from a range of vineyards in various districts for this wine,

the impact of vintage variation is minimised. This has led to a general acceptance that Grange is the most consistent of the world's great wines.

Performance

The delivery of a wine product's quality, and assurance of its taste and texture, stems from the delicate and diligent process of winemaking, whether that is traditional or modern, classic vintage or experimental and unique. Some brands adopt unique, innovative techniques while some build on the ancient art of viticulture to create the value in the product. They build credentials through association with, for example, the finest wine tasters, experts in winemaking, or their owner's experience in foreign (European) states.

Packaging

The objective of packaging is to strengthen the product's heritage, and build provenance while maintaining the brand's distinctive DNA. Thus, most brands partner with designers/ artists/ sculptors with whom the brand associates well. But classic brands also ensure consistency in their communication style that is witnessed even when they adopt innovative or new designs. The logo, signage and other branding therefore tend to remain part of the unchangeable heritage. The idea is that the bottle becomes a 'souvenir surrogate for the region/terroir/brand/nation'. Some brands also bring out limited edition bottles which draw inspiration from a celebrity (a well-known or recognisable brand ambassador, for example the artist or painters etc.)

Chocolate

Opportunities in the chocolate sector may arise by purchasing artisan brands and marketing them as separate entities. However, large producers need economies of scale, making the situation more difficult for surviving artisan brands.

Australian cities have experienced a boom in the number of high-end chocolatiers and specialised chocolate shops, such as Laurent Meric's Cacao Fine Chocolate and David Medlow Chocolates. These new stores are providing competition to more established outlets, such as Hillier's, Haigh's and Newman's.

Australia produces between 50 and 100 metric tonnes of cocoa per year. Daintree Estates (2010) is the first Australian bean-to-bar company. Other bean-to-bar companies are: Bahen & Co. (70% Madagascar), Zokoko (award-winning Ato Beni), Haigh's chocolate (70% dark single origin Peru), Bracegirdle House of Fine Chocolate, Minlaton Chocolate, Havenhand Chocolate and others.

Opportunity landscape to trade-up

Strengths

- Consumers have high disposable incomes, allowing them to spend relatively freely on non-essential food items.
- Growth of chocolate demand (fuelled by emerging Asia primarily China, Japan and India) is very high especially in gifting which promises growth in higher margin sector.
- Chocolate is relatively recession-proof.
- Competition is strong in the food sector, and despite ongoing consolidation, no single player is able to force another leading player out of the market, which ensures competition remains high.

Weaknesses

- The cost of doing business in Australia is higher than in emerging Asian markets, where infrastructure now supports manufacturing industries, resulting in a loss of investment in Australia.
- Exploitation on cocoa farms, and lack of skill training in chocolates (e.g. lack of skilled people and high factor costs) can damage brands.
- It is difficult for small players to look for economies of scale as they are struggling to develop their supply chain.
- Heavily backed Eat Australia campaigns could cause problems for companies that export to Australia.

Opportunities

- The government is keen to encourage foreign investment and offers a transparent business environment.
- New country-of-origin labelling legislation creates a unique opportunity for firms with manufacturing presence in Australia. It inhibits external competition and provides means of capitalising on nationalistic sentiment.

- Consumers are increasingly discerning, spurred on by higher disposable incomes. The premium food sector therefore provides strong opportunities for manufacturers.
- Successful cocoa growing trials have been performed in tropical Australia (RIRCD, 2010) and thus Australia may be able to develop its own cocoa production (a recent cocoa shortage is threatening small players).

Threats

- Companies are increasingly turning to New Zealand for cheaper imports, leading to disquiet among Australian farmers.
- Protectionism means agricultural industries are not as efficient as they could be, which may lead to problems as other regional agricultural producers improve their own standards within a much lower-cost framework.
- Climatic extremities leave Australian farmers vulnerable, and necessitate heavy investment in storage and harvesting facilities.
- The current review of food labelling policy by the food standards agencies of Australia and New Zealand may result in more cumbersome labelling requirements for producers.
- There is high competition from overseas related with sourcing issues.
- Global cocoa shortage may create difficulties in the short-term.

Industry Analysis

Whilst specialist, luxury or organic retailers do not feel the same price sensitivity, they are not able to secure a large volume of customers, and may have no choice but to commit to long term supplier contracts in order to secure a steady supply, quality, or specifically prepared products. Potential new entrants may struggle to compete with the aggressive marketing and pricing policies of the existing players. Nonetheless, relatively low entry and exit costs, the emergence of thriving health and ethical niches which are sheltered from direct competition from current players, and strong historical growth offer attractive prospects.

Buyer Power

Specialty, luxury or organic retailers can, due to the high level of product differentiation, justify price levels that would otherwise be unsustainable; yet the limited volume of consumers places restraints on the power of such players.

Consumers are brand loyal and particular about what they eat, which reduces their power, but a wide variety and immense product differentiation offsets this. In some cases the buyer is an organised retailer which could place pressure on a manufacturer, especially for someone who is looking to scale their operations and reach.

Supplier Power

Where possible, long term contractual obligations are avoided and switching costs are kept to a minimum. With a firm hold on key distribution channels, the leading retailers can dominate negotiations with certain suppliers. Smaller retailers, such as specialist, luxury or organic outlets may find such negotiations difficult.

The limited number of suppliers in niche areas and the centrality of product quality or preparation type restrict the available range of sourcing options. With switching costs subsequently higher, the

balance of power shifts somewhat from smaller retailers to specialist suppliers. As the world faces a cocoa shortage the power shifts towards the suppliers. With more consumers demanding sustainable food production, the pressure to meet demands increases, thus keeping supplier power high.

Threat of new entrants to the market

Potential entrants may be encouraged by the relatively low entry and exit costs. There has been a rapid growth of health consciousness, plus an increasing number of consumers opting for a more ethical or organic range of goods. This forms attractive avenues for new entrants seeking to move into a niche area that offers inbuilt protection from pricing pressures and mainstream marketing.

Chocolate manufacturing requires high capital investment, high rentals and labour costs, the distribution system is in the hands of few, and marketing expenditure is gradually increasing which adds to the barriers to entry. Apart from sourcing, Australian food label regulations also add to the concerns. Thus the threat of new entrants is moderate.

Threat of substitutes

Chocolates are seen as snacks or dessert foods, thus a high threat of substitutes can arise from foods like cakes, ice creams, sweets, and biscuits etc. Apart from this, luxury chocolates are competing with premium desserts, restaurants, sweets, and food items. A consumer spending on high quality chocolate might look instead towards coffee, fruits, etc. The threat of this is low to medium.

Degree of rivalry

The degree of rivalry is high because the chocolate industry has entrenched global players, while speciality chocolate is highly fragmented. In 2008, only seven major players accounted for more than 70% market share.

Though specialist stores for premium/luxury chocolate offerings are highly differentiated, they lack reach because of low economies of scale and distribution muscle. Thus, they can face threats from existing major players, especially those with a heritage story of their own, who can launch products lines that compete with speciality chocolates.

The growth of niche players, boutique shops etc. has created a wide variety of options with low switching costs for consumers. This, along with threat of limited margins, has added to the degree of rivalry. If South Australia decides to invest in this industry, there is still a moderate chance of making a niche product that may occupy the luxury food segment.

Roadmap for Luxury Food (Chocolates)



Figure B2. Roadmap for chocolate as a luxury food

Luxury brand marketing for chocolate

Provenance

Most chocolate brands have so far utilised the country-of-origin effect, but only for the art of producing it. Hence most European brands leverage their regional roots to the chocolatier history of their nations.

However, recently country-of-origin effect is also being witnessed in the source of the ingredient, for example Ecuadorian cocoa for Toak Chocolates. The history defines the product that is created today in addition to the uniqueness and rarity of the experiences in authentic taste and smell. Brands are also increasingly relying on the regions that are popular for the method of acquisition (c.f. fairtrade), sustainability practices, processing techniques, grower's knowledge etc.

Pricing

The main ingredient for chocolates – cocoa - is often mass produced. The original beans are becoming rare due to the very specific farming conditions required to grow the nut. Thus prices are rising as the product is becoming scarce. Luxury brands also add the value of the chocolate making process, as is done for wine, as this can vary and is important for the taste of the product. Rather than price for the health benefit or taste, the cost to the consumer is the acquisition cost of rare ingredients and the unique taste/experience.

Publicity

Chocolate brands and boutiques see value in spending money for events, tours, workshops on tasting, preparing and introducing the rich history of their brands.

This would also involve sponsoring studies, trade shows, innovative research in improving tastes, textures etc. TV shows with the most glamorous chocolatiers/chefs are a means of introducing chocolate as part of a place or part of a unique culture/tradition, since chocolate making is also seen as a tradition and an art, with references to nostalgic childhood memories.

Sampling for new launches is the most common method to help introduce the product, for example Lindt Master Chocolatiers. In an entirely unique way, Lindt represents the brand, the premium products, the uncompromising quality, and the company's all-round expertise in chocolate-making and is recognised by consumers everywhere. Some brands prefer to use publicity only for limited edition tours, launches and workshops.

Position

Dedicated luxury store formats such delicatessens, speciality stores and boutique shops are located in prime locations of main cities. Some chocolate brands also have their own unique stores dedicated to the entire brand collection and involving the consumer in an experience of the brand's heritage and its brand DNA (personage).

For example, Ghirardelli opened a store in a prime location on Hollywood Boulevard, close to the famous Disney cinema El Capitan, and near the famous stars on the Walk of Fame. After years of being exclusive to Belgium, Draps began the international Godiva expansion in 1958 by opening a Godiva boutique in Paris on the fashionable Rue St. Honoré. In 2010, Godiva opened its first store in Turkey in the heart of Istanbul. Located in the luxury shopping area of Nisantasi, this flagship store exemplifies a strategic entry into a new market for Godiva.

Persona

Chocolate brands tend to choose their founders as the building blocks of their persona, which takes time to build and requires awareness of roots and heritage. For example, Max Brenner's tagline

“chocolate by the bald man” is clearly using their founder as an inspiration and a brand ambassador. The fact that the founder learned the art in Paris, after which he returned to Israel, is often promoted by the brand to draw upon the authenticity of the product.

Certain brands prefer to use brand ambassadors to build personality traits quickly through association. Since 2009, tennis champion Roger Federer has been the global brand ambassador for his favourite chocolate, Lindt. He uniquely embodies Lindt and Sprüngli’s underlying values of Swiss-origin, premium quality and passion, and, with his global presence and popularity, he helps to establish the Lindt brand in the main markets.

Personage, or brand DNA

The core values that establish a chocolate brand's style and insignia can be in the founders/chocolate-makers/innovators or, in some cases, muses or inspirations that guide the brand practices.

For example, Godiva announced an exciting change to the Lady Godiva Program – expanding from honouring one inspiring woman each year to honouring three. Godiva surprised this year’s honourees – Erin Dinan (One Sandwich at a Time), Stephanie Bowman (One Heart for Women & Children), and Molly Rockamann (EarthDance Farms) – at a breakfast at the Rent the Runway Showroom at Henri Bendel in New York City. Godiva will always be seen as the lady in gold.

Paucity

Rarity is used through limited edition products, with packaging and location as marketing tools. The award winning product lines are also falsely used to create the effect of paucity amongst products. There are also seasonal advantages such as Easter chocolates, for example.

To help this category luxury brands create demand through scarcity. For example, the Godiva G collection, with its exclusive gift packs and numbered chocolates creates the desired effect of scarcity. Their limited edition gift item include a ‘handcrafted partnership’, and the opportunity to “celebrate in style with these exclusive gift sets that pair our delicious Belgian chocolate with beautiful metal serving pieces by American-born artist Michael Aram. Each Aram creation is entirely handmade. Long after the last chocolate is enjoyed, your thoughtful gift will endure”.

Their seasonal range has the same intent. Some brands claim the unique processes and ingredients that make the product a rarity and hence luxuriously expensive. For example Toak Chocolates focuses on the sensory analysis of chocolate and hence is able to earn supernormal profits.

Performance

Chocolate brands rely on the taste, visual appeal and aroma of the product for performance. Hence packaging that is unique, easily recognisable and associated with the brand, exclusive and classic in appeal is used.

Often stores that house luxury brands will keep samples, and use visually stimulating merchandising to deliver the promised experience. In some cases, brands also give consumers special gifts or memorabilia to keep. Often brands use customer memberships, clubs, and communities to foster their relationship and keep the experience intact, like for example the Godiva ‘Lady’ program.

Packaging

Luxury chocolate packaging must ensure that the functional benefits of the package are very high (it must keep the product safe from humidity, lock in the aroma and taste, and protect thin bars/pieces/ caramels/ inner shapes and so on during transport and storage). Brands use packaging

to build association with either the ingredients or the brand DNA (depending on which of these better communicates the uniqueness/ brand promise).

Seafood

This subsector generally includes abalone, lobster, oysters, tuna and caviar. Key species groups in South Australia include southern Bluefin tuna (aquaculture), southern rock lobster (wild catch), prawns (wild catch), abalone (wild catch), and oysters (aquaculture).

The gross value of fisheries production in South Australia rose by 1% (\$3 million), from \$437 million in 2011–12 to \$441 million in 2012–13. The aquaculture sector accounted for the largest proportion of this value, making up \$243 million (55%) of the state’s total production value. Wild-catch production was valued slightly lower, at \$198 million, accounting for the remaining 45% of the state’s total fisheries value.

Opportunity landscape to trade up

The opportunity landscape for seafood and seafood subsegments is shown in Table B6 below.

Table B6. Opportunity landscape for luxury seafood

	Abalone	Lobster	Tuna	Oyster	Caviar
Strengths	High value product	Australia positioned as world’s finest producers of lobsters demanding almost double the margins as compared to competitor nations, recent FTA with China limits competition and supports national industry especially during supply shortage, strong government support.	Australia’s clean/green image	Clean waters	Australia’s clean/green image
	Clean water –good environmental image		Climatic conditions suitable for optimum sea-food growth	Good product image	Climatic conditions suitable for optimum fish growth
	Increasing demand of product,		Close proximity to Asian markets	Active industry associations (SAOGA & OYSA)	Close proximity to Asian markets
	Potential for technology development and streamlined systems aiming to shorter grow out period and lower mortality resulting in higher labour efficiency.		High product quality; innovative industry	Australian oysters all have unique characteristics depending on where they are grown.	High product quality; innovative industry
			Recent government investment in Open Ocean Aquaculture species and sites		Recent government investment in Open Ocean Aquaculture species and sites
			Locally available brood stock and fishers experienced in their capture		Substitute industry (for caviar) well established (salmon and trout roe)
			Experienced government marine fish culture units		Experienced government marine fish culture units
			Industry interest in culturing the species		Industry interest in culturing the species
					High demand of sturgeon caviar but low

	Abalone	Lobster	Tuna	Oyster	Caviar
Weakness					sustainability limiting options for consumers.
	<p>Slow grow out period.</p> <p>High capital expense.</p> <p>Poor infrastructure esp. 3 Phase power</p> <p>Labour intensive</p> <p>Abalone vulnerability to high temperatures, lack of skills, limited co-op marketing, and high transport costs affect margins.</p>	<p>Industry fragmentation slows flexibility and adaptability to sudden changes, High costs (labour, transport, capital investments) make Australian Lobsters uncompetitive against Asian producers, High R&D costs, increasing costs of maintaining sustainability within the industry, industry in declining stage with reduction and exit of many farmers and producers. Enterprises declined due to reduced production and a decreasing number of licensees.</p>	<p>Uncertainty about future of wild stock</p> <p>Dependence on single market/currency</p> <p>High cost structure</p> <p>High dependence on imported wet feed</p>	<p>Low availability and quality of spat</p> <p>Cumbersome Lease approval process</p> <p>Low margins, short selling season</p> <p>High labour costs</p> <p>High transport costs as compared to competitors</p> <p>High dependence on Japan (concentrated market)</p> <p>High cost structure</p> <p>Complex Supply chain system support</p> <p>High dependence on imported wet feed</p> <p>Current government framework for licencing of sites</p> <p>Shortage of inshore grow-out sites</p> <p>Remoteness of suitable grow-out sites</p>	<p>High labour costs</p> <p>High gestation period (sow growth, slow maturing fish)</p> <p>High transport costs as compared to competitors</p> <p>High competition from China and well established historical organisations worldwide</p> <p>High cost structure</p> <p>Current government framework for licencing of quotas</p> <p>Fish vulnerable to habitat change (has low survival rate in alien environments except artificially mimicked ones)</p>
Opportunity	<p>Breeding to reduce grow out time</p> <p>Develop new export markets</p>	<p>Rising demand, Diversification of markets, improving transparency in supply chain and cheaper logistics,</p>	<p>Opportunities</p> <p>Industry young – low on learning curve</p>	<p>Both export and domestic market development</p> <p>Value adding opportunities</p>	<p>Declining wild caught fish supply as nations becoming strict on protecting the</p>

	Abalone	Lobster	Tuna	Oyster	Caviar
	Co-operation between farms to enhance market potential Investment in R&D to improve sector profitability (via operational efficiency)	new business models as with lobster shack diversifying sources of revenue (other than sale of wild caught lobsters), molecular gastronomy has re-introduced rock lobsters into fine dining, evolving consumer tastes and preferences, higher disposable incomes	Adding value to the product Further processing Pelleted feeds	Improving farming practices Declining wild caught fisheries Industry young-low on learning curve Increasing population and demand for fish Increasing awareness of the health benefits of eating fish Improving technology for offshore grow-out Increasing government interest in tuna culture Commonwealth and State grants available	endangered species (sturgeon) Industry young-low on learning curve Focus on organic processes of removing the eggs from the fish, more humane ways of processing the product with limited damage to environment & the species. Process of culturing and milking taking precedence over location (in the future)
Threats	Disease outbreak (he abalone virus Ganglioneuritis which is fast spreading and lethal to abalone stocks) Increased power costs Market collapse in Asia Volatile currency, global warming affecting farm output, high risk industry, medium return (20-25%)	New Zealand fast catching up with much higher productivity and cheap produce of lobsters, Lobsters highly sensitive to global warming, El Nino effect has raised concerns about shortage (diseases and premature deaths), little to no product differentiation exposes players and growing cheaper supply from South Africa, Cuba and Vietnam for lobsters that are farmed.	Propagation of NBT/SBT Disease transfer through hatchery Major growth in competitive of NBT Economic decline in Japan	Lease/licence approval process Handling and transport processes Disease from (imported) seed stock Not being able to develop hatchery protocols Increasing importation and consumer acceptance of cheap fish Pellets do not match wet feed quality (so poor substitute shifts of raw material)	Government regulations and differences in aquaculture legislations could hurt Australian farmers Increasing importation and consumer acceptance of cheap substitutes Low track of competitive nations, blind spot to evolving technologies and process innovations Marginal contribution to the global produce would limit growth

Abalone	Lobster	Tuna	Oyster	Caviar
			Economic recession in Japan	potential and affect margins
			Low availability of suitable sites	Distribution (domestic and internationally)
			Government divestment of aquaculture support facilities	fragmented and underdeveloped
			Economic downturn making it more difficult to raise funds	

Industry analysis

It should be noted that many issues facing the seafood sector are shared by the industries for abalone, oysters, tuna, lobster and caviar, as referenced in individual sections of this analysis below.

Abalone

Supplier power

A low concentration of suppliers diminishes their power. However, limited number of suppliers increases their bargaining power. The inputs required for the industry are similar, with little or no difference. In addition, distribution is highly diverse as it is mostly dependent on export. There are no economies of scale, and this, plus vulnerability to threats from producer of cuts in production added to export dependency, exposure to currency fluctuations, and high transport costs reduces supplier bargaining power.

Buyer power

Since Australian suppliers deal with premium high quality products, the consumer has low price sensitivity. The premium products are important to the customer, which reduces the power of the consumer. Awareness about industry concerns of over-farming, disease, and sustainable farming practices will also help increase preference for Australian abalone. Thus power of buyer is decreasing (moderate to low).

Threat of new entrants to the market

High capital requirements, risky working lifestyle, strict government regulations and quotas (licences) to preserve biodiversity for abalone farming are factors, along with imitation of geographic factors, the high learning curve (new competitors must spend time and money studying the market, packaging and process modifications which affects profits), government agency (zonal co-ops/agencies to promote local industry) limits to competition. These factors, plus over-exposure to few markets, low domestic demand, and the need for international logistics and distribution expertise etc. keeps the threat of new entrants low.

Substitutes

Abalone has a delectable identity of its own and has strings attached to its luxury identity. However, seasonality and crop failure may affect the consumption in a particular year. Recent awareness of

vulnerability to diseases, environmental issues such as oil spills affecting abalone's metal content etc. can raise concerns and force consumers to give up.

However, any substitute to Australian product is inferior and substantial differentiation based on region and processes from farm to shelf limits threat of substitutes.

Farming difficulties, due to the molluscs being highly sensitive to temperature, pH balance etc. can further reduce the threat of substitutes. China is currently leading in abalone aquaculture but geographic location preferences negate that effect.

Degree of Rivalry

Government limits domestic competition by becoming a facilitating agency for the small farms, thus limiting the amount of abalone to be cultured. Asian markets are fast growth regions which reduces the degree of rivalry. Australian products, however, compete with international products, which place some pressure on profitability. Very low degree of rivalry since demand outgrows supply.

Luxury brand marketing for abalone

Provenance

Companies usually build on the purity and richness of the geographic location that breeds the particular abalone species. However in the case of jade tiger abalone, it is the history and the story that builds the product. The abalone is presented to the consumer as specially picked from the most remote, untouched regions of the world.

Pricing

Pricing is based on supply demand dynamics. Any disease outbreak affects the industry as a whole because even higher prices of sales cannot make up for the loss of profits resulting from low production. This is because the market is also dependent on import prices. Thus, added value becomes extremely important.

Publicity

Companies (wholesalers and retailers) build the image of luxury by participating in awards that reward the finest catch (thus certifying the finest taste, texture, visual appeal, quality production etc.) to the consumer. Tours of remote growing regions (including farming processes), food tastings, efforts towards improving sustainability and minimising environmental impact are also used as publicity tools.

Position

Limited shores and bays within Australia's zones are accessible for commercial farming. Companies build on these locations to sell their product. Often bars and cafés are also opened in close proximity to support this branding exercise. For wholesalers and retailers, the product is sold in premium speciality or gourmet shops since it is an expensive product, and not available for the masses due to its scarcity.

