Implementation of sustainability assessment and reporting in horticulture: a case study of New Zealand's wine and kiwifruit sectors

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Abstract: The wine and kiwifruit sectors are New Zealand's most valuable horticultural sectors, representing almost 60% of export value of all horticultural exports. A significant reason for this is that globally they are seen to provide high quality and safe products that are grown ethically and with minimum impact on the environment. This success in part is due to the market assurance programmes within each sector. The kiwifruit sector for example has been underpinned by programmes like GLOBALG.A.P. and an integrated pest management programme. Similarly, the wine sector has been supported by an integrated winegrowing programme which over 20 years has evolved into Sustainable Winegrowing New Zealand. However market expectations also continue to evolve and with it so must the sector's assurance programmes. If both sectors are to maintain and increase market value they must set new aspirational goals. To help achieve this, the NZ Sustainability Dashboard Project has been operating in both sectors to augment sustainability assessment and reporting. In the wine sector, the project has supported enhancements to the Sustainable Winegrowing NZ programme, development of new scorecard tools, and individualised benchmarking reports (with video tutorials on how to interpret them). In kiwifruit, unique online web-based dashboard tools that capture, report and benchmark sustainability-related information are currently being developed and piloted amongst different types of stakeholders e.g. growers and packhouse staff. This paper describes how these initiatives have come about, grower engagement, and the associated learnings.

Keywords: participatory action research, primary industries, Zespri

Introduction

The primary sector dominates the New Zealand economy. Total primary sector export revenue was approximately NZ$38.3 billion for the year ended 30 June 2014, accounting for around three-quarters of the total merchandise export revenue (MPI, 2013). To help future proof this while at the same time maintaining, if not enhancing, social outcomes and environmental integrity, the New Zealand Sustainability Dashboard (NZSD) project was established in 2012. This project is helping primary industry partners to develop sustainability assessment, monitoring, reporting and learning tools that will empower New Zealand producers, processors and distributors of food and fibre to meet their market, regulatory, and business requirements, and societal expectations, while

contributing to New Zealand's resilience and sustainability. This paper specifically focuses on the development and implementation of tools in NZ's two biggest horticultural export sectors of wine and kiwifruit.

The NZSD project

This is being led by The Agricultural Research Group On Sustainability (ARGOS) which has been studying sustainability within NZ's primary sector since 2003. ARGOS involves around 15 researcher partners from 10 local research organisations or companies, bringing together skills in economics, social science, ecology, Māori cultural science, engineering, agribusiness and software development. The research approach underlying the NZSD project involves Participatory Action Research (PAR) that has a concerted focus on the inclusion of end-users and experts from a range of disciplines working closely together.

Fundamentally, the NZSD project aims to deliver three main interlinked outputs. Firstly, a sustainability assessment framework which sets out the goals being addressed as well as the indicators and metrics used to evaluate movement towards these goals. Secondly it aims to help industries develop assessment and reporting systems either through the direct delivery of tools or through informing industries to develop their own tools. Thirdly, tools for learning that help growers and industry improve, for example decision support, risk assessment and statistical (e.g. power analysis) tools to assess trends in sustainability indicators. The goal here is to unify and streamline reporting for better benchmarking of performance and to turn sustainability auditing into a genuine opportunity for learning by growers.

Initially, sustainability assessment and reporting tools were developed for the New Zealand wine and kiwifruit sectors because these are well-managed industries with key stakeholders who wanted to participate. For wine, Sustainable Winegrowing New Zealand (SWNZ) is the main industry partner while for kiwifruit it is Zespri which is the sole exporter of kiwifruit from NZ. Tools are now being developed for other sectors including Māori agribusiness and forestry sectors.

The NZSD project is funded largely by the NZ Government, specifically The Ministry for Business, Innovation and Employment (MBIE). It is also funded and supported by each of the primary industries involved.

