Conference sub-theme: Managing farm business

A CRITICAL REVIEW OF GLOBAL VEGETABLE BENCHMARKING

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Acknowledgements:
This research would not have been possible without the generous financial contribution of Vegetables WA.

Word count: 3,396 words

Type of paper: Academic

Statement of originality:
To the author's best knowledge and belief, this paper contains no material previously published in the public domain or written by another person except where due references are made.

March 2019 - ISBN 978-92-990062-7-6
www.ifmaonline.org - Congress Proceedings

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Abstract

The aim of this research was to conduct a critical investigation of global vegetables benchmarking initiatives for the development of a new benchmarking system for vegetable production in Western Australia. While farm-level benchmarking is far more robust for arable crop production and livestock enterprises, the rigorous benchmarking systems from non-government organisations were found to be the Farm Business Survey in the UK, Zentrum für Betriebswirtschaft im Gartenbau e.V. in Germany, AACREA in Argentina, Farm Digital in the Netherlands for innovative data sharing platforms, Agribenchmark benchmarks international farm-level data and Farm Sustainability Assessment which is based in the USA but collects global farm data. It was found that databases are similarly structured and principally based on gross margin analyses with additional information provided on fixed costs. Overall, the data that are provided are relatively standard: income/receipts from sales and the costs of various fixed and variable costs. Most benchmarking reports also provide details of yields in different formats. The final recommendation of this research is for those building a new vegetables production benchmark to also consider large-scale producers about the possibility of sharing benchmarking data.

Keywords: vegetables, benchmarking, gross margin analysis, fixed costs, variable costs.

Introduction

Evans and Lindsay (2017) are clear in their opinion that benchmarking is a key enabler of superior performance for organisations and supply chains alike. An earlier author (Pryor, 1989) discusses the strategic and operational effectiveness that results from companies comparing their performance to those at the top of their game. Pryor (1989) suggests that

efficiencies in quality and productivity can be achieved by a willingness to learn from the accomplishments of both competitors and non-competitors. In fact Pryor (1989) suggests that economies of knowledge can be gained from understanding the best practices of non-competitors who excel in their business. For example, a logistics firm could learn a great deal about cold chains from a meat processor. The latter of which is an expert in using refrigeration to maintain the quality of perishable products over time. Later developments in the field of benchmarking suggest that process and/or activity-orientated benchmarks have been over-taken by benchmarks that consider organisational systems and strategies (Yasin, 2002). The latest literature still encompasses benchmarking around strategic and operational effectiveness in a broad range of industries and it has expanded to include assessments of more socially-responsible factors such as environmental consciousness (e.g. Green et al., 2017; Prakash and Mohanty, 2017) and corporate wellness (e.g. Smith, Damron and Melton, 2017), and benchmarking the performance of service organisations (e.g. Tasopoulou and Tsiotras, 2017; Wanke, Barsos and Azad, 2017).

Benchmarking of agricultural production systems is a mature area of knowledge but a great deal has changed in the theories of benchmarking since many of the agricultural benchmarking initiatives around the world were developed. This research aims to identify and critically analyse the major farm-level horticultural benchmarking initiatives from around the world to highlight with the ultimate of goal of assessing: what's next?

Material studied/area description/methods

This paper reports on purely desk-based research. The initial approach to seeking out the data was to apply a structured search strategy to scholarly and industry databases from the author's university's Library (such as ProQuest, Scopus, Web of Science and IBISWorld). Searches were performed using terms such as: vegetable* production benchmark*, vegetable* production benchmark* (not oil), vegetable* benchmark*, horticulture* production benchmark*, horticulture* benchmark* and farm* benchmark* data but these terms yielded unmanageable, inappropriate results on issues such as benchmarking water quality and nitrogen use. A snowballing search strategy was then adopted which proved to be a great deal more effective in targeting the purpose of the present project. Particularly in the case of the USA where there are numerous and disparate benchmarking services for the nation's variable food-production industry. Non-English speaking countries were far more difficult to source information because English search terms were obviously not recognised by non-English web sites.

