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The New Zealand Sustainability Dashboard

A survey of Sustainability Dashboards in use internationally

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1 Introduction

As part of our involvement in the New Zealand Sustainability Dashboard (NZSD) project, we were commissioned to survey Sustainability Dashboards (web-based or otherwise) in use internationally. This is our report.

What is a 'Sustainability Dashboard'? As we discovered, there are many different types in existence internationally! The NZSD project, whose primary goal is to "develop [an environmentally-focused] sustainability assessment and reporting tool in partnership with five primary industry sectors in New Zealand", describes what it intends to create like this (Manhire et al. 2012, p. iii):[1]

> A multifunctional web application will be created that facilitates uploading of regular monitoring results and instantly summarises and reports back trends to the growers, to industry representatives, and to agriculture regulators and policy makers at regional and national government levels.
>
> … The Dashboard will be more than just a compliance and eco-verification tool – it will also provide a hub for learning to become more sustainable. It will create an information 'clearing house' for linking past data sources and at least five existing decision-support software applications so that growers can discover optimal choices for improved farming practice, should the Dashboard alert them that their KPIs are approaching amber or red alert thresholds.
>
> We will also design and test two new decision-support packages; one enabling farmers to calculate their energy and carbon footprint and how it can best be reduced; and a whole-farm '*What if*' decision-support package that explores how investment in improving one sustainability KPI (e.g. application of nitrogen fertiliser) affects another (e.g. farm profit). The *Sustainability Dashboard* will also include customisation capabilities for use in product traceability; for undertaking surveys of users; for estimating the value placed on different aspects of sustainability by growers, industry representatives, regulators and consumers; for comparing Māori and other communities' values in sustainability assessments; and for identifying market opportunities and constraints. The Dashboard web application will be designed so it can be quickly integrated into an industry's/sector's existing IT platform and infrastructure and this will facilitate rapid uptake.

Our survey includes both *implementations* of Sustainability Dashboards (SDs) and, where possible, the *software* underpinning them. Especially for readers not from an IT background, it is important to understand the distinction between an 'implementation' and 'software'. In essence, an *implementation* is what is created with *software* in a particular context; in other words, software is the tool used to create an implementation. For example, a carbon footprint application might be based on a spreadsheet calculation: the software is *Excel* and the implementation is the carbon footprint application. The focus of this survey is primarily implementations, but we also include software where we know something about it or where the software has been used for multiple implementations.

Based on database and Internet searches, as well as with guidance from other members of the NZSD project – thank you! – we have attempted to catalogue all significant examples of SD implementations, where such implementations are either explicitly referred to as SDs or they perform the same function albeit the 'Sustainability Dashboard' terminology is not used. Inevitably,

[1] See the next section for more details.

of course, there are bound to be gaps – SDs we have missed – due to their use of other terminology or non-English language SDs not captured by our search methodology (outlined in the next section).

As it turned out, however, though we found many items related to SDs, most are of little value to the NZSD project, and so they are not included in our survey. In order to produce a report that is as readable as possible, we have confined our survey to SDs that we think will be of interest to the NZSD project. Also, some SDs were excluded from the report or only mentioned in passing because they are very similar to other SDs we reviewed, and hence they do not contribute anything extra to our overall understanding.

For each SD reviewed we provide basic information and our assessment of where we think it lies on the continuum between 'state of the art' (potentially worthy of emulation for the NZSD, and perhaps collaboration) and 'dog/lemon' (cautionary tales, not to be repeated for the NZSD). Having catalogued SDs that we think are relevant, we leave it to interested readers to follow-up with any particular SD and try it out themselves.

With the objective of informing the NZSD's design and development, we have also done our best to uncover general principles and common threads of experience. Where possible, we identify potential collaborators (or at least their SD products) for possible follow-up. We also kept our eyes open for possible metrics for measuring end-user engagement with SDs, that might be used to address the question, Do SDs make a *real* difference? (i.e. beyond mere counts of 'clicks' and 'page views'; e.g. as is well provided for by *Google Analytics*). We tried (mostly unsuccessfully) to form an opinion as to the extent to which particular SDs seem to be being used, based, where possible, on any reported usage metrics.