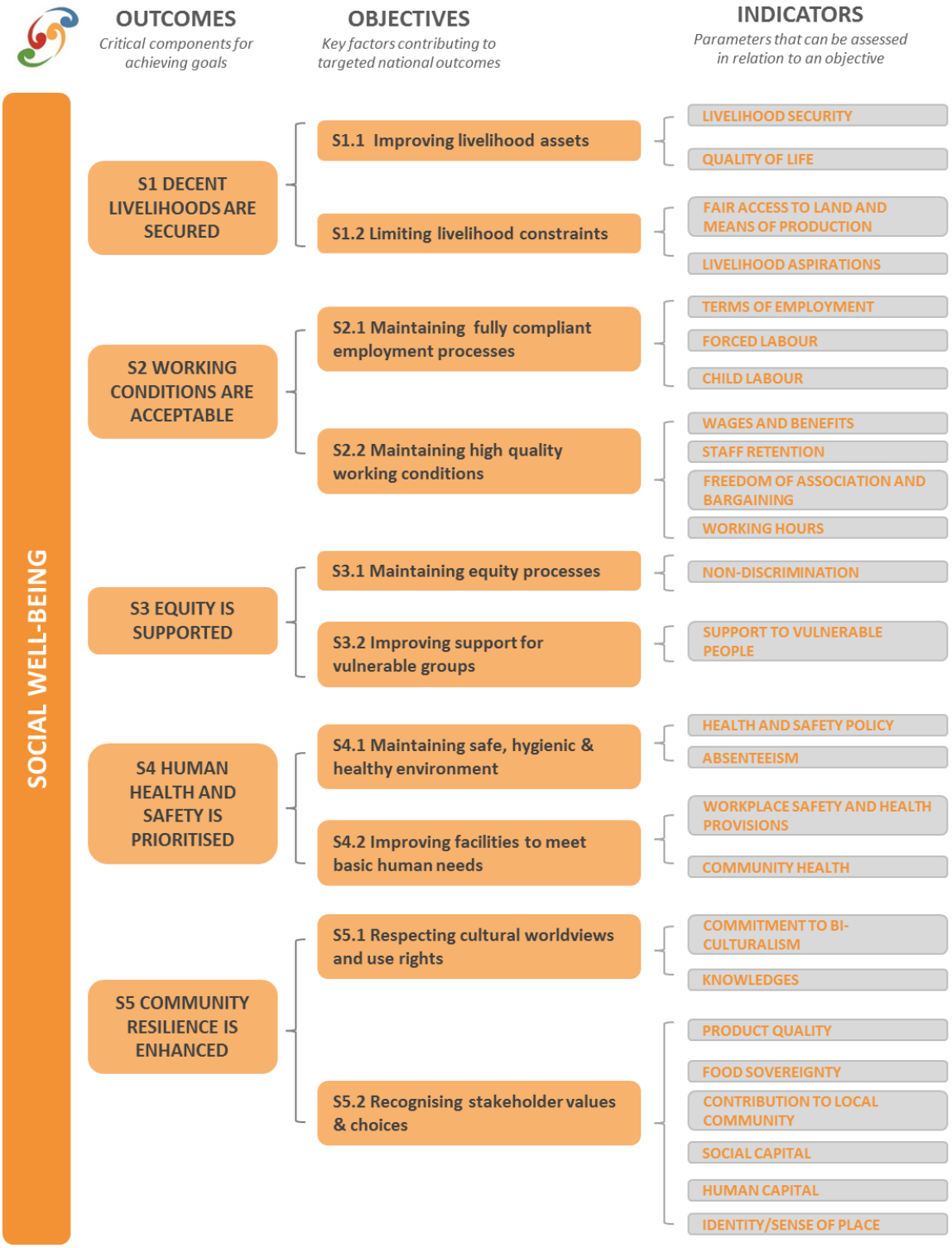
The NZSD framework

Globally, hundreds of sustainability assessment and reporting frameworks exist and an important objective of the NZSD project was to bring elements of these together to form a unified framework that met the needs of local stakeholders but which was internationally relevant. Specifically, the NZSD framework has been developed to have an overarching goal across four pillars of sustainability – Good Governance, Economic Resilience, Agro-