Persona

The main focus for abalone owners is on sustainability, and they strive to achieve premium quality and taste. Cooking and catching techniques also become traits of the product (i.e. certain kinds of cooking of a particular brand enhances particular tastes). For example, Jade Tiger Abalone™ is bred for its unique combination of sweetness and medium texture making it the 'gourmet's choice'. It is bred exclusively by The Craig Mostyn Group and is a cherished delicacy worldwide. Craig Mostyn owns and runs Australia's largest abalone farm and focuses on direct delivery of live, frozen and canned abalone from their in-house export facilities.

Personage, or brand DNA

Chefs are the prime actors that build abalone brands. A few farms also build on their heritage and historical significance, and build their product value upon the visions and values of their founders/owners.

Being 'green and clean' becomes very important for the end consumers. Thus, most brands also strive to reflect their farming practices, closeness to nature and richness in contribution to the environment through all the elements of the marketing mix (packaging, place etc.), technology used, ad methods for cultivation etc.

For example, Brand Eyre Peninsula (Australia's 'Seafood Frontier') is a marketing initiative to differentiate foods sourced from this region that have met the highest standards of environmental management, sustainability, innovation and quality, and is recognised by food connoisseurs as a certified and authentic Eyre Peninsula product. Brand Eyre Peninsula aims to position Eyre Peninsula as the one and only Seafood Frontier in Australia – the original and the best.

Paucity

Because abalone supply is very limited, scarcity is often used as a measure of premiumness. Specific regionality can also add variety to the tastes and texture of abalone, thus adding to the limited availability (seasonal features also create the same effect).

Performance

Performance is often not perceived at the end consumer level, because of many value additions are made on the product's way to the plate. Hence the onus of promoting product performance lies mostly with the chef and/or the restaurant. Their task is to recommend to their consumers certain brands through PR campaigns and publicity efforts, making the client portfolio a surrogate for the performance of the actual product. For example, Ralph Tasmanian Seafood boasts "Value-added abalone products now include rumbled meat, chilled meat, retort pouches, IQF meat, vacuum-packed meat, canned meat, dried meat as well as abalone shells and salted abalone viscera".

Packaging

Canned abalone is usually packed in tin cans with intense colours, gold rimmed logos, and seals. The intent of packages is to create the impression of finest quality and enhance the experience of fine taste and elegance. Brands also use additional information like awards and recognitions, signage and elaborate artwork on logos to build resonance with exclusivity.

Gift packs are a common form of packaging for abalone. They can be very opulent and meaningful, with each element of the design playing a significant role in portraying the brand heritage and identity. Most brands focus on the display of the product and the experience of opening the pack.

Lobster

Supplier power

A low concentration of suppliers diminishes their bargaining power with retailers at a global level, who have the option of looking for cheaper options from emerging suppliers such as New Zealand and Cuba.

However, limited number of suppliers within a protected geographical location, especially in a quota regulated industry, increases their bargaining power. The inputs required for the industry are similar, with little or no difference. In addition, distribution is highly diverse as it is mostly dependent on export. There are no economies of scale, and this plus vulnerability to threats from producer of cuts

in production, added to export dependency, exposure to currency fluctuations, and high transport costs reduces supplier bargaining power to moderate.

Buyer power

Similar to abalone.

Threat of new entrants to market

Similar to abalone, plus over-exposure to few markets, low domestic demand for premium Australian lobster, decreasing stock, and the fact that lobster is highly sensitive to climactic conditions etc. keeps the threat of new entrants low.

Substitutes

Similar to abalone, plus recent awareness of vulnerability to diseases has raised concerns about sustainability of the product, pushing demand for farmed lobster.

However, any substitute to Australian product is inferior, and substantial differentiation based on region and processes (from farm to shelf) limits threat of substitutes. Farming difficulties, as lobsters are highly sensitive to temperature, pH balance etc., further reduces the threat of substitutes.

Degree of Rivalry

Government limits domestic competition by becoming a facilitating agency for supplier based on their zonal location, limiting the amount of lobsters to be caught. Asian markets are fast growth regions for the product, which reduces the degree of rivalry. Australian products, however, compete with international products which places some pressure on profitability. Very low degree of rivalry since demand outgrows supply.

Luxury brand marketing for lobster

Provenance

Taste and techniques vary slightly, based on the region in which the lobsters are caught. Some lobster farms place high value on the historical significance of their regions.

Pricing

Pricing is not only set through supply and demand, it is also dependent on competitor pricing. For example, supermarkets offer lower prices to draw more customers. However for luxury brands this proves advantageous. They raise prices (on the basis of the perceived product value) as price indicates higher quality among competitors. Pricing is determined mainly through supply demand due to quota systems followed in Australia for catching lobsters.

Publicity

Companies (wholesalers and retailers) build the image of luxury by participating in awards that reward the finest catch, thus certifying the finest taste, texture, visual appeal, quality production etc. to the consumer. Tours of the remote regions (including farming processes), food tastings, and efforts towards improving sustainability and minimising environmental impact are also used as tools.

A new concept is the 'celebrity chef recipe' that builds on the chef's artistry. Celebrity chefs who are popular in fine dining, and fine dining restaurant owners incorporate farmed lobsters and add to the unique selling proposition (USP) to the otherwise less distinguishable product. The chef becomes the spokesperson.

Position

Limited shores and bays within Australia's zones are accessible for commercial lobster farming. Companies build on location to sell their product. Tours around the region to explore its richness

gives hands-on experience with the growing process and quality of the food, and helps build affinity for the region. For wholesalers and retailers, the product is sold as premium. Companies like Lobstershack promote their location and their dining places to build their brand's identity.

Persona

The main focus for lobster owners is on sustainability, driving them to achieve premium quality and taste in a sustainable manner. Cooking and catching techniques also become traits of the product (certain kinds of cooking of a particular brands enhances particular tastes etc.).

For example, the Western Australian Rock Lobster Fishery was one of the first fisheries in the world to receive Marine Stewardship Council Certification for sustainable fishing practices. As part of the processing procedure, after steaming the lobster, they are quenched in sea water from the pristine, A-Class Marine National Park from whence they came.

Personage, or brand DNA

Chefs are the prime associations that build lobster brands. A few farms also build on their heritage and historical significance, and build their product value upon the visions and values of their founders/owners. Being 'green and clean' has become a very important factor for end consumers. Thus, most brands also strive to reflect their practices, their closeness to nature and richness in contribution to the environment through the elements of the marketing mix (packaging, place etc.), technology used, and methods for cultivation etc.

Paucity

The government is imposing marine parks and no go fishing zones in prime hotspots, threatening the future of commercial fishing. New product launches by fisheries and restaurants add to the scarcity of the value added product. Most brands build scarcity through the unique taste of lobster through geographic advantage. An example is Ferguson Australia, who report:

"On a positive note, Ferguson Australia is proud to be unveiling a delicious new addition to its product range, gourmet Lobster Salt. There has been considerable demand for Ferguson to expand on its lobster range, and Lobster Salt, with its truly exquisite flavour, is an easy way to add a touch of class to any meal. Many high profile chefs are already showing great interest in the Lobster Salt which is due to be released early next year. Ferguson Australia recently presented the Lobster Salt at a lunch with Australian food and wine icon Lyndey Milan, to terrific feedback."

Performance

Performance is often not perceived at the end consumer level, because of many value additions on the way to the plate. Hence the onus of performance lies mostly with the chef/restaurant etc, to recommend to their consumers certain lobster brands through PR campaigns and publicity efforts, so the client portfolio becomes a surrogate for the performance of the actual lobster product.

Some brands, such as Lobstershack are trying to break the barriers and increase the involvement of the name of the brand throughout the dining experience.

Packaging

Lobster packaging is primarily focused on functional packaging attributes. Brands focus on packaging materials and design that would best preserve the quality of the product, and this often requires hiring agencies who are experts in seafood packaging and transportation.

However, brands also use logos, colours and signage to establish brand identity. Premium brands also make sure that their persona is reflected in the presentation or the aesthetic value of the

packaging. For most brands, reflecting sustainability and innovation forms the backbone of their brand value.

Tuna

Supplier power

A low concentration of suppliers diminishes their power. The inputs required for the industry are similar with little or no difference. Distribution is highly diverse, as it is mostly dependent on export. There are no economies of scale, and vulnerability to threats from producers of cuts in production, added to export dependency, exposure to currency fluctuations, and high transport costs reduces supplier bargaining power.

Buyer power

Similar to abalone.

Threat of new entrants

Factors include high capital requirements, strict government regulations and ceilings on tuna farming to preserve biodiversity. Limitation of geographic factors, the high learning curve (new competitors must spend time and money studying the market, packaging, and process modifications which affects profits), and low profitability reduce the threat of new entrants substantially to low.

Substitutes

Similar to abalone. Asia has a developed taste for tuna, as has Europe. However there are only limited substitution options that taste like tuna, and substantial product differentiation based on region and process (from farm to shelf) limits threat of substitutes (low to moderate).

Degree of Rivalry

Government limits domestic competition by becoming a facilitating agency for the small farms, limiting the amount of tuna to be cultured. Asian markets are fast growth regions which reduces the degree of rivalry. Australian products compete with cheap international products which puts pressure on profitability. The domestic players are unable to compete with imports to the nation and hence are dependent on exports. Thus degree of rivalry is medium.

Luxury brand marketing for tuna

Provenance

Co-operatives and brands build their unique selling proposition (USP) on the heritage of the region in which they catch or cultivate tuna. The main focus of the brands is the ecological impact of their catching or aquaculturing practices, along with the direct impact of geography and topography of the region.

Some brands also build associations through their rich experience and deep roots with the regions. For example, Fish4ever charges a premium for its variety of exotic tuna, primarily because of its partnerships with numerous artisan fisheries. Thus availability of myriad tastes in tuna helps them garner a premium. They also provide traceable tuna which adds to the authenticity of their promise.

Pricing

The pricing of tuna is mostly set by demand and supply. However price of the first stock (especially of Bluefin tuna in Tokyo) if related to specific event or traditions, is open to auction, and hence the quality of fish affects the price immensely. The geographical location of the fish has limited effect, as consumer is still unaware/ less concerned about it than about taste. Fresh fish is priced according to its look, taste, texture, taste, fat content etc. and chefs decide on the qualities that best suit their culinary skills and requirements.

Publicity

Shows, conferences, films, talks, seminars, new product launch promotions, media relations, partnerships, etc. are usually employed as publicity elements for farmed tuna. Heritage, new technology, sustainability, traceability, moral responsibility, and product story are often the themes of media conversations.

Position

Availability governs the brand association and builds brand equity. Usually premium and luxury brands are not available at mass outlets. They often focus on demand from direct sources such as restaurants, event organisers, delicatessens, speciality outlets, artisans etc., but this is not a universal trend. Some brands choose to sell through major supermarkets, such as ASDA, as well.

Persona

Tours, awards, and certifications are used to build brand associations with the values of a company or a co-operative. Basically, brand association is anything which stays in the customer's mind about that brand. Tours also build brand association, relating it to innovation, advanced technology and processes etc. This helps consumers experience the brand and uses ambience, environment and tastes (culinary experiences) to establish brand's association. Coverage of sustainability, reports, digital marketing, promotion on Facebook, and collaboration with government agencies help a brand to be seen as responsible, concerned and authentic. Companies try to establish reputation and build trust among their consumers to win them over with premium tuna.

Personage, or brand DNA

The chef and the recipe become the major source of creating brand identity. Tuna farmers leverage the brand values and taste authority of experts, restaurant owners, chef specialities etc. to promote their tuna.

For chefs, it is the region and the treatment of the fish that lay down the path for brand associations. While some chefs prefer to talk about the origin of the fish, others focus on presenting the tuna as simply cooked as possible, with minimal additional ingredients, and only pairing other foods or drinks to emphasise the quality of the tuna. Thus, it is the overall experience of the food, rather than the particular dish/ ambience/ flavour that communicates the brand DNA to the consumers.

Paucity

Paucity is artificially created, as tuna is not actually rare. This can be through seasonal farming, or adding unique tastes and pairings with specific fish (related to their cultivation provenance). It is also created by limiting supply to particular stores.

Performance

Celebrity chefs, the product's presence on menus of the finest restaurants, and association with prestigious clientele are some methods adopted by brands to establish performance. Certifications and awards are the most common tools used by brands to communicate their performance, as consumers lack general awareness about the finest traits of quality tuna.

Packaging

Frozen tuna packaging tends to be artistic and colourful, and often includes representation of the actual product. The colours, logos, information and packaging style define the uniqueness of the brands, since product differentiation is not easily discernible by most consumers. Packaging therefore plays a surrogate role in communicating the quality and exclusivity of the product inside.

Use of fibre-based chilled seafood packaging, such as chillitainers, is used by some brands to ensure product quality, and preserves the taste promised by brands in a sustainable manner. Packaging and transport techniques can also ensure the pristine quality of the fish, enhancing the ‘freshly caught’ image while still maintaining the hygienic value.

Most packaging is limited to cans and cardboard freezer packs; otherwise the fish is directly sold to restaurants. However, for consumer packs, the ability to communicate sustainability of the product, traceability and reliability on the brands is of utmost importance. The packaging trends that have emerged include convenience, ability to preserve freshness, and ability to relay transparency of procurement. For fresh/frozen tuna, presentation and cleanliness are of utmost importance to enhance the palatability of the product.

Oysters

Supplier power

The supplier takes the highest risk, especially with the threat of disease, variability of temperatures, weather conditions, and variance in quality, and may not be able to fetch high value for his/her product. Apart from this, most farmers are small and lack the ability to expand, thus limiting their production volume and therefore their reach. Poor competitiveness against commodity markets in China, Japan, high transport costs and lack of consistency weaken supplier power for most. Only a few are able to maintain higher than normal profits. Oysters are often used as loss leaders (Shane Comskey), therefore suppliers have low to moderate power.

Buyer power

In this case the buyer can be the restaurant or business that would purchase one or more oyster batches. Since most value addition happens in the chef’s kitchen, the power of the buyer increases. Other than country of origin affect, Australian oysters all have unique characteristics, depending on where they are grown. This shifts the balance back, as is evident in media reports indicating how farmers are reaching out to the end consumer with their innovative style and experimenting with diverse oyster dishes and menu items¹⁰⁹.

Threat of new entrants

New models such as oyster bars or cafes have started to crop up, with promising results. Thus low value add, coupled with low switching costs of consumers, brings uncertainties to this business model. However, shuckers and wholesalers have significant integration, thus decreasing profitability. Margins in the middle chain are even lower than horticulture. There is a low threat for the middle chain, as the industry suffers from technological constraints, low margins, and high costs of maintenance.

Substitutes:

Similar to abalone. Asia has a developed a taste for oysters, as has Europe.

Degree of Rivalry

Low profitability, high fragmentation, and formation of government co-ops to help growers/farmers have created high competitiveness in the industry. Stagnant profitability of the industry, and lack of a real value add weakens the farmer’s position, thus placing pressure on the price point. However, the Australian Government has strict regulations about the quality of food, and this gives oysters a brand advantage, offsetting the previous effect. Generally the degree of rivalry is medium to high.

¹⁰⁹ <http://www.theaustralian.com.au/life/food-wine/ewan-mcash-on-clyde-river-and-the-oyster-boys-are-challenging-tradition/story-e6frg8jo-1227290019351>

According to the latest ABARES Australian Fisheries Statistics (ABARES, 2014), the entire NSW oyster industry is worth a modest \$38 million — and the Clyde River accounts for roughly 10% of \$38 million. The total value of oyster production Australia-wide is \$97.3 million. Medium – low.

Luxury brand marketing for oysters

Provenance

Farmers relate their product's value to their heritage and family history to establish authenticity, and introduce a story that defines their product because there is little USP in the processing of this species. The origin of the farm and owner becomes the focus for product features.

Sampling and tasting of oysters on the farm is a method used to create and build an identity of the product. Oysters are identified by the region in which they are cultured and Australian oyster farmers sell their oysters based on where they are grown. Examples include Coffin Bay and Smoky Bay in South Australia, Moulting Bay and Blackman Bay in Tasmania for Pacific Oysters, and Cape Hawk (Roc species). These regions are touted by suppliers as the best regions (clean, green, sustainable and meaty) for cultivating oysters.

Other experiences can be added, for example the ambience, smell, and touch of the product and by promoting the coastal trails where oysters are farmed. This trend is gaining popularity for example, Ewan McAsh with his farm on Clyde River, focuses on the 'process and art' of growing oysters. The notion is not new — Gary Rodley (Tathra oysters), Steve Feletti (Moonlight Flats) and a handful of others share similar methods that are changing the way consumers experience oysters.

Pricing

Pricing is based on supply demand dynamics. Any disease outbreak affects the industry as a whole because even higher prices of sales do not make up for the loss of profits due to low production, because the market is also dependent on import prices. Thus, added value becomes extremely important, however it is also noted that top quality range products have not increased much since the Pacific Oyster Mortality Syndrome (POMS) outbreak.

Publicity

Most oyster farms are small and fragmented. They market to their domestic and international consumers with the aid of relevant Government agencies and/or industry organisations. Thus the state's oyster farmers become part of a national agency which is then held responsible to promote their crop.

This involves tastings, samplings and newsletters from the agencies, providing the latest news from the local industry. It also involves promoting the different farms, along with generating sales through partnerships with wine estates, restaurants and international clients. For example, oyster growers may partner with winemakers to create new combinations that are then featured in various connoisseur magazines, newsletters, and in competitions. Some growers use awards to partner with restaurants and chefs looking for unique and new flavours, for example Moonlight Flat oysters.

Position

The places where oysters are available become an essential part of the brand communication for this product. Some companies sell only through the direct model to ensure finest quality of product delivered (fresh chucked, personally packaged and delivered live can be some of the constraints that make the direct model of delivery more reliable).

Companies may prefer to use their own centres and outlets to sell. Some of the companies that associate their brands strongly with values such as sustainability like to deal with

supermarkets/stores that only sell brands complying to international standards, enabling them to associate their product with stringent standards and finest quality. However, there are also a few brands that do not adhere to strict norms on their distribution model. It is clear that the former strategy is seen to be more in line with luxury and premium quality oyster brands (smaller specialised farms).

Persona

Oyster farmers promote their brands on the basis of how close they are to natural methods of cultivation, how sustainable the product is, and how precise and careful they are in developing the perfect product for their consumers. The founders/farmers become the persona for the brand, but that is not enough. Certifications and awards are essential to display authenticity of the principles/values that are core to the brand. It is important to note that anything that is not mass, and not easily customisable or flexible in responding to consumer demand, but rather is the other way around (ruled by seasons of cultivation, timings of visit, direct vs. indirect ordering, packaging etc.) is able to create the persona and build equity.

Personage, or brand DNA

Brands in oyster cultivation use the values of their farmers/creators as a fundamental element that is reflected in any communication. For example, Ralston Brothers Oysters focus on the principles/visions of their families in preserving old traditional cultivation styles. Therefore, their communication, packaging, availability all reflect these guiding principles. Their signature brands, the Waterfall Oyster and the Heritage Oyster, both boast a distinctive flavour experience and preserve their unique shape. For Moonlight Oysters, French styles in packaging, food pairings, and restaurants (known for French cuisine/ specialities etc.) govern their brand communication to create an association with French oyster strains. However, for their signature brands, the personality of their farmers is used to create the brand identity.

Paucity

It is important to note that anything that is not mass, and not easily customisable or flexible in responding to consumer demand but rather is ruled by seasons of cultivation, timings of visit, direct vs. indirect ordering, packaging and so on, creates scarcity for the product. Therefore many cultivators provide oysters only in the prime seasons and close for the rest of the year. Apart from this, quotas and restrictions by the Government limit production, adding to the effect. This creates high demand during seasons of availability.

Performance

As discussed above, brands must deliver on their promise, however lack of consumer awareness about the quality and taste can become a hindrance. This is overcome through certifications, celebrity chef referrals, promotion and communication of strict production policies in newsletters, media releases, and advertisements. Apart from this, invitations to tour the region and investigate the cultivation process add to the authenticity of the brand proposition.

Packaging

Brands build association to the origin, farm and/or the artist/celebrity they associate themselves with through use of unique styles, packaging materials, aesthetics and presentation.

Sometimes brands also create packaging to enhance the experience of the taste and texture by including food and wine pairings. This helps the brand to establish its own identity and unique savoury experience.

An example of packaging enhancing the experience is the selection of Cromaris oysters' packaging in The Dieline's design selection. The Dieline is the world's most influential web portal focused on packaging design, with over a million readers, and to be mentioned by the Dieline means recognition as having one of the best product packaging designs in the world. Designed by Bruketa & Zinic OM, Cromaris present carefully selected oysters sitting in a bed of thinly shredded paper inside an unfinished wooden box made of birch. The box is minimally painted with an abstract pattern, representing the oysters it contains as well as a topographical map of the location where oysters were caught. The packaging also includes lime pieces to promote flavour pairings.

Caviar

Demand

The Swiss and French are the biggest caviar consumers followed by Americans, British and Japanese. Canadian caviar consumption is relatively small due to the size and composition of the population, but steady, with a trend to increase.

Supplier power

The low concentration of suppliers diminishes their power. The inputs required for the industry are similar, with little or no difference. Distribution is highly diverse as mostly dependent on export. There are no economies of scale, and vulnerability to threats from producers of cuts in production, added to export dependency, exposure to currency fluctuations, and high transport costs reduce supplier bargaining power.

Buyer power

Since Australian suppliers deal with premium high quality products, the consumer has low price sensitivity. Product is important to the customer, which reduces the power of the consumer. Awareness of industry concerns regarding over-farming, disease, and organic farming will also help increase preference for Australian sturgeon. Thus power of buyer is decreasing (moderate to low).

Threat of new entrants

High capital requirements, strict government regulations and ceilings on sturgeon farming to preserve biodiversity, along with the limitations of geographic factors, the high learning curve (new competitors must spend time and money studying the market, packaging, and process modifications which affects profits), and low profitability reduce the threat of new entrants substantially (low).

Substitutes

Similar to abalone. Asia has a developed taste for sturgeon, as has Europe. Consumers are becoming worried about the declining stock of sturgeon, which is forcing them to adopt cultured substitutes. However, any substitute to the real product is perceived as inferior, and there are limited substitute options that taste like sturgeon. In addition, there is substantial product differentiation based on region and process (from farm to shelf). These factors limit the threat of substitutes (medium).