We also note approaches that other software developers have used for displaying information (e.g. ranging from simple graphs of various types, to dials and many other possible techniques); however, this should be the focus of a separate piece of work delving into the best SDs identified here (and subsequently, as the NZSD project progresses).

Our search for SDs (or equivalent) in use internationally covers potentially all industry sectors, but is especially focused on agriculture. Moreover, we are primarily interested in identifying SDs that seem to work for 'small' end-users at the scale of the family farm or equivalent business unit, but that can perhaps also be scaled up for 'larger' users and higher levels of aggregation (e.g. industry sector).

There are two main intended audiences for this report: (1) Internal – members of the NZSD project, and (2) External – other stakeholders and interested industry groups. This report should also integrate with other reports being prepared by/for the NZSD project, including ones currently reviewing decision-support tools (The AgriBusiness Group 2013), key indicators of sustainability and industry sector (e.g. wine industry) information needs and capabilities (Post 2012). Presumably, some of the information in these other reports is intended to inform the *content* of the NZSD, whereas the current report is intended to identify SDs that we believe should be investigated further in order to inform how such content might be *captured*, *presented* and *used* (by end-users) by the NZSD.

Our report proceeds as follows. In the next section, to lend focus to our survey of SDs in use internationally, we summarise the likely characteristics of the NZSD that we are part of the project to build, and outline our search methodology. In Section 3, we present the SDs and other relevant resources we reviewed, followed in Section 4 by a summary of the main things we have learned. The report closes with our conclusions and recommendations.

2 Sustainability Dashboard Characteristics and Search Methodology

To lend focus to our survey of SDs in use internationally, it is worthwhile discussing the main characteristics that we envisage for the NZSD (based on Manhire et al. 2012).

We expect that there will be a SD for each industry sector that is part of the NZSD project (e.g. dairy farmers, wine growers, etc). Each sector will ultimately manage its SD themselves, ideally integrated with their existing systems.

Corresponding to this industry-level focus, each SD will comprise a range of indicators of relevance to the particular sector. Data will be gathered from each individual farmer or grower (or equivalent business unit) and aggregated and processed to enable each individual farmer/grower to view and consider her own performance on each indicator and relative to others in the sector. Depending on the sector, this might be performed on a regional or national basis, and, if suitable data are available, it would also be possible to compare performance across regions or even countries.

The SD will also have a time-series dimension. Each farmer/grower will be able to review her historical performance with respect to each indicator, also in terms of aggregate data for the sector. There will be guidance for the farmer/grower about how to input her data and evaluate her performance, and also links to various decision support tools and information about how they can be used. Finally, each sector's SD will include mechanisms for monitoring and measuring end-user engagement with the SD.

Given the discussion above, in summary, we have taken as our benchmark for surveying SDs in use internationally the extent to which any uncovered in our search has the following characteristics (covering potentially all industry sectors, but especially focused on agriculture).

- The SD comprises a range of indicators.
- Data for each indicator are collected from individual farmers/growers periodically, preferably dynamically.
- Data collection is managed by the industry body to ensure mandatory contribution of valid data. Some kind of data quality control is also likely to be required (e.g. most of the data we encountered in our survey originates from a single organisation for each SD, and users have no way of verifying the data's validity).
- Data for each indicator from individual farmers/growers are aggregated via appropriate summary statistics.
- Each farmer/grower will be able to review her current performance with respect to each indicator, and also in terms of the aggregate data, thereby enabling her to evaluate her own performance compared to others in the sector.
- Likewise, each individual farmer/grower is able to review her current performance against her historical performance, and also historical aggregated data for the sector, thereby enabling her to evaluate her own performance over time.
- Information and decision support tools are available to educate users and to help them to change their behaviour if they wish to.