March 2019 - ISBN 978-92-990062-7-6
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Results

Australia

ABARES collects and analyses some very loose farm-level benchmarking data from a sample of 304 Australian vegetable growers in 2014-15 (Australian population = 2,467). While a great deal of information is provided about the vegetables industry and its contribution to the Australian economy, there is less discussed about individual farms and even less about individual species produced. To summarise, calculations of annual farm performance are produced for 2013-14, 2014-15 and 2015-16 (projects) on the basis of:

- Cash receipts (earnings)
- Cash costs (fixed and variable)
- Farm financial performance (farm cash income and farm business profit)
- Rate of return (% including and excluding capital appreciation, farm capital at 30 June, farm debt at 30 June and equity ratio)

Other data, such as total cash receipts, rate of return, capital additions and equity, are displayed for longer time periods but are illustrated as graphs so do not provide precise information.

One of the major benefits of the ABARES data set is that raw data can be freely downloaded in XLS format for further analysis. The benchmarking average farm data are available, by state and for the nation as a whole, in an XLS spreadsheet for 2006–07 to 2015–16 (the latter being a forecast). This is a real luxury as many other high-quality data sources do not offer this facility.

A number of other potential sources of interest were also investigated but failed to yield appropriate/useable material:

- *Australian Horticulture Statistics Handbook – Vegetables – 2015/16* (published by Horticulture Innovation Australia) provides species-specific information on fruit and vegetables grown in Australia but the data are provided at the national levels of volume and value. No data are provided at the farm-level for benchmarking purposes.
- *Benchmarking Australian Vegetable Industry Points of Difference* (published by Euromonitor International in 2014) has an emphasis on the downstream end of the vegetables export supply chain into China, Malaysia, Saudi Arabia, Singapore and

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the United Arab Emirates. This report is purely aimed at market access and does not provide any data at the farm-level for benchmarking purposes.

- *IBISWorld Industry Report A0122 Under Cover Vegetable Growing in Australia* also provides information (not data) that is beyond the scope of the present study. IBISWorld is an international market intelligence organisation and publishes basic market reports. Reports are available by subscription only (i.e. through the X University Library). This report on undercover vegetables is exclusively production-orientated and does not provide any farm-level data that is helpful for benchmarking purposes. A commentary on benchmarks (e.g. purchases, profit, wages, utilities, depreciation and rent) is provided but does not provide data. A nearly-identical report is also produced for outdoor vegetables.
- PlanFarm BankWest has a long-term benchmarking system which principally covers broadacre agriculture.

New Zealand

New Zealand has a rich source of publically-available benchmarking data for its livestock industries and the Department of Primary Industries conducted a viticulture gross margin benchmarking project in 2016. New Zealand also has many private farm consultancies that benchmark farm production and financial data (e.g. New Zealand Farm Data Standards and RedSky which specialise in livestock benchmarking, and Agrigate that specialises in dairy production) but, unfortunately, none of these appear to collect data on vegetable production.

United Kingdom and European Union

The United Kingdom was found to be a rich source of benchmarking activity. DEFRA (Department for Environment, Food & Rural Affairs) contracts its farm benchmarking to the Farm Business Survey Rural Business Research consortium in England and Wales The methods for collecting and analysing this data have been developed over the Farm Business Survey's 80-year history by leaders in the field of farm management and production. The details of sampling, data collection, data analysis and definitions are clearly set out online.

For hortculture, calculations of farm performance are produced on the basis of:

- Income (termed FBI or farm business income)
- Balance sheets (in the form of gross margin analysis)

- Outputs per business, per hectare and per £100 of gross output for each of the main methods of horticultural production e.g. specialist glasshouse business, specialist fruit business, nursery stock, etc.