Presently, the eggs of more than 38 species of fish other than sturgeon, and three species of other animals are used to produce caviar substitutes. About 15 'caviar like' preparations are known in the market using fish flesh, seaweed and others mixtures of materials of various origins as their raw material. Five products can be considered simulations. Few use caviar as a component in their production recipes and a lot of different products are presently marketed which use the name caviar as a brand.

Degree of Rivalry

Increasing demand and limited supply reduces the degree of rivalry. Australian products compete with cheap international products as well as original/ traditional caviar, which puts pressure on

profitability. The domestic players are unable to compete with imports to the nation and hence are dependent on exports. The degree of rivalry is therefore medium.

Luxury brand marketing for caviar

Provenance

Breeding sturgeon is a large investment (wild catch is forbidden due to its scarcity), hence cultivation of a particular species of fish that is a cousin or close replica of the original species becomes very important. Caviar brands can charge a supernormal profit for just the geographic history of the fish they culture. However, there is a trend in promoting the terrain in which the fish are cultured, in that this can provide distinct and unique flavour in the caviar. Certain minerals can also add to the taste and are fast becoming popular among caviar lovers.

Pricing

The price of caviar is usually determined by the supply demand scenario, however since authentic caviar (not the loosely used term) is already limited, brands try to add value through diligence in the cultivation process. Some brands charge a supernormal profit that is significantly greater than others, based on the time taken to cultivate the sturgeon and the use of painless sustainable methods of extracting the eggs from the fish. For example, Caviar de Riofrio states:

“One of the main differences that differentiate our caviar from the naccarii sturgeon to others is that our females need almost 16 years to produce caviar, double the amount of time of other caviars on the market. Furthermore, the conditions that the sturgeons are farmed in at PSN are also an important factor.”

Publicity

Publicity is mostly achieved through association with celebrity chefs, use of newsletters, participation in contests, and clientele support. Some brands also invite chefs and renowned guests to their stores/farms to view the caviar production process. This, along with offering invitations to farm tours for the general public, also proves effective for the industry.

Position

Usually small farms become part of a committee or association that then becomes their retailing and marketing arm. Others, who are big enough, open direct retailing with a good online presence to attract consumers/clients. However, end users only tend to see the brands in speciality stores or large supermarkets.

Persona

The impact of persona is limited to the history of growers, generations of caviar farming, and founder/creator's vision.

Personage, or brand DNA

Usually adherence to government sustainability, green/clean programs, livelihood programs (or any other environmental protection programs) is used to establish the core qualities of the brand. Often pioneering ventures and innovation in techniques are cited to attract authentic caviar hunters.

Paucity

Although supply is currently low, in the future, consumer awareness and preferences will likely destroy the 'luxury' and 'rare' association with caviar and make it a mass product. Paucity is a tool that many brands use for certain specific sturgeon; however it is clear that the emerging consumer is not aware or knowledgeable enough to make the distinction. Value adding by the chef also destroys the ability of the company to reach directly to the consumer.

Performance

Performance is not generally perceived by the end user. Only expert chefs, tasters, food connoisseurs can identify the taste, look, texture and smell of good caviar. Hence the onus of performance lies mostly with the chef/restaurant etc. Therefore, purity of strain, advanced techniques, pristine culture farms, and the most stringent sustainable practices have emerged as symbols of performance for brands.

Packaging

Product takes priority in caviar packaging. Packaging has an important role in sealing, protecting the texture, shape, taste, and colour of caviar, however display and presentation are also important. Brands instil their heritage through the use of icons, logos, and signage in gift packs. Often packaging includes expensive materials, for example jewels or gold plating, as a symbol of exclusivity and extravagance.

The Kaspia Matriochkas presented in Limoges porcelain is a new range of caviar display and an example of the use of expensive and exclusive materials in packaging. The collaboration between Caviar Kaspia and Maison Carpenet is the result of a range of original caviar displays, rare and precious, with originality and sophistication, emphasising the caviar as well as the tradition. This fine and delicate collection, emblematic of the purest French craft, was designed by designer Georges Riu. The four Russian dolls in the collection are real hand-made jewellery, decorated with black enamel, designed with fine gold and set with a golden brass clasp. They build on their association to Russian royalty and historical significance of Russian sturgeon.

Some brands focus on the experience of consuming the caviar from their packaging, while other brands focus on building association with style and heritage through adoption of an artist's or designer's persona. A limited edition Love Collection by Caviar House was inspired by Yves Saint Laurent's self-made greeting cards.

Roadman for Luxury Food (Seafood)



Figure B3. Roadmap for seafood as luxury food

Truffles

The Australian truffle industry originated in Tasmania with the establishment of the first truffière in 1992, and the harvest of the first Australian French black truffle in 1999. During the 1990s, the Rural Industries Research and Development Corporation (RIRDC) assisted the industry by supporting a number of research projects and industry awards. The industry has since grown to a new level of maturity over the last ten years. It now appears to be entering a new phase of industry investment and growth.

Truffières are now established and producing in Victoria, New South Wales, the ACT, South Australia and southern Queensland. With limited supply and robust world prices for the prized French black truffle, Australia has an opportunity to establish itself as the largest supplier in the southern hemisphere.

Opportunity landscape to trade-up

Strengths

- Strong demand and huge potential for export to Europe and Asia.
- Reduction in worldwide production levels has resulted in sustained demand and escalating prices and this is expected to continue.
- The target market for supply is the top echelon restaurants; very selective marketing makes the product less vulnerable to price cycling or global economic pressure.
- The Australian truffle harvest season is six months apart from that of Europe so there is no direct competition with traditional truffle growers.
- Existing high interest by potential growers to enter the truffle industry.
- RIRDC reports indicate that expected future expansion of truffle production will not cause the saturation of the market in the foreseeable future.
- A truffière only requires small acreage to grow a commercially viable crop.
- An established truffière requires only small maintenance operations with low labour requirements to maintain and harvest the crop annually.
- The ATGA (Australian Truffle Growers Association) is an industry body providing network support to growers and good vector for information and promotion.
- The successful truffle growing areas of Europe are climatically similar (Mediterranean) to regions of Australia.

Weaknesses

- Current operating inoculating nurseries resisting change to trufficulture practices or adhering to a quality/accreditation scheme.
- Existing inoculation nurseries and truffières with their own business model and agenda not wanting to communicate or be involved in the ATGA or adopt industry guidelines.
- In Australia there is a lack of research and development (R&D) into trufficulture and a general lack of understanding among truffle growers.
- Many current truffle growers are retiring professionals without any horticultural/agricultural qualifications or experience.
- Much of the overseas private R&D is controlled by corporate organisations and is either not available under commercial agreements or not easily accessible.
- Some published R&D in Europe is in the native language and is yet to be translated.
- The amelioration of Australia's low pH soil, eventuating in the soil then becoming calcareous, is expensive to counteract and will require periodic maintenance with lime.

- Some agricultural soils that are high in nutrient levels or contain residual agricultural chemicals will not be suitable for truffle growing.
- There are a low proportion of trees, within truffières, currently producing truffles and low levels of production throughout the Australian industry.

Opportunities

- Potential to access new export markets that are seeking quality assured French black truffles and French black truffle products.
- Develop a 'clean green' reputation for supplying a pure and premium quality of French black truffle.
- Truffles offer a viable alternative to conventional horticultural crops for commercial producers. Attractive to small acreage property owners and hobby farmers.
- The mystique, folklore and misunderstandings surrounding trufficulture produce many inconsistencies and knowledge deficiencies that need to be addressed.
- Training for new and existing truffle growers in a range of horticultural skills and trufficulture techniques.
- Development of strong international networks and forums between truffle growers, researchers, government bodies and universities will enhance and bridge the knowledge deficiencies.
- Providing a greater knowledge bank and bridging the skills deficiencies will see improved truffle production levels and ensure the sustainability of the industry.
- Developing a suitable method of vegetative propagation of *Quercus* sp. (oak trees) will remove one variable arising from genetic differences in seed grown stock.

Threats

- Where Chinese truffles are discovered growers may not want to allow removal and disinfection of the truffière.
- Not all nurseries will want to adopt a new QA (quality assurance) system or an accreditation system.
- The periodic auditing of nurseries will be time consuming and costly to industry members.
- Inoculation nurseries that do not comply and growers not following industry standards may cause a split or segregation in the truffle industry.
- Information about truffles is scattered; throughout the world, and indeed in Australia, there are many varied theories and misguided opinions regarding truffle growing requirements and trufficulture practices.
- Being a unique subterranean symbiotic mycorrhizal fungus, the traditional agricultural growing and disease control methods can be detrimental to truffles, such as phosphate fertiliser, fungicides and herbicides.
- The depth of a global economic depression would affect the short-term potential of truffle market expansion.

Industry analysis

Note: Insufficient data available for full-fledged analysis of truffles.

Drivers for industry growth

- Growth in Australian market demand for French black truffles grown in Australia
- Counter-seasonal exports to northern hemisphere markets
- Asian market proximity and growth in demand for Australian truffles
- Continued limited supply of truffles in Europe

- Knowledge of production and demand factors affecting market pricing trends
- Increased yields of truffles from Australian truffières
- Development of quality standards to ensure consistency of Australian truffles
- Development of preserved and value-added truffle products using Australian truffles
- Development of technical and research resources for the industry
- Efficient communication and management of whole-of-industry issues.

Constraints for industry growth and sustainability

- Variable understanding of strategic export markets such as Asian markets
- Lack of consumer and market education about Australian truffles
- Variable understanding between growers on optimal climate and soil conditions to grow truffles in Australia
- Variable knowledge between growers on truffière establishment, tree handling and management systems to maximise the growth of truffles in Australia
- Variable yields, volumes and quality of Australian truffles
- Lack of quality assurance for propagation of seedlings and trees using guaranteed sources of inoculum
- Biosecurity risks especially from imported truffles
- Lack of guidance on quality grading standards for Australian truffles
- Competition and/or substitution from other country suppliers
- Variability of grower skill levels
- Lack of access to technical and research resources
- Limited further processing facilities for Australian truffles.

Luxury brand marketing for truffles

Provenance

Truffles are cultivated in specific regions, and the change in terrain/soil affects the taste and texture of truffles drastically. For example, fine quality truffles are found only in the Manjimup region of Western Australia. Farmers also use the 'country of origin factor', for example truffles initially imported from France are sold as French Black Truffles (scarce and unique in taste and texture).

Pricing

Prices of truffles depend on the size and type of truffle farmed, but demand and supply affect the prices in the domestic market as well. The kind of host trees used also affect the taste and hence the pricing.

Publicity

Newsletters, festivals, fairs and special events have become a platform for small and fragmented truffle farmers. Big farms use media releases, interviews, and competitions etc. to gain visibility and establish brand equity.

Position

Truffle growers mostly sell their products through auctions during the truffle season or directly from the farm. Some truffles are available at select stores. This creates scarcity in the minds of consumers and adds value for the farmers.

Persona

Truffles are ideally imported products, hence farmers associate the techniques adopted for cultivation around the country from which they were imported. Notably, some farmers focus on the traditional or innovative methods used to bring the finest truffles to the plate. Often the techniques

involved build the unique traits of the product for each farm (along with the region in which they are grown).

Personage, or brand DNA

Bigger farmers build their brand around the values and principles of their founders/family history and heritage. They use their heritage and experiences to establish trust in the product produced.

Paucity

Truffles are rare and the subtle flavour qualities imparted by the growing region and farmer's techniques add to this. Further availability is limited to select stores and localities and this creates the effect of paucity. Sometimes truffle sizes and unique colours are helpful in creating scarcity in the market.

Performance

Pairings of truffles with different cuisines, enhancement of their tastes when paired with fine wines etc. are unique ways that help farmers depict the quality of their product. Chef recommendations, especially popular chefs or owners of the finest restaurants of the world, improve the perception of their performance for the unaware consumer.

Packaging

Truffles are usually packed as a garnish (crushed, shaved, sliced etc.) and seen mostly in fine gourmet packaging styles, for example tins gold foiled with the brand name and nutritional information on the seal, or in traditional simple grocery style packaging of paper bags with aromatic seals and the brand colours displayed on the bag.

Farms and brands usually focus on the years of experience, heritage of the farm location, family history, awards and recognitions won to communicate product quality and premium experience to the consumer. For example, Urbani truffles use an elaborate and distinctive logo that is a symbol of the history of the brand.

Roadmap for Luxury Food (Truffles)



Figure B4. Roadmap for truffles as luxury food.

Cheese

There are four main milk producing regions in South Australia, stretching from the south east of the state to the Barossa Mid North area.

1. The southeast of the state is regarded as an integral part of the future growth of the 'South-West' milk bowl. It is predominantly supported by summer irrigated pastures. This region produces over 60% of the state's milk.
2. The River and Lakes region has been hit hard in the past by drought and severe water restrictions. However, the dairy community remaining in the region is extremely resilient and is paving the way towards a more flexible and profitable style of dairying.
3. The Fleurieu Peninsula is a predominantly dryland dairy farming area. The area is contracting in farm numbers but is holding on cow numbers and milk production. This well-known and productive dairy area is increasingly under threat from urban sprawl and competing land use. However, the farmers in the region remain committed to quality milk and herd production.
4. While the Barossa Mid North is perhaps better known for its wine and crop production, there is a thriving dairy industry still in the region, using dryland systems. Milk production has increased in the past few years, as these farmers actively aim to develop their production skills and feeding regimes.

Future opportunities

- Global dairy demand outpacing supply
- Changing economics for competing food ingredients
- Attracting investment to the industry
- Flexible and adaptable production systems
- Adopting technology to lift profits
- Widening scope for product functionality
- Building farm business skills to mitigate risk, manage volatility, and grow wealth
- Transformational advances in plant and animal technologies

Areas of industry risks/weaknesses

- Vulnerable production systems
- Attracting, retaining and developing skilled people
- Producers operating on volatile production margins
- Reduced relevance as a reliable dairy exporter
- Threats to dairy's industry reputation
- Increased accountability and costs without effective measurement
- Moving too far away from competitive production base
- Affordability critical to dairy's role in addressing nutritional needs

Better weather, lower input costs (particularly feed grains) and significantly higher farm gate milk prices have helped drive increased production. Despite differences in price mechanisms and sensitivities, strong commodity prices on international markets have boosted returns at the farm gate across all major exporters. The four largest exporters (biggest farm gate price growth) are the European Union, United States, Australia and New Zealand.

Opportunities are linked to high value niche products such as speciality cheeses, milk from small regional processors, and organic and biodynamic dairy production, which are becoming more

popular. Domestic consumption of dairy produce has also increased gradually during the last five years. In Asia, increased demand for dairy products is providing additional export opportunities.

Major companies operating in South Australia are National Foods, Warrnambool Cheese and Butter Factory, Kraft, Murray Goulburn and Goodman Fielder. About 1,500 people are directly employed on farms and a further 400 in processing.

Roadmap for Luxury Food (Cheese)



Figure B5. Roadmap for cheese as luxury food

Luxury brand marketing for cheese

Provenance

Luxury cheese brands rely on the history and generations of the community involved in cheese making. For example, Pyengana Dairy promoted its finest quality cheddar based on four generations of technique and expertise. Some brands, such as Bruny Island, build their provenance on being exclusive producers of certain cheeses.

Pricing

Price depends on the taste, texture, and paucity/scarcity of the licenses for cheese production. The value add in luxury cheeses is dependent entirely on the cheesemaker. Prices would reflect the cheesemaker's popularity and status in the market.

Publicity

Cheesemakers become the face of brands/co-operatives. Publicity activities include guest interviews with cheesemakers, participation in fairs and international competitions, media releases and newsletters. Often public relations strategies target restaurant owners and winemakers as well as consumers.

Position

Positioning in expensive delicatessen outlets, availability in select speciality stores, trade fairs, direct orders, and boutique stores can create a sense of scarcity and target selective consumers. Some cheesemakers have their own boutique outlets, helping them leverage their brand appeal through the experience offered to the consumer.

Persona

The cheesemaker's personal touch and vision creates the persona. For example, organic cheeses produced by L'artisan Cheese bases itself in the vision of its cheesemaker Matthieu Megard. To build the brand, the cheesemaker uses traditional cheesemaking techniques, and provides a tranquil garden for consumers to experience the freshness of the variety. Complex tastes or simple flavours are also dependent on the cheesemaker's style. Some cheeses raise the particular profile of regional cuisine, through food and wine pairings, thus inheriting the persona of the region they are based on.

Personage, or brand DNA

Usually the personality of the cheesemakers becomes the crux to build the brand. The signature styles of cheesemakers are identifiable in the taste, variety and techniques used in cheesemaking. However, bigger brands focus on their founder's vision and thought.

Paucity

Because of government regulations which currently do not allow unpasteurised cheese, the production of these cheeses is limited in Australia. Government regulations (national and local) affect the availability, as does seasonality, creating scarcity of the product. The region also affects the kind of cheese produced. Cattle feed also adds subtle flavours to cheese and this factor is also used by many brands to create scarcity, enabling them to charge a significant premium.

Performance

Awards, certifications, licences and reviews by expert cheesemakers, chefs, and connoisseurs act as surrogates for cheese performances. These are often used by brands and shop owners to build brand equity.

Packaging

Cheese packaging styles usually focus on attracting consumers, displaying the product and portraying the freshness and goodness, and nutritional value. Some brands rely on convenience as a packaging factor, but for most products, brand identity takes precedence over other functional benefits.

In cheese, the artisan's, and the brand's, ability to reflect itself on the shelf becomes very important as it also reflects the collection and taste. The variety of available packaging for cheeses helps individual products stand out. This often means including the cheesemaker's or celebrity chef's seal of approval, symbol or signage to leverage the historical significance, and unique branding designs to appeal more modern and experimental clientele.

Wagyu Beef

Farms in southern areas of South Australia are generally more intensive than their northern counterparts. Farmers in this area generally run European and British breeds, preferred for their ability to gain weight and produce favourable quality meat. After being slaughtered at varying ages, meat from these cattle is typically sold into high value markets. These include Korea, Russia and Japan.

The convention for the naming of a beef breed is that the breed named on the packet, in the butcher's window, or on the menu, is the breed of the bull that fathered the animal. This means an Aberdeen Angus steak will have come from a pure-bred Aberdeen bull, but the cow could have been a Hereford, or more likely a dairy breed such as Friesian or Holstein. This practice is legal, but misleading. It also makes it hard for purebred producers to get the message across that their meat has particular qualities. If the beef is not from Japan and simply labelled 'Wagyu' it is likely to be only half Wagyu, that is, the progeny of a non-Wagyu cow inseminated with Wagyu sperm.

A major strength of the Australian beef industry is its disease free, 'clean and green' image. The adoption of the National Livestock Identification System (NLIS) assists with this. The NLIS requires cattle to be given an electronic identification ear tag at an early age. As the animal progresses through the supply chain, it can be tracked via the NLIS¹¹⁰.

Opportunity landscape to trade-up

Strengths

- Efficient production methods
- 'Clean green' product image because of NLIS that ensures tracking
- Major meat exporter

Opportunities

- Management of production risk
- Increasing acceptance of Wagyu varieties especially in terms of breeding/ feeding/ treatment of cattle
- Variation in Wagyu and Kobe beef tastes depending on local preferences
- Increased demand from Asia markets
- Despite the fact that the US has a much larger cattle herd compared to Australia, it services high-value markets. This gives Australia an opportunity to provide for its significant hamburger market. The beef that enters this market is typically boxed beef that comes from northern producers.
- Attainment of greater efficiencies

Weaknesses

- Volatile global commodity markets
- Farmers do not reveal the secrets for premium quality beef (as in Kobe) (i.e. diet, techniques, breeding etc.) adding to the mystery and experience of tasting the meat
- Concentration of processing capacity
- Climatic variability
- Easily affected by recession as in 2008-11 (led to exits of many breeders)

¹¹⁰ <http://www.mla.com.au/meat-safety-and-traceability/National-Livestock-Identification-System>, accessed 9.9.2015.

Threats

- Input prices and costs are very high, risky capital business
- Disease risk from imported stock
- Trade restrictions on exports such as followed by Japan (as highly concentrated markets increase vulnerability to changes in trade agreements and safeguards)
- Climate change

Industry analysis

Demand

The disease free status and traceability of the Australian beef industry provides a competitive advantage. Increasing international demand for protein means that the future of the Australian beef industry is bright.

Supplier power

Diverse distribution channels and critical production inputs are similar, which decreases USP, however opportunities in variations in farming techniques can increase the power of suppliers in the future, and increasing trends towards sustainable and organic, clean green farming may further strengthen their power. Supplier power is medium.

Buyer power

Since Australian suppliers deal with premium high quality products, the consumer has low price sensitivity, and product is important to the customer, which reduces the power of the consumer. Awareness about industry concerns of over-farming, disease, and organic farming will also help increase preference for Australian Wagyu beef. Buyer power is therefore medium.

Threat of new entrants to the market

High capital requirements and strong brand names are important, advanced technologies are required, customers are loyal to existing brands, entry barriers are high, building stock is time intensive, there is a high learning curve and geographical locations are limited. The threat of new entrants to the market is low.

Substitutes

Cheaper variants of Wagyu can threaten demand, especially if these substitutes can compete at taste levels, as processes are easy to imitate. Significant investments are required in innovation and R&D. But consumers still look for the authentic breed, therefore the threat is medium.

Degree of Rivalry

Large industry size and increasing demand for Wagyu beef, low exit barriers, small sized breeders, seeders, processing units mean the degree of rivalry is low.

Luxury brand marketing for Wagyu beef

Provenance

The definition of 'Wagyu beef' is very specific to regions in Japan. It is ideally the cattle that is born and bred in Japan. However, Australian breeders use the term 'Wagyu' even if they simply import the calves from the region. Therefore provenance and the strains of the calves bred becomes a very important attribute. Unfortunately brands cannot only rely on this as a lot of consumers are unaware or ignorant of the beef origins they are consuming.

Pricing

International pricing decides local beef prices because Australian brands compete with international brands. However Wagyu beef pricing is also dependent on the breed, the quality of fat, quantity/fattiness of the meat, the texture, availability of quality beef in the market.

Publicity

Tours, visits, auction markets, competitions, media releases, newsletters and committee meetings are the main sources of communication.

