

Globally competitive horticultural production and marketing utilising renewable energy

A report for



By Jack Milbank

2007 Nuffield Scholar



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Foreword

In an age where, for the first time in history, in 2007 the number of obese people surpassed the number of starving people (800 million) polarity of production and consumption of food is of immense importance. Global over population is putting upward pressure on land prices forcing the cost of production of natural food stuffs skyward. Food and nutrition security should be the driving force behind all economies for without it; their capacity to work effectively is diminished. The western world's consumer demographic has succumbed to elaborate marketing campaigns driving up the consumption of processed foods, which in turn has lead to an obesity epidemic.

Supermarket chain executives apply continual pressure to reduce the returns paid to producers to drive their share prices upwards. If domestic producers are unable to supply produce at the same price as 3rd world nations such as India and Kenya then Australian producers are driven out of business. This polarity of production in third world economies for food supply to first world economies transfers' food and nutrition security from developed to developing economies. This in turn provides the supermarket chains with increasing opportunities for market entry into developing economies, **and** thus satisfying their shareholders demand for increased return on investment.

However this shift in food and nutrition security from first to third world nations although alarming is further exacerbated by the first world's drive for domestic energy security via renewable means (ethanol and biodiesel). The shift from food to fuel based production isolates the first world further as with the increase in demand of renewable energy will come establishment of more companies looking for shareholders to fund the energy production. As crops grown for energy can be mechanically produced their production will not be outsourced to low labour cost countries due to increase pressure on land availability **caused by** due to over population.

Perhaps we will find ourselves in a situation in the future where the first world will produce global energy requirements and the third world will produce global food requirements. Below is a quote from Indira Gandhi, one of the most influential people on the planet.

"We do not wish to impoverish the environment any further and yet we can not for a moment forget the grim poverty of large numbers of people. Aren't poverty and need the greatest polluters? How can we speak to those who live in villages and slums about keeping the oceans and rivers and air clean when their own lives are contaminated at the source? The environment can not be improved in conditions of poverty. Nor can poverty be eradicated with out the use of science and technology."

One of the greatest challenges ahead is the fact that by 2020 and additional three billion people have to be adequately fed.

Seeing the extent of pollution in China and India puts into context how much more there is to be done in those countries and how little control countries like Australia, USA and UK have over improving the situation in those countries. Current attempts by the developed worlds' governments at addressing climate change issues are doing little more than appeasing it's constituents in the democratic process of politics that drives western economies.

Non tariff trade barriers (NTTB) imposed by Australia on fruit and vegetable imports protect domestic producers for the time being, but as the polarity in food and nutrition security shifts to the developing world and renewable fuel production expands in the first world, this will result in the inevitable trade offs required for market access in a global economy. India and China will want increasing amounts of energy to fuel their development and Australia will need more food from low cost of production countries like India and China and therefore Australia's non tariff trade barriers will be eliminated, exposing Australian horticultural producers who do not have mechanized production systems.

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I feel it would be amiss not to thank all of the past scholars for their kind hospitality and time devoted to new scholars, Thank you. Thank you to Dr Prem Nath from the Prem Nath Agricultural Science Foundation (PNASF) in Bangalore India for his kind contribution in organising so much for me in India. I would also like to thank Kiera and Jean Luc Morcellet for hosting me in Dubai and arranging access to some amazing restaurants and kitchens in the Dubai hotel industry.

Finally, sincere thanks to Keith Sandom President NZ Passionfruit Growers Association Inc for so openly showing me around the leading growers and exporters of Passionfruit in New Zealand.

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Executive Summary

This report positions Australian Horticulture in relation to its feasibility to meet international competition at home, grow market share in key export hubs, and do so in a manner that does not cause detriment to the environment or rely heavily on fossil fuels. I pose the question of policy relating to food and energy security and where it is positioned on the list of national priorities. This is a big ask in a country where natural resource availability, labour and affordable property is limited, geographical isolation coupled with soaring oil prices are prevalent, and cooperation between producers and exporters is hostile at best. Compare this with the situation in competing horticultural nations such as Kenya, South Africa, Chile, Brazil, India, China and New Zealand.

If the Australian Horticultural sector is to remain competitive into the future, methods of vertical cooperation through the supply chain will have to undergo no less than a revolutionary shift that enables trust, joint responsibility and shared profitability between supply chain partners to thrive. We need to challenge the factors affecting the efficient movement of produce through the supply chain all the way from innovative varietal selection of plant genetics for disease resistance and taste profile through to marketing activities in retail outlets on key export destinations.

This challenge may take the form of product ownership structures and how equity in profits can be distributed to participants in that supply chain to make certain that the best possible processes are undertaken to ensure:

- i) the highest return for a particular item is gained
- ii) That the high return acts as an incentive to continually improve quality from production to transport services to retail marketing programs.