environmental Integrity and Social Well-being. This closely mirrors the main sustainability dimensions identified by FAO's Sustainability Assessment of Food and Agriculture Systems (SAFA) (FAO, 2014). Within each pillar is a hierarchy of five levels. The first describes the goal for the pillar, which is broken into the outcomes if that goal is achieved. Each outcome is further divided into objectives, or the intent of these outcomes. The achievement or movement towards the objectives will be shown using indicators and measures (Hunt, 2014). This framework is summarised in Figure 1 with an example of the outcomes, objectives and indicators within a pillar, the social well-being one, shown in Figure 2. Within each of the sectors participating in the NZSD project, the framework elements are being developed by each end-user in consultation with the project team and other stakeholders. The NZSD framework is being used to inform that.

Figure 1: Outline of NZSD framework structure.

Figure 2: Social well-being framework developed by the NZ Sustainability Dashboard Project.



Sustainability assessment and reporting tools

Tool selection

Each sector involved in the project was identified to have different timeframes for development and implementation of sustainability assessment and reporting tools. The wine sector had an immediate requirement of industry roll-out within a year. For this reason an off-the-shelf software package (SoFi from PE International) was adapted to meet their needs. The advantage of this approach is faster implementation however it offers less flexibility in design and development plus there is a subscription cost. In contrast, the kiwifruit sector had an expectation of four years or more for industry roll-out and so a bespoke solution was able to be developed. While slower, this affords great flexibility in design and development and while there may be on-going maintenance costs there is no subscription cost. The bespoke needs of the end-user are more likely to be catered for using this approach. For the kiwifruit solution, standard Microsoft technology was used with the view that this would make it more compatible with industry systems and therefore enable easier integration if required. Specifically, the dashboard was developed in ASP.NET 4 (C#) MVC using Microsoft Visual Studio 2012 with a Microsoft SQL Server 2012 Express database. Interactive charts were created using 'Highcharts' (a JavaScript solution). These different solutions are being evaluated as part of the project and will provide important learnings for other sectors interested in developing similar capabilities.

Development process

In the kiwifruit sector, where a customised solution is being built, an agile software development methodology called Scrum has been used. This is a project management framework that is suitable to projects with aggressive deadlines, complex requirements and a degree of uniqueness. In Scrum, projects move forward via a series of iterations called sprints. Each sprint consisted of a number of tasks that typically required one to two weeks to complete. Primarily the Scrum team has consisted of the software developer (tool builder), product owner (representing end-users) and scrum master (project manager). An online collaboration tool called 'Trello' was used to assign tasks and track progress. This process has been very successful for prioritising and development. Building of the dashboard tools has been overseen by a software development expert and mentor to ensure the best use of processes.

Design and functionality

For kiwifruit which is delivering a custom solution, initially a prototype was developed with its appearance and functionality largely determined by the dashboard project team with some input by industry partners. The solution has been designed to cater for three different types of stakeholders identified as important by our partners i.e. growers, postharvest operators, and Zespri staff. The design and functionality is consistent irrespective of which stakeholder type is using the application. However the content (i.e.

metrics and indicators) differs reflecting the different end-user needs and systems. For example, a grower will have access to agrichemical indicators however this does not apply to a postharvest operator who instead will have access to indicators like energy use. An important design feature of the solution is benchmarking and the ability for users to customise this. Other key features are the ability of users to enter different levels of information (e.g. whole orchard vs individual cultivar information) and the integration of existing data already being collected by industry which is important to minimise manual data entry and duplication. These were identified through consultation with end-users as essential for ease of use and for maximising engagement. The importance of incorporating features like these is discussed further below.