Position

The trend is similar to that of seafood. However another medium helps establish the brand value, this being meat auctions/ sampling events etc. This helps breeders form an image and build their brand's association.

Persona

Breeders build brand association with their heritage and experience in breeding Wagyu. An important aspect of the breeding technique is that there are trade secrets around treatment of calves, feeding of the cows and techniques to reduce the stress when they are sent to the abattoir. These trade secrets help establish the quality and taste of the beef. The practices, certifications, awards etc. help establish the brand value.

Personage, or brand DNA

Vision and heritage of the breeders/founders becomes the medium to create association to their values. Some brands use their clientele as a major source to communicate the traits of the meat produced.

Paucity

Scarcity is conveyed through the strains of beef available in Wagyu. Interestingly, Australia boasts of meat that is completely disease free due to geographic advantage. Cattle breeders can boast of one of the few cattle strains free of mad cow disease that infects competitor nations. This enables Australian cattle breeders to charge higher premium on Wagyu than other nations.

Performance

Usually, techniques used to treat the cattle, fatten the meat, taste, texture, marbled appearance etc. are signs of finest quality. These act as surrogates to check the performance, culinary potential of the meat by chefs and consumers.

Packaging

Wagyu beef packaging is primarily focussed on the display of the meat inside because the marbling texture of the meat is a signature of the quality of the meat. Most brands showcase the marbled texture in the most palatable fashion and add their signage to build on the heritage of the brand.

For example, Cabassi Wagyu displays its Master of Wagyu signature and personal seal of approval on their finest grade beef. Another feature that is common in all packaging is building brand equity to the country of origin of the meat, for example Japan. Most brands try to use emblems, languages, logos, colours that signify heritage ties to the nation or its tradition.

It is also important to note how traditionally home grown brands use very basic, traditional styles of packaging to differentiate themselves. For example, both tokusen Wagyu and local Japanese vendors selling hida beef use cardboard spring-tied packs stamped with the Government of Japan's chrysanthemum seal of "official Wagyu".

Roadmap for Luxury Food (Wagyu)



Figure B6. Roadmap for Wagyu as luxury food

Market assessments for functional food

The following tables provide detailed assessments of the factors affecting the functional food market segment in specific markets: China, Hong Kong, Singapore, Japan, Malaysia, and South Korea.

NOTE: This section of the Reference Report includes summaries of luxury food actors currently present in the food ecosystem of South Australia. The portrayal is not exhaustive and the South Australian actor base is wider and constantly evolving; for example Food South Australia provides more information about supporting actors in the region (see <http://foodsouthaustralia.com.au/guide-to/>).

China

The following analyses comprise:

- PESTLE for Luxury Food in China
- Luxury Food Actors in China

PESTLE analysis: Luxury food in China

Products	PESTLE Analysis					
	Political	Economic	Socio-cultural	Technical	Legal	Environmental
Truffles	<p>Stable government with an increasing focus on anti-corruption drives.</p> <p>Growing interest in outward FDI to foster economic ties with the West the West FTA (free trade agreement) with Australia and New Zealand.</p> <p>Government agents have been warned against extravagance especially on luxury goods.</p>	<p>Increasing affluence and disposable income of the Chinese population.</p> <p>GDP in 2013 grew at 7.7 %.</p> <p>0.76 Mn HNWI's (high net-worth individuals) in 2014.</p>	<p>Large population of people geared towards "aspirational living" will drive social acceptance of luxury food such as truffles.</p>	<p>Growing presence of local truffle industry will drive awareness.</p> <p>Lack of IP protection will result in value dilution for producers.</p>	<p>No major regulatory factors.</p>	<p>No major environmental concerns.</p>
Luxury Chocolates	As above	As above	<p>Higher disposable incomes will drive up gift-giving.</p> <p>Luxury chocolate is a major gift giving area to indicate affluence.</p>	<p>Lack of local chocolate production will drive an increasing demand for imported products.</p>	<p>No major regulatory factors.</p>	<p>No major environmental concerns.</p>
Red Wine	As above	As above	<p>Red is associated with prosperity in China and wine is seen as a symbol of sophistication.</p>	<p>Insufficient (volume and quality) local wine production will drive an increasing demand for imported products.</p>	<p>No major regulatory factors.</p>	<p>No major environmental concerns.</p>

Products	PESTLE Analysis					
	Political	Economic	Socio-cultural	Technical	Legal	Environmental
				Growing call for anti-counterfeiting measures-		
Distilled Spirits	As above	As above	Increasing focus on entertaining particularly in the business sector will drive luxury alcohol acceptance and consumption in China.	Local manufacturers will compete in the spirits sector but lack of production for brands such as Cognac and Malt Whisky will drive international demand.	No major regulatory factors.	No major environmental concerns.
Wagyu Beef	As above	As above	Demand for quality produce and higher affluence rates will drive consumption.	Imports from Japan have been banned but a black-market exists and imports are done via third countries. Lack of a local production.	No major regulatory factors, except or a ban of Japanese imports	No major environmental concerns.
Southern Bluefin Tuna	As above	As above	Demand for quality produce and higher affluence rates will drive consumption.	Taiwan now dominates global industry. Smaller local industry with growing import demand.	Regulations have been developed to restrict the manner and amount of fishing particularly in the Japan-China sea.	Bluefin is now an endangered species and much focus is being placed on reducing its consumption.
Abalone	As above	As above	As above	Small local industry with limited upscaling capability.	As above	Increasing incidence of disease among abalone species due to intensive farming and overfishing.
Rock Lobster	As above	As above	As above	No real local industry with growing demand driving import focus.	As above	Climatic changes affecting the natural ecosystem and reducing catches.
Sturgeon Caviar	As above	As above	As above	As above	No major regulatory factors.	Overharvesting, environmental pollution and black market

Products	PESTLE Analysis					
	Political	Economic	Socio-cultural	Technical	Legal	Environmental
						trade are key concerns.
Oysters	As above	As above	As above	Existing local industry with growing demand driving import focus.	No major regulatory factors.	No major environmental concerns.

Luxury food actors in China

Products	Value Chain Actors of Luxury Food in China			
	Trade agents / Importers/Wholesalers/Distributors	Food Manufacturers	Retailers	Food Service
Truffles	Kunming Truffles and Mushrooms Trading Inc., Kunming Rare Truffle Co, Micologia Forestal Aplicada, Yunnan Dabenshi Agricultural Science And Technology Development Co., Ltd, Kunming Qianxi Industry & Trade Co., Ltd. Sanyi industrial Co. Ltd, Hunan Chunhua Biotech Co. Ltd, Sinopals Industrial Co. Ltd.		China Resources Vanguard, Ole, Gautier Gourmet	Grand Hyatt Beijing, Hilton Grand Shanghai, Shangri-La Hotel Beijing, Wanda Sofitel Beijing
Luxury Chocolates	Xuanhuai Trading Company, Satolas Limited, Ferrero Trading (Shanghai) Co. Ltd, DKSH China, Sinodis China	Godiva, Leonidas, Debaue & Gallais, Lindt, Valrhona, Confiserie Sprungli, Cityshop, City Super, Fields China, Fresh Mart, Ole, Carrefour China, Wal-Mart China, Tesco China, China Resource Vanguard Co. Ltd, Lianhua Trading Group, Baixas		Chocolate Wonderland, Grand Hyatt Beijing, Hilton Grand Shanghai, Shangri-La Hotel Beijing, Wanda Sofitel Beijing
Red Wine	CVBG Grands Crus, Cavit Italy, Sarment Wines, EEDC Wines & spirits, ASC Fine Wines Beijing, Aussino Beijing, DT ASIA - BALLANDE GROUP, Jointek Fine Wines, Jebesen & Co. (China) Ltd, Torres China, Summergate Wines, Roque Fine Wines		Sotheby's Auction House, Christie's Auction House, Treasury Wine Estates Ltd, Sarment Wines, Jiuxian, Watson's Wine, Yangjiu, Force Eight Cellars, Jointek Fine Wines, magnum Fine Wines, Yantai Changyu Group Company Limited, China Great Wall Wine Co. Ltd, Tonghua Grape Wine Co. Ltd.	Grand Hyatt Beijing, Hilton Grand Shanghai, Shangri-La Hotel Beijing, Wanda Sofitel Beijing
Distilled Spirits	EEDC Wines & spirits, Guo Chaoren, Rémy Cointreau SA, Jebesen & Co. (China) Ltd, Torres China, Summergate, Aussino Beijing, DT Asia - Ballande Group	Bacardi China, Pernod Ricard, Diageo PLC, Kweichow Moutai, LVMH, Moët Hennessy	Diageo PLC, Wuliangye Yibin Co Ltd, Jiuxian, Cityshop, City Super, Fields China, Fresh Mart, Ole, Carrefour	Grand Hyatt Beijing, Hilton Grand Shanghai, Shangri-La Hotel Beijing, Wanda Sofitel Beijing

Products	Value Chain Actors of Luxury Food in China			
	Trade agents / Importers/Wholesalers/Distributors	Food Manufacturers	Retailers	Food Service
			China, China Resource Vanguard Co. Ltd	
Wagyu Beef	QP Products, Blackmore Wagyu, Mayura station China, Tenderplus Distributors, Pengxin Group, Australia China Corporation	Wagyu Bio-Tech Beijing, Wagyu Bio-Tech	Fields China, Resources Vanguard, Ole, Gautier Gourmet, China Resources Enterprise, Taste Supermarkets,	Wanliuge Cantonese Restaurant, Grand Hyatt Beijing, Hilton Grand Shanghai, Shangri-La Hotel Beijing, Wanda Sofitel Beijing
Southern Bluefin Tuna	Weimar Seafood Co, Shanghai Toyo Trading Co. Ltd, Yantai Chengsen International Trade Co. Ltd.	Group Zoneco (joint venture with Australian Fishing Enterprises), China National Fisheries Corporation, Zhejiang Fisheries, Shandong Zhonglu Oceanic Fisheries, Global Tuna Fisheries (Dalian) Co. Ltd.	Fields China, Resources Vanguard, Ole, Gautier Gourmet, China Resources Enterprise, Taste Supermarkets	Grand Hyatt Beijing, Hilton Grand Shanghai, Shangri-La Hotel Beijing, Wanda Sofitel Beijing
Abalone	Dalian Lanji Foods Co. Ltd, Lok Tin Seafood Ltd, Champion Pacific Co. Ltd, Wang Yip Shark's Fin Ltd, Princess Seafood International Trading Co. Ltd, Nortic Seafood China Importing Co, Yantai Ankang Foods Co., Ltd, Aurora Marine Co. Ltd, China DSHC Foodstuff Co., Ltd, Howard Group, Wanpin Seafood Co. Ltd	Dongshan's Eastern Star Abalone Co, Qinhuangdao Chenglong Frozen Food Co. Ltd, Dalian Lanji Foods Co. Ltd, Fuzhou Baiyang Seafood Co. Ltd, Quanzhou Huangda Fishery Co. Ltd	Fields China, Resources Vanguard, Ole, Gautier Gourmet, China Resources Enterprise, Taste Supermarkets,	Grand Hyatt Beijing, Hilton Grand Shanghai, Shangri-La Hotel Beijing, Wanda Sofitel Beijing
Rock Lobster	East Pacific Ocean International Ltd, Dalian Lanji Foods Co. Ltd, Lok Tin Seafood Ltd, Champion Pacific Co. Ltd, Wang Yip Shark's Fin Ltd, Princess Seafood International Trading Co. Ltd, Nortic Seafood China Importing Co, Yantai Ankang Foods Co., Ltd, Aurora Marine Co. Ltd, China DSHC Foodstuff Co., Ltd, Howard Group, Wanpin Seafood Co. Ltd	Qinhuangdao Chenglong Frozen Food Co. Ltd, Dalian Lanji Foods Co. Ltd, Fuzhou Baiyang Seafood Co. Ltd, Quanzhou Huangda Fishery Co. Ltd	Fields China, Resources Vanguard, Ole, Gautier Gourmet, China Resources Enterprise, Taste Supermarkets	Grand Hyatt Beijing, Hilton Grand Shanghai, Shangri-La Hotel Beijing, Wanda Sofitel Beijing

Products	Value Chain Actors of Luxury Food in China			
	Trade agents / Importers/Wholesalers/Distributors	Food Manufacturers	Retailers	Food Service
Sturgeon Caviar	Logosun Import And Export Trade Co. Ltd, Caspian Trading Co, Collins Caviar China,	Hangzhou Qiandaohu Xunlong Co, Hubei Tian Xia Sturgeon Co. Ltd, Yunnan Amuer Sturgeon Aquaculture, Dalian Zhangzidao Fishery Group Co	Fields China, Resources Vanguard, Ole, Gautier Gourmet, China Resources Enterprise, Taste Supermarkets	Grand Hyatt Beijing, Hilton Grand Shanghai, Shangri-La Hotel Beijing, Wanda Sofitel Beijing, Restaurants such as A Li Ya, Domus restaurant, Fu Lou (Lucky House)
Oysters	East Pacific Ocean International Ltd, Dalian Lanji Foods Co. Ltd, Lok Tin Seafood Ltd, Champion Pacific Co. Ltd, Wang Yip Shark's Fin Ltd, Princess Seafood International Trading Co. Ltd, Nortic Seafood China Importing Co, Yantai Ankang Foods Co., Ltd, Aurora Marine Co. Ltd, China DSHC Foodstuff Co., Ltd, Howard Group, Wanpin Seafood Co. Ltd	Qinhuangdao Chenglong Frozen Food Co. Ltd, Dalian Lanji Foods Co. Ltd, Fuzhou Baiyang Seafood Co. Ltd, Quanzhou Huangda Fishery Co. Ltd	Fields China, Resources Vanguard, Ole, Gautier Gourmet, China Resources Enterprise, Taste Supermarkets	Grand Hyatt Beijing, Hilton Grand Shanghai, Shangri-La Hotel Beijing, Wanda Sofitel Beijing

Hong Kong

The following analyses comprise:

- PESTLE for Luxury Food in Hong Kong
- Luxury Food Actors in Hong Kong

PESTLE analysis: Luxury food in Hong Kong

Product	PESTLE Analysis					
	Political	Economic	Socio-cultural	Technological	Environmental	Legal
Truffles	There are no political regulations as far as truffle is concerned. The austerity measures for food in China do not have any impact in the luxury food segment in Hong Kong. However pro-democracy struggles have affected the whole food and beverage industry with tourism taking a hit.	With booming economy and almost 14% increase in the number of millionaires over 2013, there is more demand for luxury food in the country. There have been instances when Hong Kong billionaires have purchased expensive truffles.	Socialising culture is big in Hong Kong, which is one of the major financial centres of the world, and this gives opportunity for expats and high income groups to socialise in high end restaurants and bars, thus creating more demand for luxury food.	No truffle cultivation in Hong Kong	None-Applicable	There is no duty or VAT on truffles import into Hong Kong.
Luxury Chocolates	There are no political regulations as far as luxury chocolate is concerned. The austerity measures for food in China do not have any impact in the luxury food segment in Hong Kong.	With a booming economy and almost 14% increase in the number of millionaires over 2013, there is more demand for luxury food in the country. A number of luxury chocolatiers have opened shops in Hong Kong which is a sign of increasing demand.	Hong Kong has a tradition of gifting and this helps the luxury chocolate segment to grow.	Luxury chocolatiers have a good presence in Hong Kong, and they cater to the consumers with tailor made as well as imported chocolates thereby improving the technical expertise	Excessive packaging, including those for chocolates, can pose adverse environmental concerns	Duty Free on Chocolate import into Hong Kong.

Product	PESTLE Analysis					
	Political	Economic	Socio-cultural	Technological	Environmental	Legal
Red Wine	Hong Kong has removed duties on wine imports and aided by falling Euro value, more European luxury wines are available in the country.	Hong Kong is the world's third ranked financial centre and has advanced wine and gastronomy market in the East Asia region. The financial status along with a relaxed duty for wines has ensured heavy presence of wine brands from around the world, including luxury brands.	Socialising culture is big in Hong Kong, which is one of the major financial centres of the world, and this gives opportunity for expats and high income groups to socialise in high end restaurants and bars, thus creating more demand for luxury beverage such as fine wines.	Very little wine production in Hong Kong owing to unsuitable weather for grape production. Large scale wine imports due to favourable import regulations.	None-Applicable	0% duty for wines
Distilled Spirits	There has been a relaxation of duty for distilled spirits which strength is less than 30% by volume.	Alcohol is easily available in Hong Kong due to its strong and open economy with many luxury brands having presence in the country.	Socialising culture is big in Hong Kong, which is one of the major financial centres of the world, and this gives opportunity for expats and high income groups to socialise in high end restaurants and bars, thus creating more demand for luxury beverages such as high end distilled spirits.	Depends on imports for its distilled spirit demand	None-Applicable	Liquor with an alcoholic strength not more than 30% by volume measured at a temperature of 20°C do not have any duty. Those with an alcoholic strength more than 30% have 100% duty rate.
Wagyu Beef	There are no political regulations as far as Wagyu beef is concerned.	Japan and Australia have been competing to capture the beef industry in Hong Kong and other Asian countries. The rising economy in Hong Kong has led to increased import of expensive meat such as Wagyu beef.	Demand for beef has increased dramatically over the past few years. Increased preference for high quality meat such as Wagyu beef has driven the imports from Japan and Australia	Depends on imports for its Wagyu beef demand, mostly from Australia and Japan	None-Applicable	Meat products can be imported with an official certificate recognised by the Director of Food and Environmental Hygiene. The imported meat can be subjected to inspection at various checkpoints depending on the mode of shipment of consignment.

Product	PESTLE Analysis					
	Political	Economic	Socio-cultural	Technological	Environmental	Legal
Southern Bluefin Tuna	There has been a political restraint on consumption of critically endangered species such as Southern Bluefin Tuna and it has been banned in official dinners.	No major factors.	No major factors.	None-Applicable	Classified as Critically Endangered on the IUCN Red List of Threatened Species.	Southern Blue Fin Tuna is currently banned in official dinners by the Hong Kong government.
Abalone	There are no political regulations as far as Abalone is concerned.	Increasing economy has seen the rise in import of luxury seafood such as Abalone	Cantonese food is popular in Hong Kong and thus abalone delicacies have their space in the food sector in Hong Kong.	Hong Kong is one of the main importers of abalone in the world	Much of the abalone stock which reached Hong Kong are from Africa where abalone is not farmed and thus would be smuggled, which pose serious concerns about sustainability of such produce.	Importers are encouraged to obtain health certificates issued by health authorities of countries of origin. These products are subjected to inspection at checkpoints.
Rock Lobster	There are no political regulations as far as Rock lobster is concerned. Hong Kong imports a large segment from Australia.	Due to its strong tradition for seafood consumption, Hong Kong is one of the most competitive seafood markets in the world.	With rising income, consumers are willing to experiment with new and different seafood products.	Depends on imports for its rock lobster demand	None-Applicable	As above
Sturgeon Caviar	There are no political regulations as far as Caviar is concerned.	As with other luxury food products, Caviar is also well-received in Hong Kong as the economy allows more spending on quality food.	Caviar is a high-in-demand food used across luxury hotels and restaurants in Hong Kong. The increase in demand also shows the affordability of the consumers to spend on luxurious food while	Depends on imports for its caviar demand	Wild caviar is mostly banned to preserve the species and the restaurants mostly use farmed caviars in their culinary dishes.	Import of products made of endangered species requires a CITES license. In addition, importers are encouraged to obtain health certificates issued by health authorities of countries of origin. These

Product	PESTLE Analysis					
	Political	Economic	Socio-cultural	Technological	Environmental	Legal
			socialising with friends and family.			products are subjected to inspection at checkpoints.
Oysters	There are no political regulations as far as oyster is concerned.	With the increasing economy and rate of pollution among the local oyster farms in Hong Kong there has been an increase in import of oysters.	<p>There has been an increase in the amount of oyster and wine bars located within Hong Kong.</p> <p>Several restaurants around Hong Kong feature a premium selection of some of the best oysters from France that are also paired with a variety of wine.</p>	Hong Kong has its own aquaculture farms for oysters and thus has the technology for domestic production.	The increasing rate of pollution within Hong Kong has led to restrictions and high regulations when it comes to local oyster farms. Shenzhen Bay oyster farms have undergone a ban due to the pollution in the area. The Centre for Food South Australiafety of the Hong Kong Administration has suspended imports from Namibia due to high levels of cadmium and from Donegal (Ireland) due to the presence of the norovirus in their oysters.	Importers are encouraged to obtain health certificates issued by health authorities of countries of origin. These products are subjected to inspection at checkpoints.