If the produce is treated as water flowing through a pipeline, and the supply chain partners make up the casing of the pipe in the form of the support they provide for the period of product throughput, then all partners in the supply chain have a vested interest in ensuring the produce is delivered in the most efficient, cost effective and profitable manner. This model also ensures there is a built in reliance upon one another to 'do their bit' and as a result fosters trust with the completion of each successful trade.

I looked at comparative production systems, marketing channels, and environmental programs in operation around the world and what ideas can be expanded upon and implemented in Australia. In many cases, the things required to be implemented in Australia were intangible business structures, partnerships and systems as opposed to physical production practices.

Introduction

During my study I looked at factors affecting all aspects of the horticultural supply chain from production to consumption. Models for the most effective production and consumption of food and energy in a global economy were investigated. This led to research in production in India, processing and marketing in UAE drawing on expertise and Intellectual property from Australia and NZ.

Research was conducted into the impact each sector in the supply chain had on environmental degradation and their associated energy use, how horticultural producers could take advantage of carbon credits as a by-product of food production, and how this was expressed in food labelling.

Australian Horticultural production and marketing is in a situation where insufficient domestic market alternatives are apparent leading to a decline in production standards, due to the lack of premium pricing filtering back to the grower for “export” standard produce. This acts as a dis-incentive to strive for better quality, leaving the only means for better returns to increasing supply for economies of scale; this merely drops the domestic price further and creates a greater labour shortage. Export market development in key. Energy policy in a range of countries was investigated and what target for a renewable component was incorporated in this policy, and how it related to fresh food production.

Finally I looked at how an entirely integrated system of energy production and consumption, including all by products, to ensure environmentally sound fresh food production and security by the most economical means, could be implemented.

Aims and Objectives

Six Australian Nuffield Scholars departed Sydney Australia for a whistle stop round the world tour of key agricultural areas of interest ranging from trade and policy makers in Washington DC to peasant villages in remote rural China. My principal aim was to identify what needs to be done to make the Australian horticultural sector globally competitive producers, processors and marketers in a manner that has a net benefit on farm ecology and regional environment and utilizing renewable energy where possible.

It is also my objective to understand where additional resources need to be directed in order to increase the use of renewable energy throughout the supply chain.

A secondary objective was to understand how the industry might adjust its focus to ensure its continued viability into 2028, twenty years down the track. I needed to investigate the key drivers behind what makes a nation globally competitive and how individual businesses are addressing key areas of concern to the horticultural sector such as climate change.

Recommendations

A number of these recommendations are on the cusp of, or pending, implementation and just require renewed vigour and focus to bring them into fruition.

1. Establishment of a single national market-driven integrated domestic and export Dutch auction house with state of the art global communication and technology facilities for buyers from around the world to participate in daily auctions. This must be separate and additional to the existing central market system.
2. Establishment of a Southern hemispherical horticultural marketing body with representatives from NZ, Chile, South Africa and Australia. This body will have to negotiate what crops fit in when and for which markets.
3. Further research into the use of renewable energy in fresh produce cool chains.
4. Implementation of uniform unit pricing per kilogram in all fresh produce outlets.
5. Establishment of a trial guest worker program from the Pacific islands to address seasonal labour shortages.
6. Establishment of a trial public private partnership supply chain with a singular company ownership structure with shareholders drawn from all major sectors of the supply chain, where profits are distributed as dividends equally to all participants.
This should be done as a test case on one product line to one market with the involvement of free thinking individuals who have no additional vested interest in the success or failure of the trial.
7. Renewable energy should form the backbone of the supply chain program so as to position itself for the future.
8. Fast tracking of market access negotiations with China incorporating agreements that have a limited affect on domestic horticultural industries as a result of inevitable trade offs.

Global Competitiveness

Many factors affect Global competitiveness and it is not easy to pin a single number on how Australia stacks up against the rest of the world. Cricket is easy: you just have a match between Australia and The Rest of the world, and invariably we come out on top.

Fresh produce is slightly more complex.

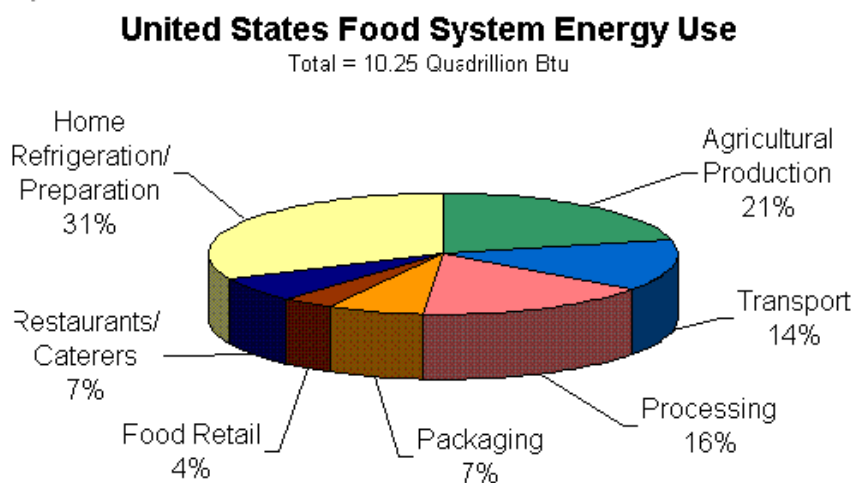
I have outlined a few of the key components that make up what defines global competitiveness.