To find SDs we searched *Google* and *Google Scholar* for websites and articles or news reports related to SDs. Search terms included (English language only)[2]: "sustainability dashboard", "agricultural environmental monitoring", "sustainability indicators", and various combinations also including key words like "web-based", "internet", "portal", "dashboard" and phrases like "farmers assess sustainability" and "reduction electricity usage dairy farming New Zealand".

We also searched *Google Images* for "sustainability dashboard" images and followed-up key references in Manhire et al. (2012) and suggestions from our NZSD project colleagues and other people mentioned in the Contacts section at the end of the report. We also searched the references of articles that we considered potentially relevant. The search results were reviewed and assessed by each of us individually first and then together.

3 Sustainability Dashboards Reviewed

We found very few examples of SDs satisfying all the characteristics outlined in the previous section. We have grouped our findings into three main categories:

1. SD implementations
2. Software for building SDs (or similar tools)
3. Other relevant resources, such as projects with apparent similarities to the NZSD project, but for which there is no information about the software nor access to the SD or software for us to check it, and also educational websites, national environmental monitoring programmes and environmental certification programmes

Moreover, in the course of our searching it became clear that SDs are differentiable with respect to two main dimensions: whether or not the SD, as well as presenting information, also functions as a decision-making tool (i.e. whereby a user can input her own data and receive output with the potential to affect her behaviour), and also the level of aggregation of the data: (a) Individual (personal), (b) Enterprise (e.g. farm, university, city), (c) Sector (e.g. dairy industry) or regional/national, and (d) International. As represented in Figure 1 below, we observed six combinations on these two dimensions – corresponding to six 'types' of SD referred to later in each of the reviews under above-mentioned categories (1) and (2).

[2] We come across SDs in other languages, but because we did not understand the languages we were unable to assess them. As mentioned earlier, other SDs may exist that we did not find them due to different terminology or language. We also did not catalogue systems for automatic monitoring.

Figure 1: Six types of SD, differentiated according to function and level of aggregation

Function	Individual (personal)	Enterprise (farm, university, city)	Sector or regional/national	International
Decision-making tool as well	(not found)	Type 1a	Type 2a	Type 3a
Data presentation only	(not found)	Type 1b	Type 2b	Type 3b

Level of aggregation

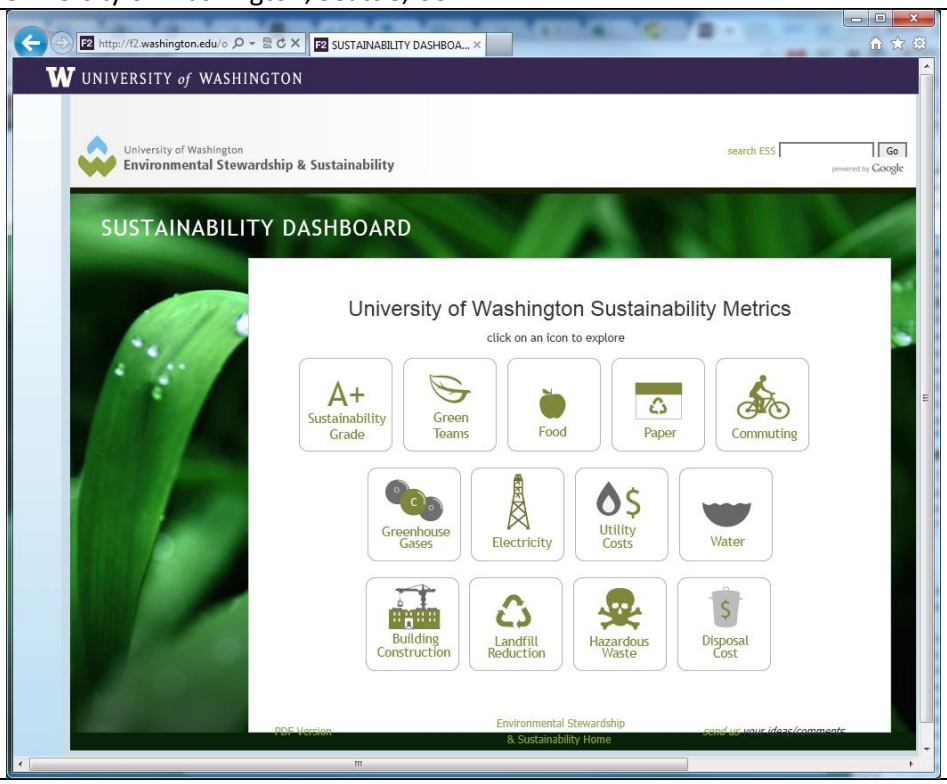
The main intended focus of our survey is SDs of Type (2a): Sector or regional/national level of aggregation that, as well as presenting data, also function as a decision-making tool (see Figure 1 above). This focus is because, as discussed in the Introduction, the NZSD is intended to help users "discover optimal choices for improved farming practice" (see the description reproduced in the Introduction) – i.e. active rather than passive engagement with the NZSD. For completeness though, and also because it may be possible to use the same software or to learn from approaches that other software developers have used to display information, we offer examples of each of the other five SD types as well.