Luxury food actors in Hong Kong

PRODUCTS		LUXURY FOOD ACTORS IN HONG KONG				
		Trade Agents/ Importers	Wholesalers/ Distributors	Food Manufacturers	Retail chains	Food Service
Horticulture	Truffles	La Fortuna Gourmet Ltd, China Wave (Mennella Group), Elizabeth Venture Ltd	La Fortuna Gourmet Ltd, Country Fresh	Perigord	Country Fresh	8½ Otto e Mezzo, Divino Group, Tott's, Grissini, The Fringe Club, Amber, Bella Vita, Cuchina, Nicholini's, Sabatini
Other	Luxury Chocolates	Panway Corporation Ltd	Panway Corporation Ltd	Godiva, Jean Paul Hevin, Leonidas, Vero	Godiva, Jean Paul Hevin, Leonidas, Vero	
Alcoholic Beverages	Red Wine	Conti Int'l (Hong Kong) Trading Co Ltd, Woodside Wines and Spirits Ltd, Hong Kong Liquor Store, Macro Wines and Spirits Asia	Golden Gate, Hong Kong Liquor Store, Wickens & Co Ltd, Macro Wines and Spirits Asia	Châteaux Siran, Margaux, Lanessan, Mouton Rothschild, Lafite Rothschild	Majestic Wines, Watson's Wines, Hong Kong Liquor Store, Wickens & Co Ltd	8½ Otto e Mezzo, L'Atelier de Joël Robuchon, Lung King Heen, Bo Innovation, Garden Café Terrace
	Distilled Spirits	Woodside Wines and Spirits Ltd, Rhum De France, Macro Wines and Spirits Asia Drinks 99	Edrington Hong Kong, Woodside Wines and Spirits Ltd, Rhum De France, Universal Exports, Macro Wines and Spirits Asia	D.J. Limbrey Distilling Co, Gerber Spirits Company, S.P.I Group	Hong Kong Liquor Store, Wickens & Co Ltd, Liquor Land	8½ Otto e Mezzo, L'Atelier de Joël Robuchon, Lung King Heen, Bo Innovation, Barsmith, Lily & Bloom, Boujis, Garden Café Terrace
Red Meat	Wagyu Beef	Sunwah Group, Waves Pacific	Aussie Wagyu Ltd, Mayura Station Full Blood Wagyu, Oakleight Ranch, Wholesome Eats, Waves Pacific, Elite Fresh Food Co. Ltd	Sekiguchi Farm Tech Co. Ltd., Meat Companion Co.	Wholesome Eats, TC Foods deli, Meat Market	8½ Otto e Mezzo, L'Atelier de Joël Robuchon, Lung King Heen, Bo Innovation, InterContinental Hotel Steak House, Blue Butcher
Seafood	Southern Bluefin Tuna					
	Abalone	Lok Tin Seafood Ltd, Wang Yip	On Kee, Lok Tin Seafood Ltd, Wang Yip Shark's Fin	OceaNZ Blue, Great	On Kee, Teck Sang, DCH	8½ Otto e Mezzo, L'Atelier de Joël Robuchon,

PRODUCTS	LUXURY FOOD ACTORS IN HONG KONG				
	Trade Agents/ Importers	Wholesalers/ Distributors	Food Manufacturers	Retail chains	Food Service
	Shark's Fin Ltd, Topsea Enterprises	Ltd, P&L Enterprises	Southern Waters	FoodMart, ParknShop	Lung King Heen, Bo Innovation, Kimberley Chinese Restaurant
Rock Lobster	Lok Tin Seafood Ltd, Ocean Presents Seafood Co Ltd, Dragon King International Limited, Surpass Trading Co. Ltd, Aq Hk Ltd	Ocean Presents Seafood Co Ltd, Dragon King International Limited, Surpass Trading Co. Ltd, I. Fish Company Ltd.	Australian Western rock lobster, CRAMAC NZ	RedDeliBox	Bo Innovation
Sturgeon Caviar	Bien Jamon Spanish Food Company, AGN Global Limited, The House of Fine Foods	Bien jamon Spanish Food Company, AGN Global Limited, The House of Fine Foods	Joosen-Luyckx Aqua Bio Ltd, Caviar Azovka, Calvisius		SPOON, Shangri-La, Cepage, Amber, Sevva, Cucina, Caviar Kaspla
Oysters	Lok Tin Seafood Ltd, Tomibo HK Co. Ltd, Dragon King International Limited	Lok Tin Seafood Ltd, Tomibo HK Co. Ltd, Dragon King International Limited	Aotearoa Fisheries Limited, Majestic Oysters Co	DCH ,Food Mart	Ambrosia, DotCod, Café Deco, La Casa Chilean Oyster Bar, Oyster and Wine Bar rocksalt

Singapore

The following analyses comprise:

- PESTLE for Luxury Food in Singapore
- Luxury Food Actors in Singapore

PESTLE analysis: Luxury food in Singapore

	Political	Economic	Socio-cultural	Technological	Legal	Environmental
Red Wine	In 2014, the Singaporean government raised the import duty on alcoholic beverages by 25%.	Consumers in Singapore appeared to trade up to more luxurious alcoholic drinks as their disposable incomes increased.	Red wine has a positive perception in terms of the health benefits gained from rich polyphenol content. With the increasing number of fine dining restaurants, the influx of wine brands and new type of wines are expected to be witnessed further in order to cater the demand of consumers	None Applicable	The Liquor Control (Supply and Consumption) Bill has been passed in Parliament. Under the new laws, the public will not be allowed to buy alcohol for take-away or consume alcohol at public places from 10.30pm to 7am daily. The new laws are expected to take effect by April 1.	None Applicable
Distilled Spirits			Consumers also purchased more fine liquors as collectibles and also as a symbol of status. Luxury vodka is mainly well-received by the younger consumers in Singapore	None Applicable		None Applicable
Wagyu Beef	None Applicable	Wagyu is usually imported from Australia, the United States, Japan and New Zealand. Prices range roughly from \$5 for a Wagyu patty to several hundred dollars per kg. Depending on factors such as the cut, marbling grade and breed of the cattle, it can cost about double to more than 10 times the price of regular beef.	Singapore's appetite for Wagyu beef is growing and the reach of the premium bovine has extended beyond expensive restaurants. Heartland supermarkets and even coffee shop stalls are serving Wagyu, with consumers increasingly willing to pay for it. Increased demand has in turn increased supply thus driving process down. Less than 5% of	None Applicable	None Applicable	None Applicable

	Political	Economic	Socio-cultural	Technological	Legal	Environmental
			domestic beef consumption is Wagyu beef.			
Southern Bluefin Tuna	None Applicable	None Applicable	Largely consumed through high end Sushi outlets in Singapore.	None Applicable	The Japanese Fisheries Agency has decided to dramatically cut the nation's catch of immature Pacific Bluefin tuna, in a bid to replenish the rapidly falling population of the prized fish. This is likely to affect supply in Singapore.	World Wild Life Fund Singapore launched a Singapore Seafood Guide booklet, discouraging the consumption of endangered species such as the Bluefin tuna.
Abalone	None Applicable	While the appetite for abalone has grown, supply has been hit by weather conditions and tightened fishing restrictions in abalone-supplying countries such as Australia.	Delicacy among the majority Chinese population. Served as a tradition at Chinese New Year reunion dinners.	None Applicable	None Applicable	Due to the lack of space suitable for agriculture, Singapore is largely dependent for imports for most of its food products, including luxury foods.
Rock Lobster	None Applicable	None Applicable	Considered a luxury seafood and is typically consumed through Chinese or western cuisine.	None Applicable	None Applicable	
Truffles Luxury Chocolates Sturgeon Caviar	As the Singaporean government actively promoted the island state as destination for FDI (foreign direct investment), leading to a	Singapore has one of the highest income per capita rates in the world, thus making it a lucrative market for these products.	Consumption of these products is largely viewed as status symbols as opposed to an actual preference for their taste.	None Applicable	None Applicable	

	Political	Economic	Socio-cultural	Technological	Legal	Environmental
Oysters	large increase in the expat community, particularly from Western / European nations, the demand for luxury foods such truffles and caviar also increased.			A small independent oyster farm growing approximate 500k Oysters at a time operates off the coast of Singapore.	Live oysters may only be imported from countries, which meet AVA's requirements for a shellfish sanitation programme. The countries currently approved for such exports are Australia, Canada, France, Ireland, the Netherlands, New Zealand, United Kingdom and USA.	

Luxury food actors in Singapore

	Horti culture	Other	Alcoholic Beverages		Red Meat	Seafood				
PRODUCTS	Truffles	Luxury Chocolates	Red Wine	Distilled Spirits	Wagyu Beef	Southern Bluefin Tuna	Abalone	Rock Lobster	Sturgeon Caviar	Oysters
Importers Wholesalers Distributors	Culina, Giorgio Ferrari, Trifola	Godiva, Laurent Bernard Chocolatier, Sweetzerland, Beschle Chocolatier Suisse	Golde n Hung Ho, Grand Vin, Water & Wine, Wine BOS, Certain Cellars, The Straits Wine Company, Diageo Asia Pacific, Crystal Wines, J&D Burleigh, Chuan Seng Huat, Hai Choo Wines & Spirits HC Wines	Giorgio Ferrari, J&D Burleigh, Golden Hung Ho, Malt Vault, BarWorks, LIQUOR LAND, Chuan Seng Huat, Hai Choo Wines & Spirits	Culina, Frosts Food & Beverage, SATS, Giorgio Ferrari, Miami Japan Food Co, Huber Butchery, WKG Enterprise, Gourmet Partner, KSP Marketing, Shiro Corp	Snorre food, Fish International Sourcing House, Sekol	Evergreen Seafood, Teck Sang, Goh Joo Hin (New Moon), Seng Hong Co, Harvest Resource Supply (Yilai), Kim Hing Food Industries Pte Ltd (Dragon Brand), Shiro Corp, Sun Kee, Oceanus Group	Evergreen Seafood, Shiro Corp	Culina, Blue Duna, Russian Caviar House	Culina, Evergreen Seafood, Pan Ocean Singapore, Snorre food, High Fresh Trading, Hai Loong Mariculture (Farm)
Retail chains	Culina Dempsey, Delicia, Supernature, Trifola	Culina Dempsey, Laurent Bernard Chocolatier, Sweetzerland, Beschle Chocolatier Suisse	Culina Dempsey, Legendary Spirits	Legendary Spirits	Four seasons gourmet market, Culina Dempsey, Hubers		Fair Price Supermarket, Cold Storage, ShengSiong, Hock Hua	Cold Storage	Delicia	Culina Dempsey, Delicia, Supernature
Food service		Capella Hotels & Resorts	Almost every medium to high end restaurant in	Almost every medium to high end restaurant in		Maguroya, Itacho Sushi	Ahh Yat restaurants			

			Singapore	Singapore						
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Japan

The following analyses comprise:

- PESTLE for Luxury Food in Japan
- Luxury Food Actors in Japan

PESTLE analysis: Luxury food in Japan

Products	PESTLE Analysis					
	Political	Economic	Socio-cultural	Technical	Legal	Environmental
Truffles	<p>Stable government with an increasing focus on aging population and austerity measures.</p> <p>Growing interest in outward FDI (foreign direct investment) to buoy struggling local economy.</p> <p>FTA (free trade agreement) with Australia and New Zealand.</p>	<p>Shrinking of the workforce due to aging population placing heavy burden on the economy.</p> <p>Austerity measures driving consumers to focus increasingly on quality over quantity.</p>	<p>Affluent older population seeks to indulge in high end products in small amounts.</p> <p>Large restaurant demand for truffles makes Japan the world's second largest truffle market.</p>	<p>Little to no local production</p> <p>High focus on products that have quality accreditation due to costs.</p>	No major regulatory guidelines.	No major environmental concerns.
Luxury Chocolates	See above	See above	<p>Affluent older population seeks to indulge in high end products in small amounts.</p> <p>Established retail and importer base for high end local and imported chocolate results in a highly discerning social user base.</p>	<p>Small local industry looking primarily at imports.</p> <p>Demand for luxury chocolates from importing nations with a premium story and high end retail options continues to drive purchasing.</p>	No major regulatory guidelines.	No major environmental concerns.
Red Wine	See above	See above	<p>Affluent older population seeks to indulge in high end products in small amounts.</p> <p>Growing entry of women into the workforce driving</p>	<p>Lack of local industry.</p> <p>High focus on quality imports particularly in fine wines with strong</p>	No major regulatory guidelines.	No major environmental concerns.

Products	PESTLE Analysis					
	Political	Economic	Socio-cultural	Technical	Legal	Environmental
			red wine consumption.	copyright and IP protection.		
Distilled Spirits	See above.	See above	Affluent older population seeks to indulge in high end products in small amounts. Luxury alcohol consumption considered a part of Japanese culture.	Large local industry with growing international awareness; however mainly restricted to whisky and sake.	Follows Japanese alcoholic regulatory guidelines.	
Wagyu Beef	See above	See above	Over 60 % of Japanese consume Wagyu beef on a regular basis. Beef is considered a delicacy and highly prized by diners.	Large local industry unable to meet demand. Australia tends to dominate most Wagyu imports.	Follows Japanese meat processing guidelines.	Fears over contamination of cattle from Fukushima.
Southern Bluefin Tuna	See above	See above	Highly popular product consumed as part of sushi and sashimi preparations.	Established local industry but rising demand is driving increasing imports.	Regulations have been developed to restrict the manner and amount of fishing particularly in the Japan-China sea.	Bluefin is now an endangered species and much focus is being placed on reducing its consumption.
Abalone	See above	See above	Presence of local industry. Increasing imports being driven by a societal demand for premium products.	Local scientists developing technologies to increase yield by embryonic manipulation of farm cultured abalone.	Regulations have been developed to restrict the manner and amount of fishing particularly in the Japan-China sea.	Increasing incidence of disease among abalone species due to intensive farming and overfishing.
Rock Lobster	See above	See above	Increasing trend towards eating out fewer times but for more quality drives consumer interest in high	Lack of large enough local industry resulting in local companies looking for technology and	No major regulatory influences.	Increasing worries over dwindling supplies caused by climate changes and marine environments.

Products	PESTLE Analysis					
	Political	Economic	Socio-cultural	Technical	Legal	Environmental
			end options such as lobsters.	trading partners overseas.		
Sturgeon Caviar	See above	See above	Extremely aggressive caviar demand by both middle class and rich Japanese especially among elite hotel has resulted in a large black market for caviar in Japan.	Lack of local industry has driven companies such as Maruha to invest in international caviar players to gain control over supply.	Growing black market driving international pressure on Japan to address illegal imports.	Overharvesting, environmental pollution and black market trade are key concerns.
Oysters	See above.	See above	Large local industry with oysters catering to both middle and upper class Japanese	Growing technology focus on increasing yields and sustainable cultivation	No major regulatory factors	Overharvesting, environmental pollution and black market trade are key concerns.

Luxury food actors in Japan

Products	Luxury food actors in Japan			
	Trade agents / Importers/Wholesalers/Distributors	Food Manufacturers	Retailers	Food Service
Truffles	Niigata Beer, Tamar Valley Truffles, Norin Kinrui, French F&B Japan Inc, NanHua County Yunhua Green Food Stuffs Ltd, Perigord Truffles Of Tasmania		Aeon supermarkets, H2O retailing, Ito-Yokado, UNY, Life supermarkets, Maruetsu retail, Max Value retail	Chateau Restaurant Taillevent Robuchon, Kyoto Takaragaike Prince Hotel, Intercontinental Tokyo, Prince Park Hotel, Tokyo, Hilton Tokyo, Grand Hyatt Tokyo, Hotel Okura Tokyo, Four Seasons Tokyo
Luxury Chocolates	Isetan Mitsukoshi Ltd, Shibuya Hikarie's ShinQs, Xocai-Asia Taiwanese Distributors, Thorntons Japan, 't BOERINNEKE - MARINO, Belfine - ChocDecor, Takara Shoji Co., Ltd	Hugo & Victor, Godiva, Leonidas, Debaube & Gallais, Lindt, Valrhona, Chocolat Moderne, Confiserie Sprungli, Royce, Aeon supermarkets, H2O retailing, Ito-Yokado, UNY, Life supermarkets, Maruetsu retail, Max Value retail		Chocolate Wonderland, Grand Hyatt Beijing, Hilton Grand Shanghai, Shangri-La Hotel Beijing, Wanda Sofitel Beijing
Red Wine	Arcane Japan, ENOTECA CO., LTD) Enoteca Co., Ltd, Koto Corporation, Mikuni Wine, 21 Community Co. Ltd, Kinoshita International Company (KICO), JALUX Group	N/A	Sotheby's Auction House, Christie's Auction House, Yamamya Wines, Tanakaya Liquor, Seijo Ishii, Wine Market Party Liquor, Enoteca, Aeon supermarkets, H2O retailing, Ito-Yokado, UNY, Life supermarkets, Maruetsu retail, Max Value retail	Chateau Restaurant Taillevent Robuchon, Kyoto Takaragaike Prince Hotel, Intercontinental Tokyo, Prince Park Hotel, Tokyo, Hilton Tokyo, Grand Hyatt Tokyo, Hotel Okura Tokyo, Four Seasons Tokyo
Distilled Spirits	Brown-Forman Corp, Beam Inc, Bacardi Japan, Bond & Co, Century Trading, Godo Shushei Co Ltd, Izumi Trading, Kanematsu Corporation, Kinoshita International, MHD Moet Hennesy Diageo, Kokubu & Co Ltd.	Suntory Corporation, Asahi Beverages, Kirin Brweries, Sapporo Breweries, Takara Shuzo Co Ltd, Yamamya Corp	Tanakaya liqour, Seijo Ishii, Wine Market Party Liquor, Enoteca, Aeon supermarkets, H2O retailing, Ito-Yokado, UNY, Life supermarkets, Maruetsu retail, Max Value retail	Chateau Restaurant Taillevent Robuchon, Kyoto Takaragaike Prince Hotel, Intercontinental Tokyo, Prince Park Hotel Tokyo, Hilton Tokyo, Grand Hyatt Tokyo, Hotel Okura Tokyo, Four Seasons Tokyo

Products	Luxury food actors in Japan			
	Trade agents / Importers/Wholesalers/Distributors	Food Manufacturers	Retailers	Food Service
Wagyu Beef	Snow Brand Foods, Nippon Shokuhin, Kobe Beef America, Ryu Mei Co Ltd, Coltibuono Trading, Global one Corporation, ANZCO Foods, Alliance Group, Blackmore Wagyu Beef, Mayura station	Nippon Meat Packers, ITOHAM FOODS INC. Maruha Nichiro, Prima Meat Packers	Yoshinoya, Sukiya, Aeon supermarkets, H2O retailing, Ito-Yokado, UNY, Life supermarkets, Maruetsu retail, Max Value retail	Chateau Restaurant Taillevent Robuchon, Kyoto Takaragaike Prince Hotel, Intercontinental Tokyo, Prince Park Hotel Tokyo, Hilton Tokyo, Grand Hyatt Tokyo, Hotel Okura Tokyo, Four Seasons Tokyo
Southern Bluefin Tuna	Kihada Fisheries Co., Ltd, Australiana F.W.F. Group, San-A Trading Co. Ltd, Seafood Exporters Australia Pty Ltd, Koyo Trading Ltd.	Maruha Nichiro, Shinki Co Ltd, Sojitz Corporation, Umami Sustainable Seafood, Nippon Suisan Kaisha, Tosenbo Co. Ltd	Aeon supermarkets, H2O retailing, Ito-Yokado, UNY, Life supermarkets, Maruetsu retail, Max Value retail	Sushi-Zanmai, Kyoto Takaragaike Prince Hotel, Intercontinental Tokyo, Prince Park Hotel, Tokyo, Hilton Tokyo, Grand Hyatt Tokyo, Hotel Okura Tokyo, Four Seasons Tokyo
Abalone	Pesca K & M Co., Ltd. Tosenbo Co. Ltd, Harvest Resource Supply (SG) Pte Ltd, OceanZ, Wildfish Export Ltd, Australian Abalone Farms Inc, Yat Sun International Ltd	Kikkoman Corporation, Maruha Nichiro, Nippon Suisan Kaisha, Kyokuyo	Aeon supermarkets, H2O retailing, Ito-Yokado, UNY, Life supermarkets, Maruetsu retail, Max Value retail	Chateau Restaurant Taillevent Robuchon, Kyoto Takaragaike Prince Hotel, Intercontinental Tokyo, Prince Park Hotel, Tokyo, Hilton Tokyo, Grand Hyatt Tokyo, Hotel Okura Tokyo, Four Seasons Tokyo
Rock Lobster	Ishikawa Kaisha Ltd, Osaka Uoichiba Co., Ltd, Pesca K & M Co., Ltd. Tosenbo Co. Ltd, Harvest Resource Supply (SG) Pte Ltd, OceanZ, Wildfish Export Ltd, Australian Abalone Farms Inc, Yat Sun International Ltd	Kikkoman Corporation, Maruha Nichiro, Nippon Suisan Kaisha, Kyokuyo	Aeon supermarkets, H2O retailing, Ito-Yokado, UNY, Life supermarkets, Maruetsu retail, Max Value retail	Chateau Restaurant Taillevent Robuchon, Kyoto Takaragaike Prince Hotel, Intercontinental Tokyo, Prince Park Hotel, Tokyo, Hilton Tokyo, Grand Hyatt Tokyo, Hotel Okura Tokyo, Four Seasons Tokyo
Sturgeon Caviar	Runzhao Fisheries Co., Ltd, Olma Caviar, Marky's Specialty Food, D'artagan Caviar, Alaska Seafood Co.	FUJI FOODS CO., LTD, Maruhacapital Investments, Nippon Suisan Kaisha	Aeon supermarkets, H2O retailing, Ito-Yokado, UNY, Life supermarkets, Maruetsu retail, Max Value retail	Chateau Restaurant Taillevent Robuchon, Kyoto Takaragaike Prince Hotel, Intercontinental Tokyo, Prince Park Hotel, Tokyo, Hilton Tokyo, Grand Hyatt Tokyo, Hotel Okura Tokyo, Four Seasons Tokyo

Products	Luxury food actors in Japan			
	Trade agents / Importers/Wholesalers/Distributors	Food Manufacturers	Retailers	Food Service
Oysters	Kunhiro Corporation, Pesca K & M Co., Ltd. Tosenbo Co. Ltd, Harvest Resource Supply (SG) Pte Ltd, OceaNZ, Wildfish Export Ltd, australian Abalone Farms Inc, Yat Sun International Ltd	Hamamatsu Uoichi Co., Ltd, Kikkoman Corporation, Maruha Nichiro, Nippon Suisan Kaisha, Kyokuyo	Aeon supermarkets, H2O retailing, Ito-Yokado, UNY, Life supermarkets, Maruetsu retail, Max Value retail	Chateau Restaurant Taillevent Robuchon, Kyoto Takaragaike Prince Hotel, Intercontinental Tokyo, Prince Park Hotel, Tokyo, Hilton Tokyo, Grand Hyatt Tokyo, Hotel Okura Tokyo, Four Seasons Tokyo

Malaysia

The following analyses comprise:

- PESTLE for Luxury Food in Malaysia
- Luxury Food Actors in Malaysia

PESTLE analysis: Luxury food in Malaysia

Products	Political	Economic	Socio-cultural	Technological	Legal	Environmental
Truffles	None Applicable	Truffle and related truffle products are almost exclusively available in only Kuala Lumpur, the nation's largest city.	While the disposable income of urbanised residents, particularly in the Kuala Lumpur, has increased, the demand for truffles is limited to expatriates and certain high net worth individuals. Consumption of luxury foods such as truffles is seen as a status symbol rather than an actual preference for its taste.	None Applicable	None Applicable	The cultivation of truffles in Malaysia is not possible due to its tropical climate.
Luxury Chocolates	The rapid expansion of the cocoa industry in the late 1970s and early 1980s has triggered the realisation that the multi-faceted activities of the industry would have to be coordinated and integrated under an umbrella organisation to ensure its continued health growth. Thus, the Malaysian Cocoa Board (MCB) was established.	Malaysia has the largest cocoa processing industry in Asia/Oceania, followed by Indonesia and Singapore. It is the 5th largest processing country in the world, after the Netherlands, the USA, the Ivory Coast and Germany.	Local cocoa consumption was still low at 0.5kg per capita compared to 3.5kg in developed countries. Due to a high Muslim population ratio, many luxury chocolatiers do not offer products that include alcohol.	None Applicable	Licensing and grading is carried out to ensure the quality of Malaysian cocoa beans to meet the required Malaysian standards. MCB undertakes to license wet cocoa bean processors, cocoa traders, cocoa grinders and cocoa graders. It is also the responsibility of MCB to set guidelines and standards for cocoa beans and cocoa products, and regulatory. Many luxury chocolate outlets do not serve products that include alcohol to	Cocoa prices are volatile and influenced by climates, pests, diseases etc.