Labour costs

Australia – minimum wage -	\$17/hr
UK - minimum wage -	\$12/hr
NZ – minimum wage –	\$10/hr
USA – minimum wage -	\$8/hr
China – minimum wage -	\$2/hr
India – minimum wage -	\$0.22/hr
Kenya – minimum wage -	\$0.10/hr

We are able to combat this handicap by production on a large scale where land is not a limiting factor, but water **is**. However this increase in production size without due market research often results in over production in the domestic market, causing the price returned to the grower to drop.

USA Food System Energy use



Source : Hellar and Keoleian. Lifecycle-Based sustainability indicators for assessment of the US food system

Air Freight as a component of product value

Product	Variety	AV Freight as a % of total cost	PMC Freight as a % of total cost
Apples	Red Delicious	38%	31%
Apricots		43%	34%
Avocadoes	Hass	31%	25%
Bananas	Lady Finger	41%	34%
Cherry	Sweet heart	23%	18%
Kiwifruit	Hayward	29%	23%
Grapes	Crimson seedless	49%	40%
Lychees	Fai Zee Siu	30%	24%
Mandarins	Honey Murcott	51%	42%
Mangoes	Kensington Pride	31%	25%
Mangoes	Honey Gold	44%	36%
Nectarines	Arctic Snow	49%	40%
Oranges	Naval	54%	45%
Passionfruit	Misty Gem	28%	22%
Paw Paw	Yellow	53%	44%
Peaches	Flame creast	53%	44%
Pears	Williams	48%	41%
Pineapples		67%	48%
Persimmons	Fuyu	30%	24%
Rock Mellon	Colorado	58%	52%
Strawberries	Camerosa	27%	12%

Sea Freight as a component of product value

Sea Freight (40ft Reefer) cost by destination for bulk supply.

Jebel Ali – UAE \$3900

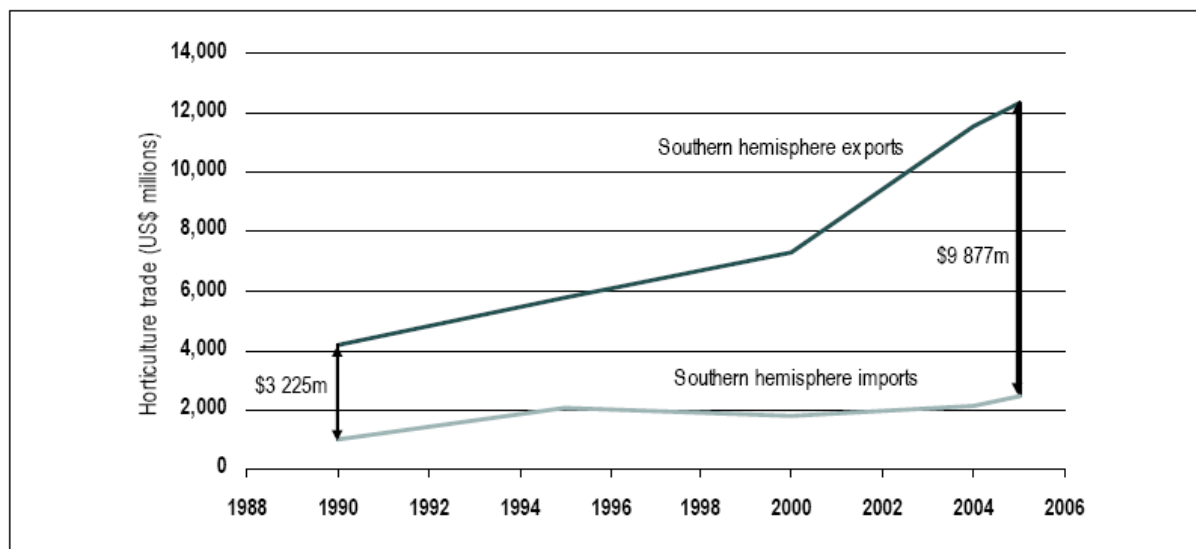
Hong Kong - \$3850

Kauhsiung –Taiwan \$4000

This represents approximately 10% of an average shipment value taken up in freight.