Content

To date, the indicators and metrics of sustainability that have been included in the NZSD tools have been largely identified by the end-users to ensure their immediate needs have been met and to encourage participation. For the kiwifruit sector, these have mainly been production (i.e. number of trays, fruit size), revenue, cost and input (e.g. electricity, fertiliser, agrichemical) metrics. An example of a social indicator was included (i.e. community donations in dollars) but testing identified that this may not be a good measure of community support as some growers make contributions in non-financial ways (e.g. volunteering). For the wine sector, energy, water and agrichemical use metrics have initially been included. Within each dashboard these have been aligned with the appropriate pillars and objectives. As the tools are developed further, other relevant indicators and metrics will be added that align with the NZSD framework. Given the potentially large number of indicators and metrics required to provide information on all aspects of sustainability, aggregated indices of performance may be developed and sharp prioritisation undertaken to identify what measures are needed.

Evaluation

Early versions of the NZSD tools are being regularly evaluated by several end-users within each sector. Feedback from trialists is being obtained through semi-structured interviews conducted face-to-face. This iterative is being used to prioritise the development, content and functionality of the dashboard solutions.

Maximising participating and trust

One of the biggest challenges of this project will be obtaining enough engagement from end-users to provide the minimum amount of information needed to meet industry and market needs. This is particularly so for the kiwifruit industry whose growers are typically over 55 years old, have limited computer experience and may be sceptical of the value of such tools. Several strategies are being used to maximise uptake.

Firstly, a key driver for growers engaging with NZSD tools is that they enable them to meet compliance processes. In the wine sector, the NZSD tool (known as WiSE; *Wine*

Industry Sustainability Engine) must be used and completed by growers for their products to be included in the Sustainable Winegrowing NZ programme and subsequently be eligible to enter NZ wine awards. For the kiwifruit sector, the NZSD tool has been identified for its potential to aid with its existing compliance processes, like GLOBALG.A.P. For example, information already being collected by the NZSD could be automatically fed into the GLOBALG.A.P. process, or vice versa, thereby simplifying the compliance process for growers.

Importantly, participation and trust in the tool is likely to increase if personalised, rapid and tuned benchmarks can be provided. Thus, the NZSD tools endeavour to provide instant benchmarking as soon as users upload their own data. Tuned benchmarks in the wine industry include regional and soil type benchmarks for water use, regional and catchment (5 or 10 km radius) agrichemical use benchmarks (Figure 3), and operation-size benchmarks for water and energy use by wineries. Similarly for kiwifruit, users can customise benchmarking i.e. using drop-down menus (shown in Figure 4) they can specify benchmarks for a particular region, growing method (e.g. conventional or organic) or cultivar.

With wine, video tutorials are provided to help users interpret their reports and the benchmarking within. To date, feedback from growers has identified the benchmarking feature as particularly valuable and something that is likely to drive change.

Figure 3: Example of agrichemical use reporting and benchmarking for the NZ Wine Sector, produced by the NZSD project.