Products	Political	Economic	Socio-cultural	Technological	Legal	Environmental
					maintain halal certification.	
Red Wine	As a country of Muslim majority, the country's political parties at times use the banning of alcohol in certain areas as means of satisfying certain religious fundamentalist. However popular tourist and urban areas are largely unaffected.	Malaysia has a relatively small consumer base for wine. Australia is the dominant supplier with 48% market share. In 2013, the import market was valued at US \$75 million, amounting to 6 million litres.	There was a shift in preference towards wine, especially among young working adults who are becoming increasingly sophisticated with wine drinking. The perception of wine as a healthier choice than cognac and whisky further propelled demand in Malaysia. Although the majority of Malaysia's population is comprised of Muslims whose faith prohibits alcohol consumption, wine in Malaysia remained profitable for wine companies. Cabernet and Shiraz are the two most popular red wines.	Malaysia lacks the climate, soil and grape variety to cultivate its own red wines.	Tariff for non-sparkling wine (HS 2204): (A) Import duty of RM 7 (USD 2.20) per liter; (B) Excise duty of RM 12 (USD 3.76) per liter plus 15%; (C) 5% sales tax on CIF + duty. Labels on imported wines must give a specific description of the product, the alcoholic content, as well as the primary ingredients used in production.	None Applicable
Distilled Spirits		Despite being a country with Muslim majority population (for whom consumption of alcohol is not allowed), Malaysia ranks among the top 10 consumers of alcohol worldwide.	Whisky and brandy are the most popular spirits in Malaysia, which have grown in popularity due to increase in middle class Malaysian population and	Certain domestic distilleries produce "low-end" spirits for the lower socio-economic population of Malaysia.	See above. The legal purchasing age for alcohol in Malaysia is 18.	None Applicable

Products	Political	Economic	Socio-cultural	Technological	Legal	Environmental
			high urbanisation.			
Wagyu Beef	Malaysia imports a large proportion of its Beef.	Increasing wealth has resulted in more consumers indulging in high cost premium meat products.	While Wagyu is prized for its high marbling, there is a perception among Malaysian's that fat in Beef is unhealthy. The minority Hindu population of Malaysia is unlikely to consume beef.	None Applicable	In order to get mass acceptance in Malaysia's majority Muslim population, all meat products should be halal certified.	None Applicable
Southern Bluefin Tuna	The Malaysian Ministry of Agro and Fisheries Development Authorities are trying to review the Malaysian International Tuna Port	None Applicable	There is no real demand for Bluefin tuna in Malaysia, except from the small Japanese migrant population.	None Applicable	None Applicable	Sustainability for Bluefin tuna catch is at risk, with considerable overfishing by major fishing countries such as Japan.
Abalone	None Applicable	There is currently one commercial abalone farm in Malaysia, located in the island state of Penang.	Abalone is considered a delicacy among the Chinese population of Malaysia (~24%) and is typically consumed at high end restaurants. Canned and dried versions are also popular.	While it typically takes between four and five years for abalone to grow to an acceptable size in the wild but with using Recirculation Aquaculture System (RAS), it only takes the Malaysian farm between two-and-a-half and three years.	None Applicable	None Applicable
Rock Lobster	None Applicable	In 2012, Dardens Restaurants signed a deal for RM1.86 billion to develop the world's largest lobster aquaculture farm in Pulau Timbun Mata, Semporna, and Sabah.	In 2014, world's largest seafood restaurant chain Red Lobster opened in Kuala Lumpur.	The recently developed iLAP, in East Malaysia is a fully integrated lobster aquaculture operation that will produce in progressive Phases more than 18 thousand metric tonnes	Lobsters are exempted from the recently introduced 6% GST introduced in Malaysia.	None Applicable

Products	Political	Economic	Socio-cultural	Technological	Legal	Environmental
				of Panulirus ornatus (Rock) lobsters annually by 2030.		
Sturgeon Caviar	None Applicable	None Applicable	While the disposable income of urbanised residents, particularly in the Kuala Lumpur, has increased, the demand for caviar is limited to expatriates and certain high net worth individuals. Consumption of luxury foods such as truffles is seen as a status symbol rather than an actual preference for its taste.	In June 2014 it was announced that Malaysian sturgeon fish farms are being developed by the country's Federal Land Development Authority (Felda).	Sturgeons are an endangered species. Sturgeon Caviar is regulated by Convention of International Trade in Endangered Species (CITES) and certification is required.	Certain activists are concerned about the potential environmental impact of sturgeon farming in Malaysia.
Oysters	Malaysian Government had pledged to strengthen the capability of local communities to generate sustainable income through a program known as "Knowledge Transfer Programme" (KTP) where technological development and knowledge-transfer of farming methods has been applied to the local communities. Seed funding to start-up the programme will be provided by the government and marketing agencies are assigned to buy-back the oysters cultured by the local communities.	Oyster farming is a newly emerging seafood industry in Malaysia. It has enormous potential for growth, in both local and international market. The current oyster trade in Malaysia is valued at RM28 million (Malaysia's Trade Statistics) in 2013. This represents only 14% of the demand	Oysters in Malaysia are largely consumed by the Chinese population (estimated to be over 95% based on a 1995 marketing survey) Traditionally Oysters in Malaysia are cooked and have been served as part of Chinese dishes. The practice of consuming Oysters raw is only now gaining attraction in certain urban areas.	None Applicable	Oysters are exempts from the recently introduced 6% GST introduced in Malaysia.	Oyster farming is considered as a green aquaculture since filter-feeding bivalves are able to reduce eutrophication effects on the coastal environment.

Luxury food actors in Malaysia

PRODUCTS	Horticulture	Other	Alcoholic Beverages		Red Meat	Seafood				
	Truffles	Luxury Chocolates	Red Wine	Distilled Spirits	Wagyu Beef	Southern Bluefin Tuna	Abalone	Rock Lobster	Sturgeon Caviar	Oysters
Importers	Sri Manisan (Hegner Asia Connect)	DPO International, Mokaya, paragon Series, Sweet Kiss food Industries, Trans World Confectionery, Advansoft (Orley Foods), Aeroshield, Pastry Pro, Fidani chocolatier, Benns Chocolate & Candy Manufacturer	Caldbeck Macgregor, Wine Cellar, Vintage Cellars, Milawa, ASIAE URO Wines, Luen Heng F&B, Diageo Asia Pacific, The Straits Wine Company, Nam Lee Cheong, Albert's Wine & Spirits, Foo Hing, Harilan Wine and Spirits, Wine Warehouse	ASIAEURO Wines, Luen Heng F&B, Diageo Asia Pacific, Ricard Malaysia, Nam Lee Cheong, Foo Hing, Harilan Wine and Spirits, Teo Seng Chan Liquor Merchants, Single Malt, Thai Seng Liquor	Unifrozen, Topaz Food Haven, Fatric, Lucky Frozen, Sri Manisan (Hegner Asia Connect)	Fatric	Nutrisource, Safcol, GST Group, Fatric, Sun Kee, JSP Aliotide, Sovereign Delicacies Corporation, Codiva Cannery, Tangarua Aquaculture (Farm), Piau Kee Live & Frozen Seafood	Topaz Food Haven, East West Seafoods, Fatric, Sri Manisan (Hegner Asia Connect)	C-food portions, Fatric, Felda Caviartive Blue Dream Park (producer), Perak Cavi, Sri Manisan (Hegner Asia Connect)	Topaz Food Haven, GST Group, Fatric, Southern Rock Seafood, Sri Manisan (Hegner Asia Connect)
Wholesalers										
Distributors										
Retail chains	Fresh truffles almost impossible to find in retail.	Village Grocers, Jaya Grocers, Sam's Grocers, Isetan, Cold Storage, Jason's, Ben's Independent Grocers	Wine Warehouse, Village Grocers, Jaya Grocers, Sam's Grocers, Isetan, Cold Storage, Jason's, Ben's Independent Grocers	Wine Warehouse, Village Grocers, Jaya Grocers, Sam's Grocers, Isetan, Cold Storage, Jason's, Ben's Independent Grocers	Food Concepts, Village Grocers, Jaya Grocers, Sam's Grocers, Isetan, Cold Storage, Jason's, Ben's Independent Grocers	Rarely available.	Safcol	Food Concepts		Food Concepts, Village Grocers, Jaya Grocers, Sam's Grocers, Cold Storage, Jason's, Ben's Independent Grocers,

			Jason's , Ben's Indepe ndent Grocers							Southern Rock Seafood
Restaurants/H otels?	Marini's on 57	Marini's on 57	Almost every mediu m to high end restaura nt in Malays ia	Almost every medium to high end restauran t in Malaysia	Gyuichi	Very high Japanese restaurants at times.		Marini's on 57 Red Lobster High end Chinese restaurant s	Marini's on 57	Marini's on 57 Shucked

South Korea

The following analyses comprise:

- PESTLE for Luxury Food in South Korea
- Luxury Food Actors in South Korea

PESTLE analysis: Luxury food in South Korea

Product	PESTLE Analysis					
	Political	Economic	Socio-cultural	Technological	Legal	Environmental
Truffles	Korea has been ranked 5th in the world for 'ease of doing business' according to the World Bank Group, encompassing factors such as 'trading across borders' (where Korea ranks third); It continues to open up its market to foreign exporters with numerous bilateral, strategic economic partnerships and Free Trade Agreements.	The recent breakthroughs in the artificial cultivation of truffles in South Korea are expected to create a source of income for farmers. With higher disposable incomes and increasing interest in luxury goods, truffles are increasingly being sought after as haute cuisine items.	Truffles are considered one of the 'Three Great Delicacies' (Caviar, Foie Gras, Truffles), sought after as status symbols and high-class indulgences.	The Korea Forest Resources Research Institute of South Jeolla Province declared that it had succeeded in artificially cultivating truffles late last year. This follows HanaBioTech's work with Dr. Ian Hall, a truffle expert from New Zealand since 2005.	None Applicable	Truffles have yet to be found cultivating in Korea in natural state. Artificial cultivation creates the risk of exotic cultivated species invading a native ecosystem. Sustainable cultivation is a major concern, with truffle production declining, particularly in Europe. Some experts believe climate change to contribute to this decline, whilst recently planted truffle orchards are thought to be stabilising production.
Luxury Chocolates	As above	South Korea's confectionery conglomerate Lotte Confectionery entered the European premium chocolate market with their acquisition of Guylian in 2008. The rise of incomes and private consumption as a result of Korea's	Korea has an active gifting culture, with many designated days for various gifting purposes, in which chocolates have always been a common gift good. Dark chocolates have been reported to be particularly favoured amongst the Korean consumers,	None Applicable	None Applicable	Cocoa prices are volatile and influenced by climates, pests, diseases etc.

Product	PESTLE Analysis					
	Political	Economic	Socio-cultural	Technological	Legal	Environmental
		rapid economic development has translated to increased caloric intakes per capita, as people develop a sweet tooth and find the appeal of luxury chocolates.	perceived as a more premium form of chocolate that is lower in fat content and greater in antioxidant properties.			
Red Wine	Korea has entered into a number of bilateral free trade agreements (FTAs) with countries such as Chile, the U.S., the E.U., Australia, and now soon New Zealand. This has had significant implications on wine trade, with the elimination of import tariffs, resulting in more competitive prices. <i>See also truffles</i>	With growing wealth and increasing disposable incomes, more consumers are purchasing wines for private consumption. The E.U., U.S., and other FTAs have resulted in lowered imported prices on wines from the major wine exporting regions.	Wine is traditionally a status symbol amongst Koreans, commonly associated with sophistication and luxury. As wine becomes more affordable and wealth increases, consumers are enjoying the greater accessibility to wine as a social drink.	Korea lacks the climate, soil and grape variety to cultivate its own red wines.	The legal purchasing age for alcohol in Korea is 20.	Grape qualities are highly volatile and sensitive to climatic conditions, resulting in 'vintages' that vary year to year and thus are valued differentially according to quality.
Distilled Spirits	Korea has entered into a number of bilateral FTAs with countries such as Chile, the U.S., the E.U., Australia, and soon New Zealand. This has had significant implications on spirits trade, with the elimination of import tariffs (formerly 15%), resulting in more competitive landed prices.	With growing wealth and increasing disposable incomes, more consumers are purchasing wines for private consumption. The E.U., U.S., and other FTAs have resulted in lowered imported prices on distilled spirits from the major wine exporting regions.	South Korea has a significant drinking culture and is highly reflective of its social structure, lifestyle and traditions. As such, drinking is very integral to Korean social dynamics. Soju is a popular Korean distilled spirit based on rice/wheat/barley and is highly commonplace.	Soju is by far the most popular Korean liquor and is dominated by Jinro (brand: Chamisul), Lotte BG (brand: Chuheum Chuhrum), Muhak (brand: Joeun Day), Daesun Liquor (brand: C1), Bohae Liquor (brand: Ipsaeju) etc. Consequently, these companies represent Korea's largest capabilities in	The legal purchasing age for alcohol in Korea is 20.	None Applicable

Product	PESTLE Analysis					
	Political	Economic	Socio-cultural	Technological	Legal	Environmental
	<i>See also truffles</i>			producing distilled spirits.		
Wagyu Beef	<i>See truffles</i>	Increasing wealth has resulted in more consumers indulging in high cost premium meat products.	Wagyu, like many other luxury food products, has seen growing popularity with the rise in wealth and disposable incomes. However, Korea also prides itself in its own beef, 'hanwoo', and competes strongly with other premium beef such as Wagyu.	<i>None Applicable</i>	Wagyu beef imports from Japan are prohibited and thus Korea imports most of its Wagyu from Australia.	Sustainable production remains a main concern. As Korea bans Japanese Wagyu imports, most of its Wagyu comes from Australia where Japanese Wagyu genetics have been bred for their marbling quality in Wagyu beef.
Southern Bluefin Tuna	Korea has banned seafood imports from major trade country Japan based on concerns regarding radioactive contamination from the Fukushima nuclear disaster. <i>See also truffles</i>	Increasing wealth has resulted in more consumers indulging in high cost premium seafood.	Bluefin tuna, or guromaguro, after its Japanese name, is highly regarded amongst Koreans. Like many other premium food products, consumption has seen growth with rising wealth.	Korea is a major fishing country for Pacific Bluefin Tuna.	Korea shall take necessary measures to regulate the catches of juveniles (age 0-3) by managing Korean fishery in accordance with the Conservation and Management Measure (CMM) adopted by the Western and Central Pacific Fishery Commission.	Sustainability for Bluefin tuna catch is at risk, with considerable overfishing by major fishing countries such as Japan.

Product	PESTLE Analysis					
	Political	Economic	Socio-cultural	Technological	Legal	Environmental
Abalone	<i>See truffles</i>	Increasing wealth has resulted in more consumers indulging in high cost premium seafood.	Abalone was traditionally served as food for royalty and continues its reputation as the 'ginseng' of the sea. It is perceived to be pure, natural and nutritious, as it lives only in clean waters and feeds on seaweed. 'Sea Women' are Korean free-diving women who have long harvested abalone off the waters of Korea's southernmost Jeju Island.	Korea also farms abalone from its aquacultures, which are typically more affordably priced than those harvested by 'Sea Women'.		Sustainable harvesting of abalone is a main concern. Natural abalone fetch higher prices, as they are regarded to be of higher quality.
Rock Lobster	Prior to the Korean-US FTA, lobsters were primarily reserved to premium wedding banquet halls, high-end seafood restaurants and hotel buffets. However, following the FTA, more importers and retailers have entered the market, holding large in-store promotions. <i>See also truffles</i>	Increasing wealth has resulted in more consumers indulging in high cost premium seafood. It imports more than half its lobsters from the U.S., followed by Canada. Imports rose 29% in 2014, from the previous year, valuing at around USD 74 million.	Like many other premium food products, consumption has seen growth with rising wealth. Canadian import lobsters are considered to be of higher quality than that of the U.S.	None Applicable		Sustainability remains to be the main concern for lobster harvesters.
Sturgeon Caviar	<i>See truffles</i>	Increasing wealth has resulted in more consumers indulging in high cost premium seafood.	Caviar is considered one of the 'Three Great Delicacies' (Caviar, Foie Gras, Truffles), sought after as status symbols and high-class indulgences.	Almas Caviar, a sturgeon aqua-farm in Korea, is a top supplier of caviar not only in Korea but also to Japan and the US. It imported 200 sturgeons from Russia in 1997	None Applicable	Sturgeons have been known to escape, as when a monsoon flooded the farm in the summer of 2007 and some swam away. Creates the risk of exotic cultivated species

Product	PESTLE Analysis					
	Political	Economic	Socio-cultural	Technological	Legal	Environmental
				and began yielding caviar in 2009.		invading a native ecosystem.
Oysters	<i>See truffles</i>	Increasing wealth has resulted in more consumers indulging in high cost premium seafood.	Like many other premium food products, consumption has seen growth with rising wealth.	Oyster farming is highly significant in Korea, with approximately 90% of its domestic oysters coming from aquacultures.		Sustainable harvesting of oysters is a main concern. Natural oysters fetch higher prices, as they are regarded to be of higher quality.

Luxury food actors in South Korea

Products	Luxury food actors in South Korea				
	Trade agents / Importers	Wholesalers & Distributors	Food Manufacturers	Retailers	Food Service
Truffles	Chef's Food, Cheese Market, Value Maker/Cheese Party		Fungo & Tartufo, Plantin Sas Hour De Nyons, Tartufi Morra Tartufalba	Chef's Food, Lotte Department Store, Shinsegae Department Store, Hyundai Department Store, Gourmet 494 Hanwha Galleria, Cheese Market, Cheese Party.	Grand Imperial Hotel, Grand Hilton, Novotel, Lotte Hotel, Ritzcarlton, Millennium Hilton, Sheraton Walkerhill, Hyatt Regency, Park Hyatt, Chosun Hotel, W Seoul Hotel
Luxury Chocolates	EuroHNJ, JF&B, Lotus Korea, Lotte Confectionary, Maeil Daires		Godiva, Leonidas, See's Candies, Laderach, Michel Cluizel, Guylian, Ferrero Rocher, Lindt & Spruengli, Galler etc.	Frenchshop, Lotte Avenuel, Galleria Department Store East, Lotte Department Store, Lotte Premium, Shinsegae Premium, G-market, CU, Ministop, GS25, Godiva Chocolate Café, Gourmet 494 Hanwha Galleria	Godiva Chocolate Cafe
Red Wine	<p>As of 2012, Wine importers in Korea have also been Lotte Liquor, Vintage Korea, Shinsegae L&B, Nara Cellar, Les Vins de Maeil, Sureung Corp, Allvintage Wine, Dana Cellars, Shindong Wine, Sumir Food & Wine, Maxxium Korea, Finno Holding, Sung Hyun Wine, Bacchus Wine Korea, Cave de Vin, Buenosaires wine & steak, KAJA Wine & Spirits Trading, Yeonil Wines & Spirits Sales, Daeyoo Wines, Fine Liquor Korea.</p> <p>http://blog.naver.com/PostView.nhn?blogId=leesir8811&logNo=20147472115</p> <p>http://www.smrwines.com/ENG016ComercioAsiaCorea.htm</p> <p>Many importers are members of Korea Wine & Spirits Importers Association (KWSIA) and/or Korea Imported Ligor Wholesalers' Association (KILWA).</p> <p>http://www.kilwa.or.kr/membership/membership01.asp</p> <p>www.kwsia.or.kr</p>		Chateau Reaut, Chateau Greysac, Domaine Fabre, Chateau Cos d'Estournel, Chateau Montrose, Chateau Langoa Barton, Chateau Moulin La Graviere, Chateau Haut Brion, Domaine La Barroche, Chateau Mouton, Rothschild, Clos Henri, Domaines Barons de Rothschild, Jim Barry, Chateau Durfort-Vivens, Yaluba Chateau de Croignon, Penfolds, Hardy's	Dure, KAJA Wine & Spirits Trading, L'Espirit de Bundang, Winenara, Ableliquor, Asiana Duty Free, Cep D'Or, Chateau M, Chiko Vino Shop, D & J Company, Dongwha Duty Free, Vino 494 Hanwha Galleria, High Street Market, Hyundai Department Store, JDC Duty Free, Korean Air Cyber Sky Shop, Lbwine, Magnum The Bottle Shop, Monodream, Mundovino, Pieroth Korea, Nara Cellar, Pinot Noir, Podo Plaza, Purple Wine Cellar, Seoul Wine, The Jell, The Malt Shop, Tiwi Trade, W23 Wine Shop & Bar, Wine N, Wine Outlet, Wine Topia, WineDC, Winegace, Wineland, Winline, E-mart, Lotte Department Store, HomePlus, Shinsegae Department Store, Costco, Lotte Premium, Shinsegae Premium, Lotte Avenuel, Galleria Department Store East	Pierre a Seoul Gagnaire, Grand Imperial Hotel, Grand Hilton, Novotel, Lotte Hotel, Ritzcarlton, Millennium Hilton, Sheraton Walkerhill, Hyatt Regency, Park Hyatt, Chosun Hotel, W Seoul Hotel
Distilled Spirits	Saeyoung Liquor, Plaza Liquor, SeoJung Liquor, China		Jinro, Lotte Liquor BG, Muhak, Kumbokju,	KAJA Wine & Spirits Trading, L'Espirit de	Pierre a Seoul Gagnaire