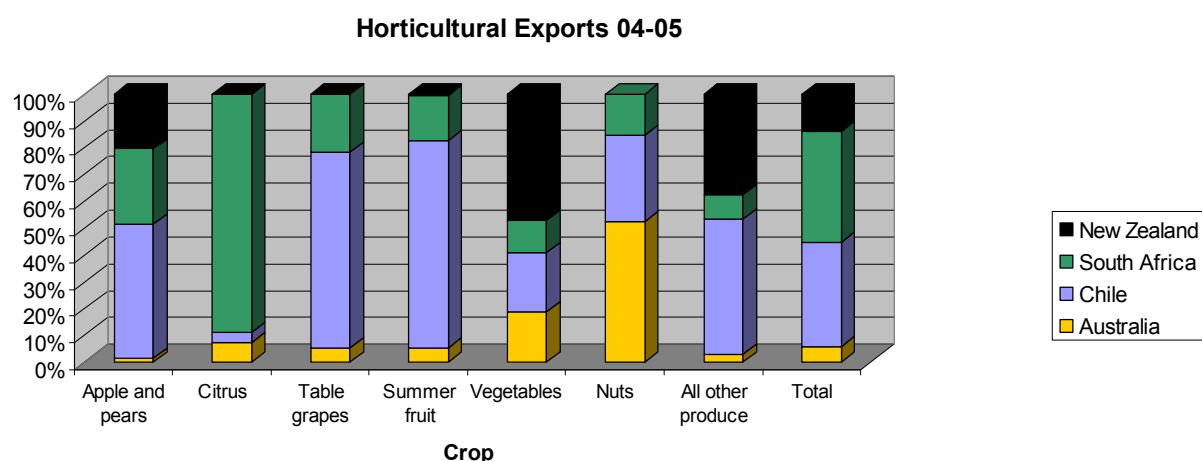
The strength of the Australian Dollar and it's subsequent exchange rate increases the pressure on buyers to source fruit from competing nations such as Chile, South Africa and New Zealand. This means Australian producers transporters and exporters have to identify more efficient means of consistently servicing export markets.

Southern Hemisphere exports to Northern Hemisphere markets



Data source: FAO (2007).

Major Southern Hemisphere exports 2004/2005



Data Source HAL 2006 – Graphed by J.Milbank

Horticultural Production and Processing

Key issues affecting horticultural growers in Queensland

- Economic viability
- Bio-security and quarantine
- Value chain transparency and relations
- Market access
- Natural resource management
- Drought and natural disasters
- Labour

Queensland GVP of Horticultural crops as at Dec 2007.

Table 2. Gross value of production, first-round processing and total primary industry estimates and forecasts 2005–06, 2006–07 and 2007–08

Commodity GVP (a)	2005–06 (c)	2006–07 (c)	2007–08 (d)	change 2006–07 to 2007–08
	\$m	\$m	\$m	%
Horticulture				
Fruit and nuts				
Bananas	300	400	450	13
Pineapples	40	65	70	8
Mangoes	60	80	55	-31
Mandarins	75	90	95	6
Strawberries	120	120	130	8
Avocados	45	75	65	-13
Macadamias	55	40	25	-38
Apples	35	35	45	29
Table grapes	n/a	n/a	40	n/a
Other fruit and nuts	55	95	105	11
Total fruit	785	1000	1080	8
Vegetables				
Potatoes	35	40	45	13
Tomatoes	165	200	215	8
Capsicums & chillies (f)	80	100	100	0
Other vegetables	460	470	430	-9
Total vegetables	740	810	790	-2
Total fruit and vegetables	1525	1810	1870	3

Cumulative Australian Horticultural Productivity

	2009-10	2014-15	2019-20
	%	%	%
Pome and stone	3.2	7.2	11.5
Citrus	4.1	9.4	14.9
Grapes	4.8	11.1	17.7
Other temperate fruit	4.0	9.3	14.9
Tropical fruit	4.0	9.2	14.8
Olives	5.1	11.8	19.0
Nuts	4.6	10.6	17.0
Root vegetables	4.1	9.4	14.9
Other vegetables	3.9	9.1	14.5
Amenity horticulture	4.1	9.4	14.9
Processed vegetables ^b	4.1	9.4	14.9
Processed fruit ^b	4.1	9.4	14.9
Juice ^b	4.1	9.4	14.9
Olive oil ^b	4.1	9.4	14.9

^a Total factor productivity - cumulative change from 2005-06 base year values.

^b Productivity on labour only.

Source: The CIE.

Production systems varied greatly around the world with varying degrees of efficiency and expertise.

Australia has very little more to do with regard to improving our production efficiency. After years of internal competition and harsh environmental conditions, those that are still producing are invariable doing so in a best practise manner. However I have included some figures on productivity growth rates by commodity. The majority of instances where there is a significant increase in productivity is as a result of increased area of production as opposed to increased production per unit output.