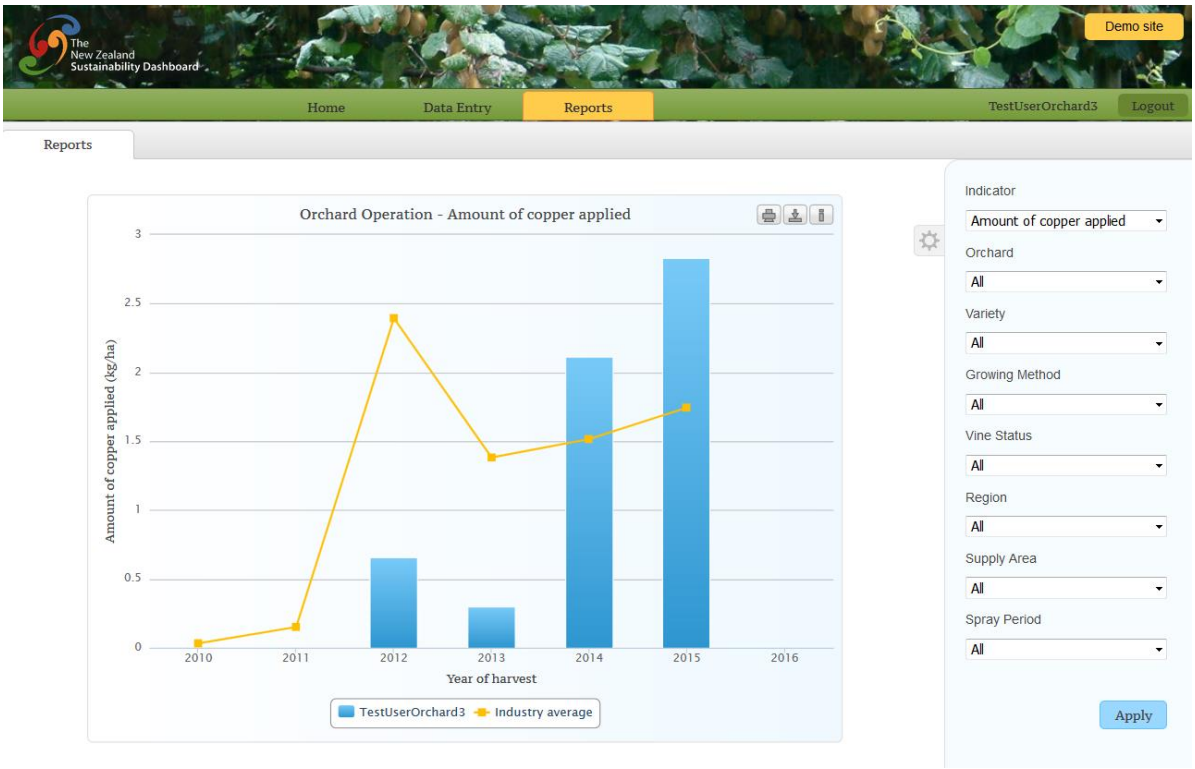
2 Powdery Mildew Control - Number of Applications (spray passes)

Your Vineyard	Within 5 km*	Average number of applications (passes) per block	Otago	New Zealand
0.3	0.2	Lime Sulphur	0.2	0.2
8.9	10.0	All PM controls	10.2	10.2
8.5	9.8	Sulphur	8.3	7.3
1.0	0.7	DMI	0.8	0.9

*Grouped data to ensure confidentiality

Minimising data capture and entry has been identified as important for good engagement. Where possible, information that is already being collected will be entered into the tools and preferably this will be done automatically by linking to existing databases. An example of this is electronic spray diaries held by some sectors. These spray diaries can be interrogated to provide information relating to not just agrichemical use but also a number of other sustainability-related issues like water use, greenhouse gas emissions, eco-toxicity, and pest and disease incidence. For kiwifruit, spray diaries held by industry are already successfully being imported, analysed and reported (Figure 4). It is hoped that the dashboard tools will also link to regional and national databases, maps or models (e.g. weather and soil maps) that will allow growers to better interpret their farming outcomes.

Figure 4: Example of reporting and benchmarking in the prototype NZSD kiwifruit tool for kiwifruit growers. Here, copper use is automatically derived from imported spray diaries collected by industry. A menu on the right allows fine-tuning of benchmarks.



It is anticipated that the tools can be used to interrogate and report relationships between management decisions, inputs and outcomes. For example, relationships between fertiliser use and environmental impacts (e.g. nitrate leaching) or production. This feature is likely to further drive participation.