The Farm Business Survey also has an interactive online benchmarking tool to compare individual farm performance to benchmarking data. Table 1 summarises the type of data available and if it is available for horticultural farms.

Table 1: Summary of Farm Business Survey *individual* farm benchmarking capabilities

Benchmark	Country	Horticulture farms included	Further analysis
Enterprise Gross Margins	England	No	N/A
	Wales	No	N/A
Net Farm Profit	England	Yes	Farm size
	Wales	No	N/A
Balance Sheets	England	Yes	Type of ownership
	Wales	No	N/A
Performance Ratios	England	Yes	Type of ownership
	Wales	No	N/A

The Farm Business Survey online Farm Benchmarking tool also has the capability to compare individual farms with benchmarks from the 28 EU countries (including EU28 as a whole) however these data are limited to cereals, dairy, mixed crop, sheep and goats, and specialist cattle. As such, there are no data available for horticulture enterprises. On the other hand, the OECD has a Fruit and Vegetables Scheme. This scheme is principally dedicated to setting out up-to-date quality standards and does not provide benchmarking data but it is very extensive and gives a thorough overview of what these industries are aiming to achieve in terms of optimising marketing opportunities.

AHDB is a farmer-funded levy board in the UK which supports six sectors (pig production, dairy, beef and lamb, arable crops, potatoes and commercial horticulture). It has developed the Farmbench programme for benchmarking financial, technical and productivity performance data. While it has not yet been rolled-out for commercial horticulture production, farm-level benchmarking data are available for potato production.

Finally, Andersons is a private farm business consultancy that collects and analyses farm benchmarking data. This is an example of a private organisation that has developed a benchmarking method but its method and data are inaccessible so cannot be used for the purposes of this review.

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Germany & Austria

Zentrum für Betriebswirtschaft im Gartenbau e.V. (ZBG), or the Centre for Business Management and Applied Research in Horticulture, publishes benchmarking data (in German only) from partnerships with horticultural tax advisors and extension staff who forward de-identified data from farm:

- Balance sheets
- Profit and loss accounts
- Accounts on farm structure, i.e. acreage, labour, marketing channels and main crops

ZBG has a database of more than 2000 sets of farm accounting data per year, drawn from about 1000 horticultural enterprises; about 80 benchmark indicators are published. It shares its benchmarking data with its neighbouring German-speaking countries of Austria, Luxembourg and Switzerland.

The Thünen Institute is a German Federal Research Institute that is part of the German Ministry of Food and Agriculture. It does extensive work with vegetables and runs the international Agribenchmark programme so all of its data are associated outside and beyond the Institute.

Bundesanstalt für Agrarwirtschaft, Federal Institute of Agricultural Economics ("AWI") in Austria is a research institute responsible for providing advice on matters relating to agricultural policy, food economics, agricultural enterprises and rural affairs. All of the Institutes' publications and data sets are in German. For each of the years 1994-2015, three data sets are available for public downloading:

- Table DI: Data pertaining to all agricultural holdings, holding types, production areas, less-favoured regions, mountain farms, federal states, organic and conventional farms and various eco-social categories.
- Table Section DII: Statistics arranged by the 28 strata, size classifications of holdings and specialised farms.
- Table Section DIII: Statistics arranged according to Austria's NUTS[1]-III regions.

[1] NUTS (French abbreviation for *nomenclature des units territoriales statistiques*) is a system of hierarchically-organised territorial units used for statistical purposes within the EU.

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The Netherlands

The Netherlands has a highly-advanced horticultural industry with digital information sharing at its heart: producers identify themselves as entrepreneurs rather than farmers. Frug|Com is a network hub for the vegetables supply chain that connects producers and retailers through digital network techniques. Its latest projects include "Veggepedia", which provides consumers with transparency via supply chain information about product origin and brand, and "Farm Digital", which is an online platform for the free exchange of food certification data throughout the supply chain. While there is no evidence that this organisation collects farm-level benchmarking data, its innovative approach to collecting and sharing data would make it a worthwhile target for data collection methods and technologies.