Australian fruit production, area and yield annual growth rates

	<i>Area</i>	<i>Yield</i>	<i>Production</i>
	% growth rate/year	% growth rate/year	% growth rate/year
Australia			
Apples	0.4	-0.4	0.0
Pears	-0.2	-0.8	-1.0
Summerfruit	3.7	-1.2	2.4
Avocados	6.6	2.5	9.2
Bananas	2.9	0.7	3.6
Oranges	-1.1	0.8	-0.3
Mandarins	2.6	2.7	5.5
Other citrus	-1.7	-0.2	-1.9
Cherries	-0.2	4.2	4.0
Rubus	4.7	-0.9	3.8
Other tropical fruit	2.4	1.9	4.4
Wine, table and DVF grapes	8.7	-1.9	6.6
Mangoes	4.7	4.4	9.3
Kiwi fruit	-3.7	3.1	-0.7
Pineapples	-2.3	0.6	-1.8
Strawberries	6.2	4.2	10.7
Melons	0.6	3.8	4.5
Horticulture			
Including grapes	4.5	-1.1	3.4
Excluding grapes	1.3	-0.1	1.2
Overseas competitors			
New Zealand	1.1	0.7	1.8
South Africa	2.2	1.2	3.4
Chile	2.8	1.1	3.9
Brazil	0.0	1.5	1.5
United States	0.3	0.8	1.0

Note: Average annual growth rates between 1990 and 2005.

Source: FAOSTAT (2007)

Horticulture is the most efficient method known for obtaining food, measured by return on energy invested. Agriculture can be thought of as an intensification of horticulture, using more labour, land, capital, and technology. This means that agriculture, usually consumes more calories of work and resources than can be produced in food, and so is on the wrong side of the point of diminishing returns. That is a good definition of unsustainability, while horticulture is probably on the positive side of the curve. It is believed that this is how horticulture can be distinguished from agriculture. It may take several millennia, as we are learning, but agriculture will eventually deplete planetary ecosystems, and horticulture may not. Source : <http://www.energybulletin.net/19334.html>

Large scale Grape production in Australia 400 acres vs. India 30 acres



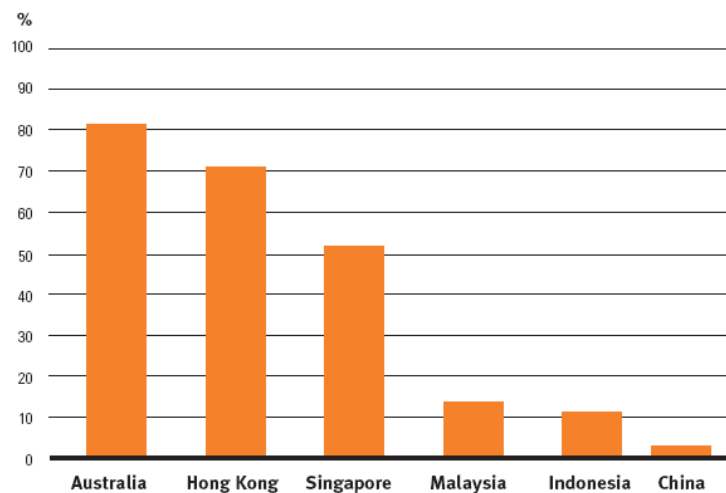
Horticultural Marketing

Domestic

The marketing options of fresh produce in Australia are relatively limited, in comparison with other countries, as highlighted by this table below.

Top five grocery chains' market share

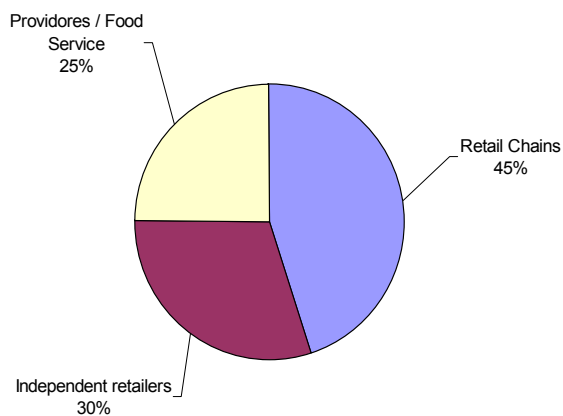
TOP FIVE GROCERY CHAINS' MARKET SHARE:
SHARE OF ALL CATEGORY VOLUME (%)



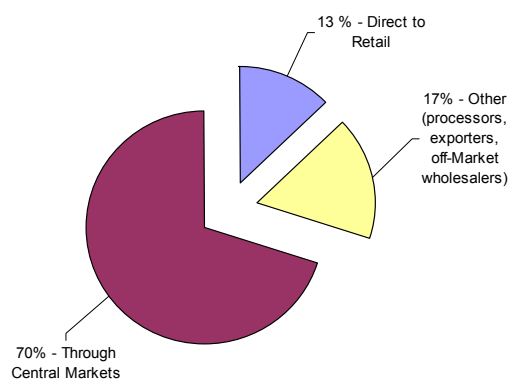
Source: AC Neilson

I have spent very little time focused on domestic marketing, as, in my opinion this is our downfall; we need to be export focused, and therefore in brief I have highlighted the standard produce distribution channels below.