Products	Luxury food actors in South Korea				
	Trade agents / Importers	Wholesalers & Distributors	Food Manufacturers	Retailers	Food Service
	<p>Liquor, Ox Liquor, Sunlight and Korea, Gaja Liquor, Daeyou western liquor, Saga MyungJu, Sunghak Liquor, World Liquor, etc.</p> <p>Many importers are members of Korea Wine & Spirits Importers Association (KWSIA) and/or Korea Imported Liqor Wholesalers' Association (KILWA). http://www.kilwa.or.kr/member/ship/membership01.asp www.kwsia.or.kr</p>		<p>Bohae Brewery, Daesun Distilling, Diageo Korea, Pernod Ricard Korea, Lotte Chilsung Beverage, Hiscot, Doosan Corp, Jinro Ballentine's</p>	<p>Bundang, Asiana Duty Free, Dongwha Duty Free, Vino 494 Hanwha Galleria, High Street Market, Hyundai Department Store, JDC Duty Free, Korean Air Cyber Sky Shop, Lotte Department Store, HomePlus, Shinsegae Department Store, Costco, Lotte Premium, Shinsegae Premium, Lotte Avenuel, Galleria Department Store East</p>	
Wagyu Beef	<p>Japanese Wagyu is prohibited from trade in Korea – cannot be imported. Wagyu in Korea is primarily sourced from Australia. Kobeso, Owai Commercial, F&S, HyupJin Corp</p>			<p>Gourmet 494 Hanwha Galleria, Kobeso</p>	
Southern Bluefin Tuna	<p>Yangji Tuna, Blue Tuna, Tuna Factory, Marine Tuna</p>			<p>Gourmet 494 Hanwha Galleria, Garak Market, Noryangjin Fisheries Wholesale Market, Jagalchi Market, Dagil Tuna Shop, Yangji Tuna</p>	
Abalone	<p>Chamjunbok seafood, Dashima JunBok Seafood, Daewoon Seafood, Daejin Junbok Distribution, Daehan Bada, Dolphin Junbok, Bada nongjang, Banseok seafood, Elim Seafood, Youngjin Seafood, Wando Junbok Village, Wooil Seafood, Youjin Seafood, Yoonil Seafood, JungWon Seafood, JinMyung Seafood, Chanyoung Seafood, Chungsan Bada Cham Junbok, ChungHaeJin Seafood, TaePyungYang Live Fish, Wando Live Fish, Tojong Junbok seafood, Gold Sea Geum Junbok, HoonHee seafood</p>			<p>Gourmet 494 Hanwha Galleria, Garak Market, Noryangjin Fisheries Wholesale Market, Jagalchi Market, Ulsan Seafood Market</p>	
Rock Lobster	<p>Dacho seafood, Seabank International, Daejin Jeonbok,</p>			<p>Gourmet 494 Hanwha Galleria, Garak Market, Noryangjin Fisheries Wholesale Market, Jagalchi Market, Ulsan Seafood Market</p>	
Sturgeon Caviar	<p>Chef's Food, Blac Caviar, Zwyer Caviar, Montecito Caviar, Almas Caviar, Cheese Mall</p>		<p>Sturia Caviar, Zwyer caviar, Imperial Caviar, Kaviari, Pescaviar, Cataliment S.L., Blac Caviar, Imperial Caviar,</p>	<p>Chef's Food, Lotte Department Store, Shinsegae Department Store, Hyundai Department Store, Gourmet 494</p>	<p>Grand Imperial Hotel, Grand Hilton, Novotel, Lotte Hotel, Ritzcarlton,</p>

Products	Luxury food actors in South Korea				
	Trade agents / Importers	Wholesalers & Distributors	Food Manufacturers	Retailers	Food Service
			Montecito Caviar, Almas Caviar, Tipiak Epicerie	Hanwha Galleria, Cheese Mall	Millennium Hilton, Sheraton Walkerhill, Hyatt Regency, Park Hyatt, Chosun Hotel, W Seoul Hotel
Oysters	Haerim Seafood, HK Food System, HaePoong Distribution, KangDong Seafood, GeumChun Distribution, Cham Seafood, Sampoong Seafood, etc.			Gourmet 494 Hanwha Galleria, Garak Market, Noryangjin Fisheries Wholesale Market, Jagalchi Market, Ulsan Seafood Market	

References

- 3ders, 3D printer and printing news (2011). Food Printing - "The Killer App" of 3D Printing, <http://www.3ders.org/articles/20111030-food-printing-the-killer-app-of-3d-printing.html>, accessed 21.8.2015.
- ABARE-BRS. (2010). Australian fisheries statistics. Australian Bureau of Agricultural and Resource Economics – Bureau of Rural Sciences, Canberra.
- ABARES (2014). Australian Fisheries and Agriculture Statistics 2013, available at: agriculture.gov.au/abares/publications, accessed 9.9.2015.
- ABARES, Australian Bureau of Agricultural and Resource Economics and Sciences. (2015). Agriculture, Fisheries and Forestry in South Australia, 2015, report by the Government of Australia.
- ACI (2014). Food Packaging Improvement. Available at <http://www.aci.health.nsw.gov.au/ie/projects/food-packaging-improvement> accessed on 4.9.2015
- Aghbashlo, M., Hosseinpour, S. & Ghasemi-Varnamkhasti, M. (2014). Computer vision technology for real-time food quality assurance during drying process. *Trends in Food Science & Technology*, 39(1):76–84.
- Ahlqvist, T., Kettle, J., Hytönen, E., Niemelä, K., Kivimaa, A., Vanderhoek, N., Dufva, M., Mäkinen, T., Kurkela, E. & Valovirta, V. (2013). South Australian Cellulosic Value Chain Technology Roadmap. Stage 2. Future options for the cellulosic fibre value chain in the Green Triangle, South Australia: strategic technology roadmaps, business cases and policy recommendations. VTT Customer Report, VTT, CR-04761-13. http://www.dmitre.sa.gov.au/manufacturing_works/programs_and_initiatives/cellulose_fibre_chain_initiative, accessed 25.5.2015.
- Ahvenainen, R. (2003). Active and intelligent packaging: an introduction. In Ahvenainen, R. (Ed.), *Novel Food Packaging Techniques*. Woodhead Publishing, Cambridge, U.K, pp. 5–21.
- Aider, M. & Barbana, C. (2011). Canola proteins: composition, extraction, functional properties, bioactivity, applications as a food ingredient and allergenicity – A practical and critical review. *Trends in Food Science & Technology*, 22:21–39.
- Asheim, B.T. & Coenen, L. (2005). Knowledge bases and regional innovation systems: Comparing Nordic clusters. *Research Policy*, 34(8): 1173–90.
- Asmawi, M.Z., Seppo, L., Vapaatalo, H. & Korpela, R. (2006). Hypolactasia and lactose intolerance among three ethnic groups in Malaysia. *Indian Journal of Medical Research* 124: 697–704.
- Andersen, P.D., Dahl Andersen, A., Jensen, P.A. & Rasmussen, B. (2014). Sectoral Innovation system foresight in practice: Nordic facilities management foresight. *Futures*, 61: 33–44.
- Australian Research Council, ARC. (2015). Industrial Transformation Research Program, <http://www.arc.gov.au/industrial-transformation-research-program>, accessed 8.7.2015.
- Azmir J., Zaidul, I.S.M., Rahman, M.M. & Omar, A.K.M. (2013). Techniques for extraction of bioactive compounds from plant materials: a review. *Journal of Food Engineering*, 117: 426–436.
- Baiano, A. (2014). Recovery of biomolecules from food wastes – a review. *Molecules*, 19:14821–14842.

- Balasubramaniam, V.M.B., Martínez-Monteagudo, S.I. & Gupta, R. (2015). Principles and application of high pressure-based technologies in the food industry. *Annual Review of Food Science and Technology*, 6: 435-462.
- Balzano, J. (2014). China's Health Food Reforms Offer More Proposals than Solutions. *Forbes*, Dec 11, 2014, <http://www.forbes.com/sites/johnbalzano/2014/12/11/chinas-health-food-reforms-offer-more-proposals-than-solutions/>, accessed 27.8.2015.
- Baum and Whiteman (2015). 11 Hottest Food & Beverage trends in Restaurants and Hotel Dining for 2015 + 22 Buzzwords: The Whiteman Report, <http://www.baumwhiteman.com/2015Trends.pdf>, accessed 21.8.2015.
- Beames, G. (2003). The Rock, the Reef and the grape: The challenges of developing wine tourism in regional Australia. *Journal of Vacation Marketing* 9(3): 205-212.
- Becker, J. (2015). Oyster farmers amalgamate to take on Asian market. *ABC Rural*, 16 Apr 2015, <http://www.abc.net.au/news/2015-04-14/oyster-farmers-eye-asian-market-with-new-commercial-entity/6392374>, accessed 27.7.2015.
- Bech-Larsen, T. & Grunert, K.G. (2003). The perceived healthiness of functional foods-A conjoint study of Danish, Finnish and American consumers' perception of functional foods. *Appetite*, 40(1), 9–14.
- Bertrand Connolly, S. (2014). Convenience Drives Food Packaging Innovation. *Food Processing*. 1.6.2014. Available at <http://www.foodprocessing.com/articles/2014/convenience-drives-food-packaging-innovation/?show=all> accessed 3.9.2015.
- Besbes, S., Attia, H. & Blecker, C. (2014). Adding Value to Agricultural Products and Agrifood Byproducts by Highlighting Functional Ingredients. *Journal of Chemistry*, vol. 2014, Article 848231, 2 pages.
- Brand Packaging (2015). Holography Keeps Packaging Fresh. *Brand Packaging*, 26.3.2015, <http://www.brandpackaging.com/articles/84977-holography-keeps-packaging-fresh>, accessed 28.8.2015.
- Bruwer, J. & Alant, K. (2009). The hedonic nature of wine tourism consumption: an experiential view. *International Journal of Wine Business Research*, 21(3): 235 – 257.
- Buchert, J., Cural, D.E., Ma, H. & Kruus, K. (2010). Crosslinking food proteins for improved functionality. *Annual Review of Food Science and Technology*, 1:113–138.
- Buchert, J., Selinheimo, E., Kruus, K., Mattinen, M.-L., Lantto, R. & Autio, K. (2007). Using cross-linking enzymes to improve textural and other properties of food. In: Rastall, R. (Ed.). *Novel Enzyme Technology for Food Applications*. Woodhead Publishing Limited, England, pp. 101-139.
- Christensen, C. M. (1997). *The innovator's dilemma: when new technologies cause great firms to fail*. Boston: Harvard Business School Press.
- Cohen, W.M. & Levinthal, D.A. (1990). Absorptive Capacity: A New Perspective on Learning and Innovation. *Administrative Science Quarterly*, 35(1): 128-152.
- Cook, P. (2014). Recent developments in the international abalone industry. Centre of excellence in natural resource management, University of Western Australia.

- Corrales, M., Fernandez, A., & Hand, J.H. (2013). Antimicrobial packaging systems. In: Han, Jung H., ed. *Innovations in Food Packaging* (2nd Edition). Jordon Hill, GBR: Academic Press, 2013. pp. 133–170.
- Crawford, E. (2015). Slow-to-evolve FDA regulations could holdback 3D printing of food. <http://www.confectionerynews.com/Regulation-Safety/Slow-to-evolve-FDA-regulations-could-holdback-3D-printing-of-food>, accessed 17.8.2015.
- Cummins, A.G. & Roberts-Thompson, I.C. (2009). Prevalence of celiac disease in the Asia-Pacific region. *Journal of Gastroenterology and Hepatology*, 24: 1347-1351.
- CSIRO (2015). Lab 22 offers 3D printing. <http://www.csiro.au/en/Research/MF/Areas/Metals/Lab22>, accessed 21.8.2015.
- DANMAP. (2014). The Danish Integrated Antimicrobial Resistance Monitoring and Research Programme. <http://www.danmap.org/About%20Danmap.aspx>, accessed 2.6.2015.
- Dauriz, L., Remy, N. & Sandri, N. (2014). *Luxury shopping in the digital age*. McKinsey & the Company, 2014.
- Department of Agriculture, Fisheries and Forestry, DAFF, Government of Australia. (2012). *FOODmap: An analysis of the Australian food supply chain*. A report commissioned by the Australian Government and prepared by Steve Spencer and Martin Kneebone, Freshlogic.
- Department of Health, Government of Australia (2015). National Antimicrobial Resistance Strategy 2015-2019. [http://www.health.gov.au/internet/main/publishing.nsf/Content/1803C433C71415CACA257C8400121B1F/\\$File/amr-strategy-2015-2019.pdf](http://www.health.gov.au/internet/main/publishing.nsf/Content/1803C433C71415CACA257C8400121B1F/$File/amr-strategy-2015-2019.pdf), accessed 2.6.2015.
- Department of Industry, Government of Australia, RDAR & PIRSA (2015). *Mapping Capabilities and Connections*. A project conducted in the Riverland of South Australia by the Department of Industry through a partnership with RDA Murraylands and Riverland (RDAR) and PIRSA.
- Department of Industry, Government of Australia (2015). *Country of Origin Labelling*, <http://www.industry.gov.au/industry/IndustrySectors/FoodManufacturingIndustry/Pages/Country-of-Origin-Labelling.aspx>, accessed 1.7.2015.
- Department for Manufacturing, Innovation, Trade, Resources and Energy, Government of South Australia. DMITRE. (2012). *Manufacturing Works*. A strategy for driving high-value manufacturing in South Australia, October 2012.
- Dervojeda, K., Verzijl, D., Nagtegaal, F., Lengton M., Rouwmaat, E., Monfardini, E. & Frideres, L. (2013). *The Sharing Economy: Accessibility Based Business Models for Peer-to-Peer Market*. European Commission Business Innovation Observatory, Sep 2013, http://ec.europa.eu/enterprise/policies/innovation/policy/business-innovation-observatory/files/case-studies/12-she-accessibility-based-business-models-for-peer-to-peer-markets_en.pdf, accessed 27.8.2015.
- Desmond, R. (2014). 3D Bioprinting Master's Degree Offered For the First Time Ever. 3ders, 3D printer and printing news, May 9, 2014, <http://3dprint.com/3461/biofabrication-masters-degree/>, accessed 26.8.2015.
- Economic Development Board of South Australia. (2015). *Using value chain mapping to build comparative advantage*. The Department of State Development, South Australia.

- eMarketer (2015). Australian-Retail-Ecommerce-Sales. <http://www.emarketer.com/Article/Australian-Retail-Ecommerce-Sales-Top-10-Billion-2015/1011823>, accessed 13.8.2015.
- Ercili-Cura, D., Lille, M., Legland, D., Gaucel, S., Poutanen, K., Partanen, R. & Lantto, R. (2013). Structural mechanisms leading to improved water retention in acid milk gels by use of transglutaminase. *Food Hydrocolloids*, 30(1):419–427.
- Ercili-Cura, D., Miyamoto, A., Paananen, A., Yoshii, H., Poutanen, K. & Partanen, R. (2015). Adsorption of oat proteins to air-water interface in relation to their colloidal state. *Food Hydrocolloids*, 44: 183–190.
- Estrada-Flores, S. (2014). Competitive foods initiative. Insights and Trends on Plant & Equipment Purchases by Food Manufacturers. *Food SA*, September 2009.
- Estrada-Flores, S. (2015). *Food SA Industry Intelligence Report*, March 2015.
- Estrada-Flores, S. & Bethell, H. (2014). Mapping of the South Australian Food Industry Sectors and Clustering Rationale. *Food SA*.
- Estrin, J. (2008). *Closing the Innovation Gap: Reigniting the Spark of Creativity in a Global Economy*. New York, NY: McGraw-Hill.
- Etzkowitz, H. & Klofsten, M. (2005). The innovating region: toward a theory of knowledge-based regional development. *R&D Management*, 35(3): 243–55.
- Etzkowitz, H. & Leydesdorff, L. (2000). The dynamics of innovation: from national systems and ‘Mode 2’ to a Triple Helix of University–industry–government relations. *Research Policy*, 29(2): 109–23.
- Euromonitor (2014). *Health and Wellness Performance Overview*. Datagraphic, Oct.9. www.euromonitor.com.
- European Commission (2014). Roadmap for cross-cutting KETs activities in Horizon 2020. Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs, Directorate H-Service Industries, http://ec.europa.eu/growth/industry/key-enabling-technologies/eu-actions/rockets/downloads/cross-cutting-kets-roadmap_en.pdf, accessed 25.8.2015.
- Fearne, A. (2009). Sustainable Food and Wine Value Chains. Adelaide Thinkers in Residence, Government of South Australia. http://www.thinkers.sa.gov.au/lib/pdf/Fearne_Final_ReportCopyforWeb.pdf, accessed 28.5.2015.
- Fernandes, J.P., Neto, R., Centeno F.F., Teixeira M.F. & Gomes A.C. (2015). Unveiling the potential of novel yeast protein extracts in white wines clarification and stabilization. *Frontiers in Chemistry*, 3: 20.
- FMI (2014). U.S. Grocery Shopper Trends. Food Marketing Institute, Arlington, <http://www.fmi.org/>
- FMI (2015). The Power of Meat. Food Marketing Institute, Arlington, <http://www.fmi.org/>
- Food Freshness Technology (2015). It’s Fresh! Ethylene Remover, <http://www.foodfreshnesstechnology.com/group-companies/its-fresh-e-ethylene-remover/>, accessed 31.8.2015.
- Food SA. (2014). Competitive Foods Initiative. Mapping of the South Australian Food Industry Sectors and Clustering Rationale, February, 2014.

- Fruit Logistica (2015). http://www.fruitlogistica.com/Press/PressReleases/News_10752.html, accessed 13.8.2015.
- FSANZ (2013). Standard 1.2.7 – Nutrition, Health and Related Claims.
- Gartry, J. (2014). Study shows Australian livestock industry leading the way in antibiotic resistance. ABC Rural, 27 May, 2014. <http://www.abc.net.au/news/2014-05-27/strong-regulation-keeps-antibiotic-resistance-out-of-livestock/5481172>, accessed 2.6.2015.
- Georget, E., Miller, B., Callanan, M., Heinz, V. & Mathys, A. (2014). (Ultra) high pressure homogenisation for continuous high pressure sterilization of pumpable foods – a review. *Frontiers in Nutrition*, 2014(1): article 15.
- Gil-Chavez, G.J., Ayala-Zavala, V.J., Heredia, B., Sepulveda, D., Yahia, E.M. & Gonzalez-Aguilar, A. (2012). Technologies for extraction and production of bioactive compounds to be used as nutraceuticals and food ingredients: an overview. *Comprehensive Reviews in Food Science and Food Safety*, 12:5–23.
- Government of South Australia. (2010). South Australian Food Strategy 2010–2015. http://www.pir.sa.gov.au/_data/assets/pdf_file/0020/233462/SA-food-strategy-2010-2015.pdf, accessed 13.5.2015.
- Grunert, K.G. & Wills, J.M. (2007). A review of European research on consumer response to nutrition information on food labels. *Journal of Public Health*, 15(5), doi:10.1007/s10389-007-0101-9.
- Gunellus, S. (2010). The Shift from CONsumers to PROsumers, *Forbes*, Jul 3, 2010, <http://www.forbes.com/sites/work-in-progress/2010/07/03/the-shift-from-consumers-to-prosumers/>, accessed 27.8.2015.
- Gyimóthy, S. & Mykletun, R.J. (2009). Scary food: Commodifying culinary heritage as meal adventures in tourism. *Journal of Vacation Marketing*, 15:3, 259-273.
- Hallott, A. (2013). The future potential for developing luxury tourism and hospitality in Lapland. Haaga-Helia University of Applied Sciences, Helsinki.
- Hamer, M., Owen, G. & Kloek, J. (2005). The role of functional foods in the psychobiology of health and disease. *Nutrition Research Reviews*, 18(1):77–88.
- Harrington, R.J. and Ottenbacher, M. J. (2010). Culinary Tourism—A Case Study of the Gastronomic Capital. *Journal of Culinary Science & Technology*, 8:14–32, 2010.
- Hartman Group (2013). Modern Eating: Cultural Roots, Daily Behaviors. <http://www.hartman-group.com/publications/reports/modern-eating-cultural-roots-daily-behaviors>, accessed 21.8.2015.
- Häusler, A. & Munch, T. (1997). Microbial production of natural flavors. *ASM News*, 63: 551–559. <http://www.asm.org/ccLibraryFiles/FILENAME/000000004550/oct97HauslerFeature.pdf>, accessed 27.8.2015.
- Hautamäki, A. & Oksanen, K. (2015). Systemic Development of Service Innovation. In Agarwal, R., Selen, W., Roos, G. & Green R. (Eds). *The Handbook of Service Innovation*. London: Springer-Verlag, pp. 349–371.
- Hayes, M.G., Fox, P.F. & Kelly, A.L. (2005). Potential applications of high pressure homogenisation in processing of liquid milk. *Journal of Dairy Research*, 2005, 72(1):25-33.