Another very progressive horticulture organisation is Greenport Holland which refers to itself as a "horticultural cluster" of cultivation companies, auctions, merchants, exporters, horticultural suppliers and, financial and advisory institutions. Like Frug|Com, there is not any immediately-obvious information about farm-level benchmarking but it aims to optimise the entire vegetable supply chain by facilitating businesses collaboration. This organisation could provide knowledge about effective data sharing platforms once established.

France, Italy and Spain

A lot of the work that Agribenchmark (discussed later) does is about the Spanish horticultural industry. Other than this, Eurostat provides an agricultural census for France, Italy and Spain on the number of farm holdings, production data and labour input into agriculture but this is not specifically about horticulture and is not truly a source of benchmarking data.

Overall the benchmarking data for vegetable production for these countries is extremely limited. This is surprising since the OECD (2016) claims that these nations are the top-three producers of fruit and vegetables in the European Union. It is possible that there are some small grower-led organisations that collect and analyse benchmarking data in these countries but language differences may account for why they did not appear in any searches that were conducted for this investigation (i.e. English search terms were not recognised by non-English web pages).

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Canada

Despite Canada having a large horticultural industry, the quantity of useful benchmarking data is small. Statistics Canada produces most of the publically-available data on factors like producers' operating expenses, production and value, farm capital, stock sales, and sales however it is presented in confusing and disparate formats and requires complex compiling for analysis. A report is available on "Farm financial survey, capital investment and capital sales of farms, average per farm" but the data are only presented by province rather than by production type.

Less disappointing is the benchmarking data produced by the province of Alberta. Its web site on Economics and Competitiveness has some publically-available reports on cost of production for greenhouse crops and, fruit and vegetables. Unfortunately, these reports are not produced on an annual basis and were written around 2012-2013. However, the report by Serecon Management Consulting Inc. (2012) has a very useful benchmarking data collection sheet that may be of use for future benchmarking development.

The Canadian Horticultural Council is an organisation that has conducted some benchmarking work and represents Canada's 20,000 horticultural producers; data are only available to members. Jardins-Nature is Canada's largest producer of organic tomatoes so may have a large database of its own benchmarking data.

USA

The USDA has an extensive data base of farm production and financial data available from Economic Research Service but it is dominated by broadacre agriculture. Data are available exclusively on the vegetables industry from the USDA but there are no farm-level data and a lot of the information from the latter source is about trade and forecasts. The University of Minnesota has an impressive online farm benchmarking service (https://finbin.umn.edu/) but, like the USDA, it is only dedicated to broadacre agriculture. Iowa State University Extension and Outreach's Ag Decision Maker group has also conducted some work on vegetable production budgets but this was one-off research so the data are not continuous over time.

California is the principal location of vegetable production the USA (58.1%). The temperate zones of California and Florida account for over half of the nation's vegetable production and approximately two-thirds of industry revenue (Madigan, 2017). Consequently, searches for sources of benchmarking data were focused on California.

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Despite California being a rich source of data on its horticultural industry, like the rest of the nation, very little farm-level data are available. The best source of data, although not nearly the quality of that produced in Australia or Europe, was found to be from a report produced by the California Department of Food and Agriculture in its California Agricultural Statistics Review, 2015-2016. While this report addresses all production systems in the state, it is dominated by macro-level data and sector descriptions. The best farm-level benchmarking data are longitudinal and list costs of production and outputs but lack specific detail about the vegetables industry.