Learning tools

In addition to helping industries undertake sustainability assessment and reporting, the NZSD project also hopes to provide learnings to become more sustainable. Benchmarking and providing feedback showing weak sustainability performance is probably not enough on its own to trigger change amongst growers or industry stakeholders. Thus, the project aims to provide best practice and decision support tools to aid management. In the Wine sector for example, the project has led to the development of individualised reports that describe and benchmark the use of inputs on vineyards, but which also provide best practice recommendations to drive more sustainable outcomes. For example a new powdery mildew resistance management strategy has been developed by SWNZ. In line with this the NZSD project has developed an individualised one page report that highlights how, based on the previous seasons spray programme, the grower performed against the new strategy. Not only has this publicised the new strategy and provided targeted advice to the growers, but the industry gets an overview of which parts of the

new strategy need the most focus. Consequently they are able to tailor their other forms of dissemination to address the largest issues.

Preliminary evidence indicates that reporting and benchmarking is helping to optimise practices. It was identified that about 40% of wine growers were applying sub-optimum levels of sulphur for efficacy against powdery mildew. Through individualised benchmarking and reporting this potential issue was highlighted. The following season this group of growers, when compared to the rest of the industry, statistically significantly increased their sulphur application rates by 25%.

In terms of assisting industries at a policy level, the research team is currently developing two tools: (i) a biodiversity risk assessment tool that can be used to help predict the effects of land use change on biodiversity within production landscapes and better inform land management policies, and; (ii) a power analysis module that can help optimise indicator sampling design criteria like the number and frequency of measures, optimum rotors of measures between years, and duration of sampling. For the latter, the goal is to ensure sufficient statistical power is achieved to provide an early alert of upcoming risk while minimising costs and impost on the growers themselves.

Industry implementation

In June 2014, the NZSD tool for the wine sector (WiSE) was rolled out to all growers and wineries. The NZ wine sector has taken ownership of the tool and embedded it within their existing processes, making it part of business-as-usual. The individualised reports and dashboards are evolving as members become familiar and comfortable with the system. The NZSD project is now working with SWNZ on delivering their new strategic plan by providing advice on global best practice in sustainability.

For kiwifruit, the tools have initially been developed as standalone (i.e. external to existing industry systems), with the expectation that the kiwifruit sector, in particular Zespri, would take ownership and incorporate it into their existing or future systems. This integration is seen as important for ensuring the solution continues to be used. However, future integration is uncertain given the industry is currently making significant changes to their existing information systems. It is therefore possible that the dashboard tools will not be adopted by industry. Given this, it is proposed that the NZSD project continues to develop the tools but less so i.e. the focus would be to demonstrate how information could be collected, analysed and reported, rather than developing a fully functional tool for the industry to use. For example, as has been done with wine, the kiwifruit dashboard could be modified to illustrate how agrichemical use could be reported with additional benchmarks like the average for all orchards within 5 kms of the current orchard. It is expected that this would inspire the development of future industry systems for sustainability assessment and reporting. Also, the project will continue to provide information and knowledge to assist industry to strengthen its sustainability assessment

and reporting. This change of tact highlights the challenge of working in a real-world situation with a dynamic industry like NZ's kiwifruit sector.

Key to the successful adoption of tools and findings from the NZSD project to date has been a strong and respectful relationship between the project team and the main end-users. In particularly, this has been enabled by having dedicated NZSD project managers in each sector who have worked closely with their respective stakeholders for a number of years. This has been invaluable firstly for identify industry needs but also for meeting those needs as each manager has developed a deep understanding of their industries. End-user involvement from the beginning and throughout is essential for ensuring their sustainability assessment and reporting needs are met and to prevent unnecessary and unwanted development.

Conclusions

The NZ Sustainability Dashboard project is assisting NZ's primary sector to undertake effective sustainability assessment and reporting. At a grass-roots level this will allow growers to lift performance while at a sector and national level it will strengthen New Zealand's ability to respond to customer and market demands for information relating to the economic, social and environment consequences associated with NZ's food and fibre production. The project is already helping the NZ wine and kiwifruit sectors to undertake more effective sustainability assessment and reporting using quite different approaches. Central to this has been a strong and positive relationship between the project team and end-users.

Acknowledgements

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