- Heiniö, R.-L., Pentikäinen, S., Rusko, E. & Peura-Kapanen, L. (2014). Food for Seniors. VTT Research Report, VTT-R-04594-14. Espoo, Finland: VTT.
- Hekkert, M., Suurs, R., Negro, S., Kuhlmann, S., & Smits, R. (2007). Functions of innovation systems: A new approach for analysing technological change. *Technological Forecasting and Social Change*, 74(4), 413–432.
- Hemery, Y., Holopainen, U., Lampi, A.-M., Lehtinen, P., Nurmi, T., Piironen, V., Edelmann, M. & Rouau, X. (2011). Potential of dry fractionation of wheat bran for the development of food ingredients, part II: Electrostatic separation of particles. *Journal of Cereal Science*, 53: 9–18.
- Holohan, W. and Remaud, H. (2012). *The Impact of Eco-Friendly Attributes on Bordeaux Wine Tourism and Direct to Consumer Sales*. Academy of Wine Business Research. 8th International Conference, June 28-30 2014, Geisenheim, Germany.
- Howarth, H.T.L. (2011). ILTM Asia The future of luxury travel. *Travel & Tourism News*, June 2011.
- Huen, E. (2015a). 3D Food Printing: Is It Ready for Luxury Dining? *Forbes*, July 31, 2015. <http://www.forbes.com/sites/eustaciahuen/2015/07/31/3d-food-printing-is-it-ready-for-luxury-dining/>, accessed 14.8.2015.
- Huen, E. (2015b). How 3D Printing Will Change the Future of Fine Dining. *Forbes*, August 6, 2015. <http://www.forbes.com/sites/eustaciahuen/2015/08/06/how-3d-printing-will-change-the-future-of-fine-dining/>, accessed 14.8.2015.
- Hurun Report & ILTM Asia (2014). The Chinese luxury traveller. Hurun Report & ILTM Asia.
- IBISWorld (2014). IBISWorld Industry Research Reports. www.ibisworld.com.au/industry/, accessed 29.7.2014.
- IDDBA (2015). *What's in Store*. International Dairy-Deli-Bakery Assoc. Madison, Wis. www.iddba.org.
- Jacobsen, J. (2015). 2015 New Product Development Outlook. *Beverage Industry*, 106(1): 56-65.
- Jermann, C., Koutchma, T., Margas, E., Leadley, G. & Ros-Polski, V. (2015). Mapping trends in novel and emerging food processing technologies around the world. *Innovative Food Science and Emerging Technologies*, 31:14–27.
- Jiang, Z-Q, Sontag-Strohm, T., Salovaara, H., Sibakov, J., Kanerva, P. & Loponen, J. (2015). Oat protein solubility and emulsion properties improved by enzymatic deamidation. *Journal of Cereal Science*, 64:126–132.
- Johnson, A. (2013). Kellogg differentiates augmented reality efforts with entertainment. *Mobile Marketer*. 28.10.2013, <http://www.mobilemarketer.com/cms/news/software-technology/16473.html>, accessed 28.8.2015.
- Kamenez, A. (2013). Food: The Next Frontier for The Sharing Economy? *Fast Company*, Jan 31, 2013, <http://www.fastcompany.com/3005324/food-next-frontier-sharing-economy>, accessed 28.8.2015.
- Kaplinsky, R. & Morris, M. (2002). Handbook for value chain research. International Development Research Centre, IDRC. <http://www.ids.ac.uk/ids/global/pdfs/VchNov01.pdf>, accessed 13.5.2015.
- Kenney, M. (Ed.) (2000). *Understanding Silicon Valley. The Anatomy of an Entrepreneurial Region*. Stanford, CA: Stanford University Press.

- Kerry, J.P, O'Grady, M.N, & Hogan S.A. (2011). Past Current and potential utilization of active and intelligent packaging systems for meat and muscle-based products: a review. *Meat Science*, 74:113–130.
- Kerry, J.P. (2013). New Packaging Technologies, Materials and Formats for Fast-Moving Consumer Products. In: Han, Jung H., ed. *Innovations in Food Packaging (2nd Edition)*. Jordon Hill, GBR: Academic Press, 2013. pp. 549–584.
- Kivela, J. and Crofts, J.C. (2006). Tourism and Gastronomy: Gastronomy's Influence on How Tourists Experience a Destination. *Journal of Hospitality & Tourism Research*, 30(3): 354-377.
- Kumar, P., Sharma, N., Ranjan, R., Kumars, S., Bhat, Z.F. & Jeong D.K. (2013). Perspective of Membrane Technology in Dairy Industry: A Review. *Asian Australasian Journal of Animal Sciences*, 26:1347-1358.
- Kumari, L., Narsaiah, K., Grewal, M.K, & Anurag, R.K. (2015). Application of RFID in agri-food sector. *Trends in Food Science & Technology*. 43:144–161.
- Lacroix J. (2015). Designing immersive packaging experience for intense connections. 3.8.2015 Brand packaging, <http://www.brandpackaging.com/articles/85134-designing-immersive-packaging-experiences-for-intense-connections>, accessed 28.8.2015.
- Lee, D.S. (2013). Antioxidative packaging. In Han, Jung H., ed. *Innovations in Food Packaging (2nd Edition)*. Jordon Hill, GBR: Academic Press, pp. 111–209.
- Lee, J.L. & Rahman, A.T.M. (2013). Intelligent Packaging Food Products for Food Products. In: Han, Jung H., ed. *Innovations in Food Packaging (2nd Edition)*. Jordon Hill, GBR: Academic Press, pp. 171-209.
- Leppanen, H. & Gronroos, C. (2009). The hybrid consumer. Hanken School of Economics, Helsinki.
- Llopis, G. (2013). Working with an Entrepreneurial Attitude is a Powerful Addiction. *Forbes*, January 15, 2013. <http://www.forbes.com/sites/glennllopis/2013/01/15/working-with-an-entrepreneurial-attitude-is-a-powerful-addiction/>, accessed 28.5.2015.
- Madureira, A.R., Tavares, T., Gomes, A.M.P., Pintado, M.E. & Malcata, F.X. (2010). Invited review: Physiological properties of bioactive peptides obtained from whey proteins. *Journal of Dairy Science*. 93(2): 437-455.
- Malik, K., Tokkas, J. & Goyal, S. (2012). Microbial pigments: A review. *International Journal of Microbial Resource Technology*, 1:361–365.
- Manning, B. & Freeman, J. (2011). Collaborative Marketing and SME Export Performance: A Network Perspective. In M. MacCarthy (Edit.), *Proceedings of the 2011 Australian and New Zealand Marketing Academy Conference*, pp.1–9.
- Mellentini, J. (2014). 10 Key Trends in Food, Nutrition & Health 2015. *New Nutrition Business* 20(2/3). <http://www.new-nutrition.com/report/showReport/1235>, accessed 27.8.2015.
- Minihan, C. (2014). Exploring the culinary tourism experience: an investigation of the supply sector for brewery and restaurant owners. Colorado State University.
- Misra, N.N., Patil, S, Moiseev, T., Bourke, P, Mosnier J.P., Keener, K.M. & Cullen P.J. (2014). In-package atmospheric pressure cold plasma treatment of strawberries. *Journal of Food Engineering*. 125:131–138.

- Muckersie, E. (2014). How five food and beverage brands use digital to innovate. FreshMind, January 24, 2014. <http://www.freshminds.net/2014/01/five-large-food-beverage-brands-truly-innovating/>, accessed 13.8.2015.
- Muratoglu, S. (2015). 5 critical packaging trends for 2015. Available at <http://www.packagingdigest.com/food-packaging/5-critical-packaging-trends-2015> accessed 3.9.2015
- Nambisan, S. & Baron, R. A. (2013). Entrepreneurship in Innovation Ecosystems: Entrepreneurs' Self-Regulatory Processes and Their Implications for New Venture Success. *Entrepreneurship Theory and Practice*, 37(5):1071–1097.
- Nielsen. 2015. *Nielsen Global Survey: Snack Occasions and Trend Spotting*. The Nielsen Company, www.nielsen.com/.
- NRA (2015). Restaurant Industry Forecast. National Restaurant Association, <https://www.restaurant.org/downloads/pdfs/news-research/research/forecastexecsummary2015-final.pdf>, accessed 21.8.2015.
- NSW Health.(no year). Food Packaging Design Accessibility Guidelines. Available at http://www.packagingcovenant.org.au/data/Resources/NSW_Health_-_Food_Packaing_Accessibility_Guidelines.pdf accessed on 4.9.2015
- Odriozola-Serrano, I., Aguiló-Aguayo, I., Soliva-Fortuny, R. & Martín-Belloso, O. (2013). Pulsed electric fields processing effects on quality and health-related constituents of plant-based foods. *Trends in Food Science and Technology*, 29 (2): 98-107.
- OECD. (2014). Factbook 2014, Economic, Environmental and Social Statistics. Elderly population by region. <http://dx.doi.org/10.1787/factbook-2014-en>, accessed 28.5.2015.
- Oksanen, K. & Hautamäki, A. (2014). Transforming regions into innovation ecosystems – A model for renewing local industrial structures. *The Innovation Journal: The Public Sector Innovation Journal*, 19(2), article 5.
- Osma JF, Toca-Herrera JL & Rodriguez-Couto S (2010). Uses of laccases in the food industry. *Enzyme Research*, Article ID 918761, 8 pages.
- Pabby, A.K., Rizvi, S.S.H. & Sastre, A.M. (Eds.) (2015). *Handbook of membrane separations – chemical, pharmaceutical, food and biotechnical applications*. CRC Press, USA.
- Packaged Facts (2014). *Food Formulation Trends: Ingredients Consumers Avoid*. Feb, 2014, www.packagedfacts.com.
- Peelman N., Ragaerta P., De Meulenaer B., Adons, D., Peeters, R., Cardon, L., Van Impef, F., Devlieghere, F. (2013) Application of bioplastics for food packaging. *Trends in Food Science & Technology*, Vol. 32, Issue 2, August 2013, pp. 128–141
- Pelgrom, P.J.M. (2015). PhD Thesis: Dry fractionation for sustainable production of plant protein concentrates. <http://edepot.wur.nl/331968>.
- Pilollo, R., Monaci, L., & Visconti, A. (2013). Advances in biosensors development based on interacting nanotechnology and applied to food-allergen management. *Trends in Analytical Chemistry*, 47:12–26.
- PIRSA (2007). *South Australian Food Plan 2007–2010*. Government of South Australia.

- PIRSA (2011a). What is food security? Challenges and opportunities for a globally competitive food industry. The Market Research and Development Unit of PIRSA, April 2011.
- PIRSA (2011b). Riverland Citrus Industry Value Chain Analysis. An analysis of two navel orange supply chains. Export Chain Report, September 2011.
- PIRSA (2011c). Value Chain Development, Agriculture, Food and Wine project. Rural industry adjustment and development funds report. Report written by Samantha Hellams, PIRSA, February 2011.
- PIRSA (2012a). Tuna to China. A market strategy report, September 15, 2012.
- PIRSA (2012b). Potato Value Chain project report, December, 2012.
- PIRSA (2013a). Economic analysis of improvements arising from the South Australian case study of the National Lamb Value Chain Project. Report prepared for PIRSA by Freshlogic, February, 2013.
- PIRSA (2013b). 2012–2013 PIRSA Annual Report. PIRSA, 30 September 2013.
- PIRSA (2014a). Wine investment opportunities in South Australia.
http://pir.sa.gov.au/_data/assets/pdf_file/0003/233526/Wine-Opportunities-South-Australia.pdf, accessed 28.5.2015.
- PIRSA (2014b). Food and Wine ScoreCard 2013-14, PIRSA, Government of South Australia.
- PIRSA (2015). Premium food and wine from our clean environment.
<http://www.priorities.sa.gov.au/content/premium-food-and-wine-our-clean-environment>, accessed 28.5.2015.
- Plantic. (2008) Case study. Marks & Spencer Adopt Plantic® Packaging. Available at
http://www.plantic.com.au/Case%20Studies/Plantic_MS_CS.pdf accessed 3.9.2015 .
- Plassman H, O’Dohert J, Shiv B & Rangel A (2008). Marketing actions can modulate neural representations of experienced pleasantness. PNAS, 105(3): 1050-1054.
- Plimmer, J. (2013). Augmenting and securing the consumer brand experience through smart and intelligent packaging for food, beverages and other fast-moving consumer goods. In: Farmer, N., ed. Trends in Packaging of Food, Beverages and Other Fast-Moving Consumer Goods (FMCG): Markets, Materials and Technologies. Jordon Hill, GBR: Woodhead Publishing. pp. 35–57.
- Porter, J. (2014). Blackmores' Foot Soldiers, adaptability key to Asian Success. Financial Review, November 28, 2014. <http://www.afr.com/business/blackmores-foot-soldiers-adaptability-key-to-asian-success-20141201-11whvk>, accessed 28.5.2015.
- Porter, M.E. (1998). Clusters and the new economics of competition. Harvard Business Review, Nov/Dec 1998, 76(6):77–90.
- Prahalad, C.K. & Krishnan, M.S. (2008). The New Age of Innovation, Driving cocreated value through global networks. New York, NY: McGraw Hill.
- PwC (2011). 2011 Financial Performance Report. Thriving in a Connected World.
http://www.gmaonline.org/file-manager/GMA_Publications/2011_financial_performance_report.pdf , accessed 1.6.2015.

- Quadri-Felitti, D. and Fiore A.M. (2012). Experience economy constructs as a framework for understanding wine tourism. *Journal of Vacation Marketing* 18(1): 3–15.
- Regional Development Australia: Adelaide Hills, Fleurieu & Kangaroo Island. (2014). Sustainable Food & Wine Project, Discussion paper 7, June 2014.
- RIRCD (2010). Producing cocoa in Northern Australia. RIRDC Publication No. 09/092.
- Roland Berger Strategy Consultants. (2013). Additive manufacturing - A game changer for the manufacturing industry? Munich: Roland Berger Strategy Consultants.
http://www.rolandberger.com/media/pdf/Roland_Berger_Additive_Manufacturing_20131129.pdf, accessed 14.8.2015.
- Roos, G. (2012). Manufacturing into the Future. Adelaide Thinkers in Residence, Government of South Australia. <http://www.thinkers.sa.gov.au/roossummary/files/inc/917488524.pdf>, accessed 2.6. 2015.
- Roos, G. (2014). The constantly changing manufacturing. In CEDA (2014), *Advanced Manufacturing: Beyond the production line. The committee for economic development of Australia*, April 2014, pp. 31–56.
- Rupasinghe H.P.V. & Yu L.J. (2012). Emerging preservation methods for fruit juices and beverages. In *Food Additive*, Y. El-Samragy, Ed., InTech, 2012, <http://www.intechopen.com/books/food-additive/emerging-preservation-methods-3-for-fruit-juices-and-beverages>, accessed 27.8.2015.
- Saarela, M.H. (2011). Probiotic functional foods. In: *Functional foods: concept to product 2e*. Ed. M. Saarela. Woodhead Publishing Limited, pp. 425-448.
- Sagar, J. (2012). Bacteria control claimed for 'cold plasma' treatment of food, Australian Food News, Feb 6, 2012, <http://ausfoodnews.com.au/2012/02/06/bacteria-control-claimed-for-%E2%80%98cold-plasma%E2%80%99-treatment-of-food.html>, accessed 27.8.2015.
- Saldana, G., Alvarez, I., Condon, S. & Raso, J. (2014). Microbiological aspects related to the feasibility of PEF technology for food pasteurisation. *Critical reviews in Food Science and Nutrition*, 54:1415-1426.
- Salehi, F. (2014). Current and future applications for nanofiltration technology in the food processing. *Food and Bioproducts Processing*, 92:161–177.
- Sampedro, F., McAloon, A., Yee, W., Fan, X. & Geveke, D.J. (2014). Cost Analysis and Environmental Impact of Pulsed Electric Fields and High Pressure Processing in Comparison with Thermal Pasteurization. *Food and Bioprocess Technology*, 7(7):1928–1937.
- Savioz, P. & Blum, M. (2002). Strategic forecast tool for SMEs: how the opportunity landscape interacts with business strategy to anticipate technological trends. *Technovation*, 22, pp. 91–100.
- Scott-Thomas, C. (2011). Digital technologies driving food industry growth. Food navigator. 22.7.2011 <http://www.foodnavigator-usa.com/Markets/Digital-technologies-driving-food-industry-growth> accessed 1.6.2015.
- Shenoy, S. (2005). Food tourism and culinary tourist. Clemson University.
- Sibakov, J. 2014. PhD Thesis: Processing of oat dietary fibre for improved functionality as a food ingredient, VTT, Finland, <http://www.vtt.fi/inf/pdf/science/2014/S67.pdf>.

- Sloan, E. (2015). The Foodie Phenomenon. *Food Technology*, February 2013, Volume 67, No.2.
- Sloan, E. (2015). The Top Ten Food Trends. *Food Technology*, April 2015, Volume 69, No.4.
- Smith, C. (2015). How E-Commerce Is Finally Disrupting The \$600 Billion-A-Year Grocery Industry, *Business Insider*, January 20, 2015. <http://uk.businessinsider.com/e-commerce-disrupting-huge-grocery-market-2014-12>, accessed 13.8.2015.
- Som, A. & Blanckaert, C. (2015). *The Road to Luxury: The Evolution, Markets and Strategies of Luxury Brand Management*. Singapore: Wiley.
- Som, A. & Pape, N. (2015). Brand and line extensions: an empirical study from the new age luxury industry. *Luxury Research J.*, Vol. 1, No. 1, pp. 18-39.
- Sontag-Strohm, T., Lehtinen, P. & Kaukovirta-Norja, A. (2008). Oat products and their current status in the celiac diet. In: Arendt EK and Dal Bello F (eds.) *Gluten-Free Products and Beverages*. Elsevier, Amsterdam, the Netherlands, pp. 191–202.
- Sorin, K. (2015). Instagram advertising shows strong potential for luxury brands. *Luxury Daily*, July 2, 2015. <http://www.luxurydaily.com/instagram-advertising-shows-strong-potential-for-luxury-brands/>, accessed 29.7.2015.
- Staight, K. (2015). 3D Food Printing, Kjeld van Bommel interview, <http://www.abc.net.au/landline/content/2015/s4223769.htm>, accessed 13.9.2015.
- Steeman, A. (2015). The Latest in Active Food Labels. *Best in Packaging*. 12.1.2015, <http://bestinpackaging.com/2015/01/12/the-latest-in-active-food-labels/>, accessed 28.8.2015.
- SVARM (2014). Swedish Veterinary Antimicrobial Resistance Monitoring reports, <http://www.sva.se/en/antibiotika/svarm-reports>, accessed 2.6.2015.
- Technomic (2013a). *The Flavor Consumer Trend Report*. Technomic Inc., Chicago. <https://www.technomic.com/>
- Technomic (2013b). *The Breakfast Consumer Trend Report*. Technomic Inc., Chicago. <https://www.technomic.com/>
- Teixeira, A., Baenas, N., Dominguez-Perles, R., Barros, A., Rosa, E., Moreno, D.A. & Garcia-Viguera, C. (2014). Natural Bioactive Compounds from Winery By-Products as Health Promoters: A Review. *International Journal of Molecular Sciences*, 15:15638-15678
- Terefe, N.S., Buckow, R., Versteeg, C. (2014). Quality-Related Enzymes in Fruit and Vegetable Products: Effects of Novel Food Processing Technologies, Part 1: High-Pressure Processing. *Critical Reviews in Food Science and Nutrition*, 54(1):24–63.
- Terefe, N.S., Buckow, R., Versteeg, C. (2015). Quality-Related Enzymes in Plant-Based Products: Effects of Novel Food Processing Technologies Part 2: Pulsed Electric Field Processing. *Critical Reviews in Food Science and Nutrition*, 55 (1):1–15.
- The Economist. (2011). Fostering innovation-led clusters A review of leading global practices. A report from the Economist Intelligence Unit. http://www.economistinsights.com/sites/default/files/downloads/EIU-ATIC_Report2_Web_Revised.pdf, accessed 3.7.2015.
- The Economist. (2014). Business in the blood. *The Economist*, November 1st, 2014.

- The Luxury Society. (2012). Fine Wine Goes Online, <http://luxurysociety.com/articles/2012/08/fine-wine-goes-online>, accessed 28.5.2015.
- The Maggie Beer Foundation. (2015). <http://www.maggibeerfoundation.org.au/>, accessed 28.5.2015.
- The Minister for Science and Information Economy of the State Government of SA. (2014). Commercialisation of Publicly Funded Research in SA. A report prepared for the Premiers Science and Industry Council Industry Working Group, by LeMessurier Solutions, November, 2014.
- Thinfilm (2015a). Cost-effective safety and reliability for temperature sensitive shipments. Available at <http://www.thinfilm.no/products/smart-labels/>, accessed 28.8.2015.
- Thinfilm (2015b). Thinfilm and G World Unveil First “Smart Wine Bottle” Powered by Printed Electronics. Press Release. 10.7.2015, <http://www.thinfilm.no/news/thinfilm-and-g-world-unveil-first-smart-wine-bottle-powered-by-printed-electronics/>, accessed 28.8.2015.
- Thinfilm (2015c). NFC Opensense, <http://www.thinfilm.no/products/opensense/>, accessed 28.8.2015.
- TNO (2015). 3D printing makes food unique. <https://www.tno.nl/en/focus-area/healthy-living/food-nutrition/food-innovations/3d-printing-makes-food-unique/>, accessed 21.8.2015.
- Troye, S.V., Supphellen, M. & Jakubanec, S. (2012). The Consumer as a Co-Producer and Prosumer: Convenience Food Marketing. In Rudolph, T., Schlegelmilch, B.B., Bauer, A., Franck, J. & Meise, J.N. (Eds). Diversity in European Marketing. Springer, 2012, pp. 179–192.
- Tyler packaging (2015). Augmented Reality, <http://www.tylerpackaging.co.uk/augmented-reality.html>, accessed 28.8.2015.
- Tymms, S. (2011). Design, format and impact of front-of-pack nutrition labelling: an independent review of refereed literature. Report commissioned by the Australian Food and Grocery Council, May 2011.
- U.S. Dept. of Health and Human Services. 2013. Summary Health Statistics for U.S. Children. Dept. of Health and Human Series. Series 10, No. 8. Dec. www.cdc.gov/nchs/data/series/sr_10/sr10_258.pdf, accessed 21.8.2015.
- Vanderroost, M., Ragaert, P, Devlieghere, F., & De Meulenaer, B. (2014). Intelligent food packaging: the next generation. Trends in Food Science & Technology, 39:. 47–62.
- Verganti, R. (2009). Design-Driven Innovation. Changing the Rules of Competition by Radically Innovating What Things Mean. Boston, MA: Harvard Business Press.
- Wang, Y.G., Yan, Y.S., XU, J.J., Du, R.F., Flatz, S.D., Kühnan, W. & Flatz, G. (1984). Prevalence of primary adult lactose malabsorption in three populations of northern China. Human Genetics. 67(1): 103–106.
- Weston, R. (2014). Do you tweet whilst you eat? How food and drink brands are experimenting with social media. FreshMinds, June 12, 2014. <http://www.freshminds.net/2014/06/47-millennials-tweet-whilst-eat-can-food-drink-brands-capitalise/>, accessed 13.8.2015.
- Wiedmann, K-P., Hennigs, N. & Siebels, A. (2007). Measuring Consumers’ Luxury Value Perception: A Cross-Cultural Framework. Academy of Marketing Science Review, Vol. 11, article no. 7.

Wyatt, S. L. (2014). The State of the Snack Food Industry. Presented at SNAXPO Snack Food Assoc. Annual Meeting, Dallas, March 1–4.

Yam, K.L, Takhistov, P.T, & Miltz, J. (2005). Intelligent packaging; concepts and applications. *Journal of Food Science*, 70: R1–R10.

Ye, M. (2015). The Impact of 3D Printing on the World Container Transport. Department of Transport and Logistics, Delft University of Technology.