With government funding reduced in so many sectors, it is likely that very large food production companies will become the new sources of production data. Madigan (2017) states that 94% of vegetable production comes from small, family-owned farm businesses but there are a few very large producers which may have their own internal benchmarking systems so the search for benchmarking methods and data needs to turn private production companies like:

- Monterey Mushrooms Inc. (estimated market share: 3.2%) specialising in mushroom production
- Bolthouse Farms (estimated market share: 2.1%) specialising in carrot production
- Sun World International (estimated market share: <1.0%) specialising in table grape production among other species

A few other less-obvious sources have been identified which do not make their data publically-available but may be worth contacting about sharing data:

- Farm Financial Standards Council
- The Farm Credit Council
- Ag Decision Maker at Iowa State University
- University of Idaho "Idaho AgBiz" (note that the data from this organisation is mainly data from various research project so is not consistent over time)

International benchmarking initiatives

Agribenchmark is an international not-for-profit network of experts in agricultural and horticultural production (agricultural economists, advisors, producers and value chain specialists). Its latest report (2014) provides a global overview of specific production systems (apples, wine grapes, tomatoes and carrots). The report is mainly dominated by national production information but there are some farm-level data available on apples

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(from Chile, Germany, Italy, South Africa and Switzerland) and wine grapes (from Australia, France, Germany, Italy, Spain and South Africa) that would be helpful to replicate for vegetables.

FAOSTAT is a database of statistics produced by the United Nations' Food and Agricultural Organisation. Its scope is vast and it holds production data for most nations and for most vegetable species from at least 2010-2015, sometimes as far back as the early 1960s. While there is a clearly-defined method for its data collection and analysis but a draw-back of this service is that it does not produce farm-level data in a single report so data on outputs (yield, area harvested, production quantity), inputs (fertilisers, pesticides, wages and land use) and prices (incurred by both consumers and producers) must be laboriously compiled.

The European Commission has published accountancy and production data in the European Farm Accountancy Data Network (FADN) since 1965 from about 80,000 agricultural holdings. While this is the only benchmarking database to include horticultural produce in its analysis, data are not aggregated into species, rather data are available for "fruit" and "vegetables and flowers". The OECD and the EU's database, Eurostat, was also consulted for sources of benchmarking data but its resources and reports do not drill-down to the farm-level.

The UNIVEG Group is an international vegetable production company (among other things). It started in Belgium in 1987 and has grown into a truly global vegetable producer. While its web site does not mention farm-level benchmarking, a production company of this size would inevitably have production data in abundance. Nature Sweet Tomatoes is based in the USA and is a substantial producer of tomatoes. Along with UNIVEG, this company may collect its own benchmarking data that may be useful to Vegetables WA. Another potential contact for global benchmarking data is Cuesta Roble Greenhouse Vegetable Consulting. Its web site has some interesting data for sale that might lead to future collaborations with large-scale producers who collect their own benchmarking data.

Discussion & conclusion

This research aimed to investigate vegetable benchmarking initiatives from around the world. A number of significant findings emerged from the enquiry. First, the data and their presentation are fairly standardised and can loosely be described as accountancy data (income, receipts, payments, etc.) and production (yield). Second, in terms of countries leading horticultural benchmarking initiatives: the UK and Germany are particularly

progressive and thorough, the Netherlands has existing data-sharing platforms and Austria is well-focused on including ecological measures in its benchmarking. The European Commission's FADN reports extensive horticulture data but is antiquated in its reporting and the data are not aggregated into vegetable species. Despite advances in benchmarking theory (Green et al., 2017; Prakash and Mohanty, 2017), measures of responsible production are still universally lacking. Third, a limitation of this research is that English search terms did not yield findings from non-English web sites (a particular problem for small grower-led organisations). As such, personal communications and contacts will be required to further explore benchmarking initiatives in non-English speaking countries; particularly France, Italy and Spain. Finally, targeting large-scale vegetable producers (e.g. Univeg and Sun World International) for sharing benchmarking data is advisable. Since the demise of government investment in agriculture, large-scale producers are increasingly developing their own monitoring systems and have sophisticated data collection and analysis protocols. Their benchmarking systems will be performance-based, up-to-date and sector-specific thereby making them potentially more attractive for collaboration than government or university-based initiatives.

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March 2019 - ISBN 978-92-990062-7-6
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