Domestic Produce pathways



Distribution of produce in Australia



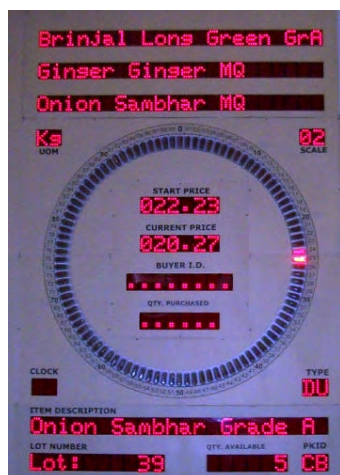
Growers primary method to sell produce

Source : Brisbane Markets Limited annual report 2007

Domestic sale of fresh produce is primarily dominated by three parties,:

- 1) Corporate growers supplying supermarket chains
- 2) Marketing agents in each of the capital cities supplying a mix of independent grocers, smaller chains and selected lines to larger chains.
- 3) There is a very small but growing sale of produce at 'local' farmers' markets
- 4) There is a growing shift toward internet-based independent home delivery structures.

I think it would be beneficial to investigate the possibility of operating a Dutch auction house as an additional alternative to the domestic wholesale market. Below is a picture of one I saw in operation in India



Export

I focused my study on the Middle East, India and China as markets with potential for expansion in the supply of fresh Australian produce. I have summarized below some of the figures that lead me to this conclusion, along with my experience traveling there. Dubai is a very mature market with regard to Australian produce, but that does not mean there is any limit on the opportunities. I believe we can do things so much more efficiently to grow Australia's market share in this region.

The food services industry in the Gulf is valued at US\$ 1.75 bn (wholesale value). Dubai & Abu Dhabi account for 80% of the market, with the hotel industry accounting for 17%. Asian cuisine is the most popular.

Export trends for selected fruit lines

List of importing markets for a product exported by Australia in 2005

Dates, figs, pineapples, mangoes, avocados, guavas

Australia's exports represent 0% of world exports for this product, its ranking in world exports is 38

Importers	Exported value 2005 in US\$ thousand	Share in Australia's exports, %	Exported quantity 2005 (tonnes)	Unit value (US\$/unit)	Export trend in value between 2001-2005, %, p.a.	Export trend in quantity between 2001-2005, %, p.a.	Export growth in value between 2004-2005, %, p.a.
World	10652	100	3,819	2,789	8	-4	9
Japan	2628	25	350	7,509	16	9	-25
Hong Kong (SARC)	2087	20	1,073	1,945	-1	-8	22
Singapore	1731	16	821	2,108	-7	-15	32
United Arab Emirates	986	9	347	2,841	19	-2	73

With regard the supply of Fruit to India, I believe the target market of affluent consumers in India would be of similar size to that of the Australian Market. Imported fruit is not a middle class purchasing class but rather regarded as an extravagant expression of affluence in the wealthier circles. Much of the Indian trade is controlled from UAE. In order to service this market effectively, quality needs to be superior to that of fruit supplied on the domestic Australian market.

With regard to supply of fruit to China and/or Hong Kong much of our success depends upon pending Free Trade negotiations between Australia and China. At present the most commonly exported lines such as nectarines, citrus, grapes, and mangoes face ever increasing pressure to compete as water costs start to play a significant part in the cost break down of each box. Additional water costs have added up to \$2 per box of export fruit.



Export Passionfruit from NZ to Los Angeles with uniform packing and branding across the industry.

Below are two tables indicating the expected make up of horticultural exports based on production capacity. I have been unable to ascertain independent data verifying corresponding market growth in each category. We need to further investigate the projected target markets for each commodity and their capacity to absorb this.

Overall projected export volumes using CIE's future focus HI-link Model

		2006	2008	2010	2012	2014	2016	2018	2020	Average annual growth	Cumulative
Exports											
Fresh products	Kt	459.7	449.3	481.2	542.8	589.6	644.4	647.0	647.5	2.5%	40.8%

Projected Export Volumes using CIE's future focus HI-link Model

		2006	2008	2010	2012	2014	2016	2018	2020	Average annual growth	Cumulative
Exports											
Pome	Kt	16.67	13.46	11.91	11.24	9.90	8.56	7.37	6.29	-6.7%	-62.2%
Stone	Kt	14.41	11.51	10.03	9.33	8.24	7.12	6.12	5.19	-7.0%	-64.0%
Berries	Kt	4.51	4.25	4.43	4.90	4.78	4.59	4.36	4.08	-0.7%	-9.6%
Kiwifruit	Kt	1.25	1.38	1.53	1.71	1.81	1.90	1.99	2.08	3.7%	66.2%
Citrus	Kt	162.91	158.74	163.46	173.13	174.33	174.61	175.97	175.43	0.5%	7.7%
Grapes	Kt	55.07	51.17	49.58	49.10	48.83	47.46	46.05	44.53	-1.5%	-19.1%
Other temperate fruit	Kt	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.5%	61.0%
Tropical fruit	Kt	14.64	11.04	8.79	7.25	6.55	5.77	5.13	4.54	-8.0%	-69.0%
Olives	Kt	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.04	2.7%	45.2%
Nuts	Kt	25.26	40.03	70.07	114.15	162.90	226.89	241.12	256.95	18.0%	917.0%
Root vegetables	Kt	135.81	134.68	141.69	154.07	156.25	153.35	146.75	138.27	0.1%	1.8%
Other vegetables	Kt	29.16	22.98	19.69	17.87	15.96	14.12	12.12	10.12	-7.3%	-65.3%
Nursery	index	0.05	0.02	0.01	0.01	0.01	0.00	0.00	0.00	-18.5%	-94.3%
Turf	index	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-22.3%	-97.1%
Cut flowers	index	0.70	0.41	0.25	0.17	0.13	0.10	0.08	0.06	-16.4%	-91.9%
Processed vegetables	Kt	22.27	14.83	10.26	7.12	5.97	4.73	3.23	1.53	-17.4%	-93.1%
Processed fruit and nuts	Kt	54.25	49.33	45.47	42.85	41.68	39.46	36.90	34.64	-3.2%	-36.1%
Orange and other juice	Kt	225.21	120.38	67.09	37.87	29.82	24.66	27.27	29.81	-13.4%	-86.8%
Olive oil	Kt	2.71	3.26	3.72	4.25	4.59	4.89	5.21	5.45	5.1%	101.1%

Source: HI-link model.

Food production with a net benefit on the environment

I believe we are only just beginning to see the manifestation of this in the form of environmental impact labeling on food stuffs in the UK. In essence producers are in the unique position of being able to produce a carbon positive product when they take into account the carbon dioxide the plants take in during production. This is in stark contrast to non-agricultural production systems such as car manufacturing.

By calculating the quantity of excess carbon after production energy inputs are accounted for, excess carbon can then be traded, creating a secondary income stream for producers. The further processed a food is the less likely it is to be carbon positive, due to the additional energy inputs during processing. Industry groups and marketing companies need to advertise this fact in persuading consumers to eat fresh unprocessed foods.

Growers seem to be nervous about the consequences of environmental impact labeling, but growers need to be on the front foot and promote their environmental efficiency in food production.



Environmental impact labelling in the UK

Labeling in the UK demonstrating transport to market method as well as the fact that the product makes up a part of the five required serves per day.

Renewable energy

Australia has a renewable energy target of 25% by 2020. By comparison Prince Edward Island which we visited on the Global focus program has a target of 30% by 2016.

The following excerpt taken from the Agricultural Alliance on Climate Change Report. “Renewable energy offers significant financial and other benefits to landholders and rural communities. Previous reports imply wind and bio-electricity could generate total annual revenues of \$300-1000 million by 2020 with an ambitious emissions reduction target or other policy support for renewable energy. Estimates undertaken for this report suggest potential wind royalties of up to \$150 million a year, or more.”

During my study I was unable to identify a supply chain dedicated to the use of renewable energy from production to consumption. This is an area I believe needs further work and will be the model of the future.

Biofuel supply is expected to exceed the Government’s target of 350 ML by 2010, and significant further expansion of domestic biofuel production in the medium term would be possible with step changes in production technologies or specific policy action in addition to the introduction of emissions trading. Realizing the benefits of increased production and use of biofuels will require all stakeholders to be involved in developing practical pathways for commercializing biofuels that are environmentally sustainable and do not disrupt food and fibre production, along with significantly increased research and development into prospective second generation biofuels that are relevant to Australia.

Biofuels not the long-term solution

The announcement that EU energy ministers have agreed to increase the share of biofuels used in transport to 10% by 2020 has drawn criticism from The House of Commons Environmental Committee that is supported by UK organic group The Soil Association on the grounds that bio-crops may be unsustainable and damaging to the environment.

In a recent press release The Soil Association stated it welcomed the committee's conclusions that any expansion of biofuel production might damage rather than benefit the environment. The committee said it recognized that some biofuels were sustainable and could be used to reduce emissions, but that current biofuel technology could result in damaging land use (including water pollution and loss of biodiversity) and the loss of crucial rainforests round the world. It said the government should concentrate on the use of sustainable biofuels, such as waste vegetable oil and other biofuel technologies with robust measures put in place to guard against environmental damage.

In a speech at the Energy Biotechnology Frontier Symposium last November, Professor John Manners from the CSIRO Plant Industry said there are currently three potential models of biofuel production:

- 1) Where the same feedstock can be used for either food or biofuel production interchangeably (eg ethanol production from sugarcane and corn in Brazil and the USA/ the production of biodiesel from vegetable oils in Europe. This model has raised the food versus fuel debate and is considered by many to be unsustainable.
- 2) Where a biofuel is produced from a waste co-product of food production eg the production of ethanol from corn stover residues and the fibrous bagasse that remains after juice extraction from sugarcane. These are financially attractive renewable feed stocks that could be quickly adopted industries, but they have a high expense of fermentation of residues.
- 3) Where marginal land that is not highly suited to food production is used to produce hardy non-food crops that act as dedicated feed stocks for biofuels. (Examples of these under discussion are the grass *Miscanthus* as a feedstock for ethanol and the shrub *Jatropha* as a source of oil for biodiesel, but these will require the establishment of totally new production and processing industries. Sugarcane has many qualities that make it attractive as a feedstock for biofuel production.)

Source: <http://www.soilassociation.org>

I believe Horticultural industries need to focus on incorporating renewable fuels into their production systems especially in the cold chain and global distribution of perishable produce from Australia to key Northern hemisphere markets. Any opportunity to engage in an integrated food and fuel system is obviously the most desirable. I have highlighted one possible system identified during my study.

A Project called the Geripa project was established in Brazil. The technical and economic potential were studied in an ecological and socio-agro-industrial project in Sao Paulo, Brazil, operating for 12 months of the year on 4310 ha planted with sugarcane and sweet sorghum. A total of 40 000 litres of alcohol per day was produced with the time for economic return being 4.6-5.4 years with 0 to 100% finance. Electricity generation was 5.20 MW, with 4.76 t/year of food, 2800 head of cattle and, when fully operational, 5600 employees. This provided basic requirements for a city of 17,300 inhabitants, constituting auto-sustainability in terms of the Kyoto protocol. Substitution of petroleum by alcohol reduced emissions of pollutants and carbon dioxide. Below I have inserted a diagram of how the system was constructed.

Conclusion

I wanted to try and assemble some sort of summary consisting of three dot points of key lessons learned during my Nuffield scholarship.

However, I believe the lessons learned will unravel themselves as the depth and breadth of what the Nuffield experience has provided comes to fruition. In an attempt to summarise what I have found at this stage I will put a few dot points down, this may only serve as an indication of naivety in 2008 when I look back on it in 2028. Please feel free to download my presentation from the Nuffield website for more information, or feel free to get in contact with me directly.

Firstly, climate change will be the biggest deciding factor on whether there is globally competitive horticultural production, processing and marketing with a net benefit on farm ecology and regional environment utilising renewable energy in 2028. Opportunities for development in the horticultural sector should not be focussed on increased production, but exist for the development of horticultural marketing, plant breeding, agronomic management techniques, horticultural engineering in the fields of mechanisation, robotics, traceability and food safety.

Secondly, Australia is globally competitive in horticultural food production, though unsustainably, due to government policy toward labour, food security, bio-security, supply chain co-operation.

It is essential that people development relating to food security is not solely directed at the knowledge and skills involved in a single aspect of food security which is production but focused on the value skills across the entire supply chain can bring from pre-production to consumption.

Thirdly it is said Agriculture produces the crops we need, therefore any investment in people involved in agriculture contributes to our food and energy security. But, horticulture produces the crops we want. Therefore any investment in people involved in horticulture ensures we always get what we want.

Plain English Compendium Summary

Project Title:	Globally competitive horticultural production, processing and marketing with a net benefit on farm ecology and regional environment utilising renewable energy
Nuffield Australia Project No.:	
Scholar:	Jack Milbank
Organisation:	Global Fresh Connect Pty Ltd / Villarica Fruit Orchard
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Objectives	To identify how best Australia horticultural producers, processors and marketers can compete on a global basis given Australia's geographical isolation, increasing costs of production, limited availability of labour and small domestic market
Background	As an Agronomist, producer and marketer of fresh produce I was interested to investigate how a global supply chain of fresh produce could exist at maximum efficiency with a net benefit to all involved.
Research	Research was conducted primarily in China, India, Dubai and New Zealand. Research was conducted in these countries due to India's ability to produce labour intensive crops at a very low cost of production. India is ideally located between European, Australian, Asian and Middle Eastern Markets.
Outcomes	Globally competitive food trading can have a net benefit on regional environment. This is achieved through the engagement of labour in poorer countries in a socially responsible manner which in turn raises their standard of living and wealth and subsequently generates a new market for western economies. Australia's greatest asset is the Intellectual Property relating to corporate food production, management and distribution. Australia's greatest challenges are supply chain cooperation, and access to resources for food production. Energy use within the food system needs to be accurately dispersed between those involved in its production, distribution marketing and consumption so that the imposed environmental cost is not landed on the producer.
Implications	Market Acceptance of such a system is limited by people's perception of what defines sustainable production. Communication, trust, and reliability are three key factors in making a global food and energy system workable. Obstacles are those of currency, language, distance and governance relating to bio-security and Non Tariff Trade Barriers.