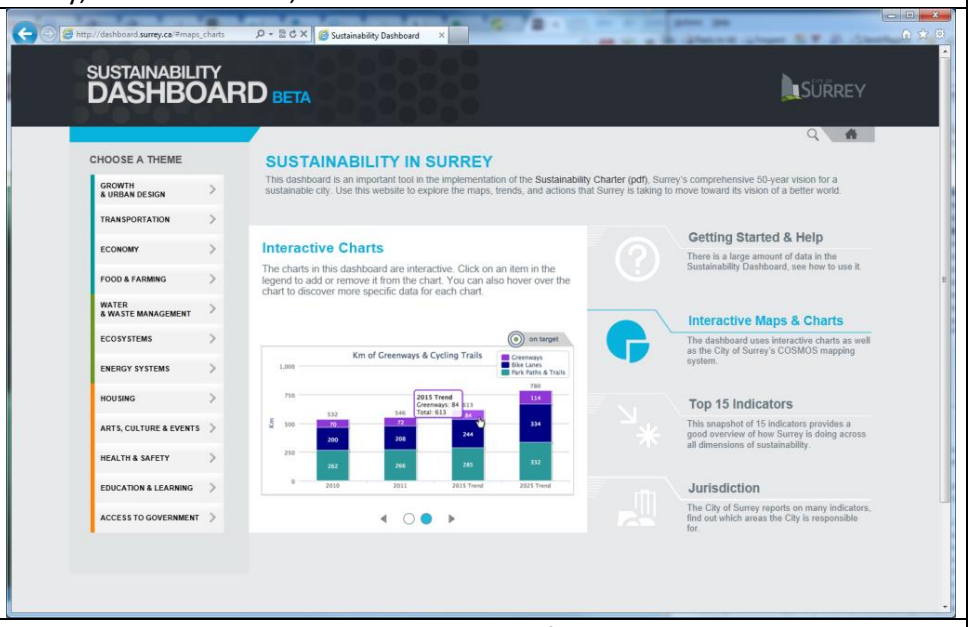
In addition, an important part of the NZSD concept is that it aggregates data from many similar sources, such as from individual farms, to the industry sector level. Many SDs either performed no aggregation or the focus of aggregation was the same as the focus for data collection, especially SDs targeted at demonstrating a company's sustainability performance. Thus, we mark those that appear to collect data from multiple similar sources with an asterisk – hence the intended NZSD (ideal) is Type (2a)*.

3.1 Sustainability Dashboard implementations

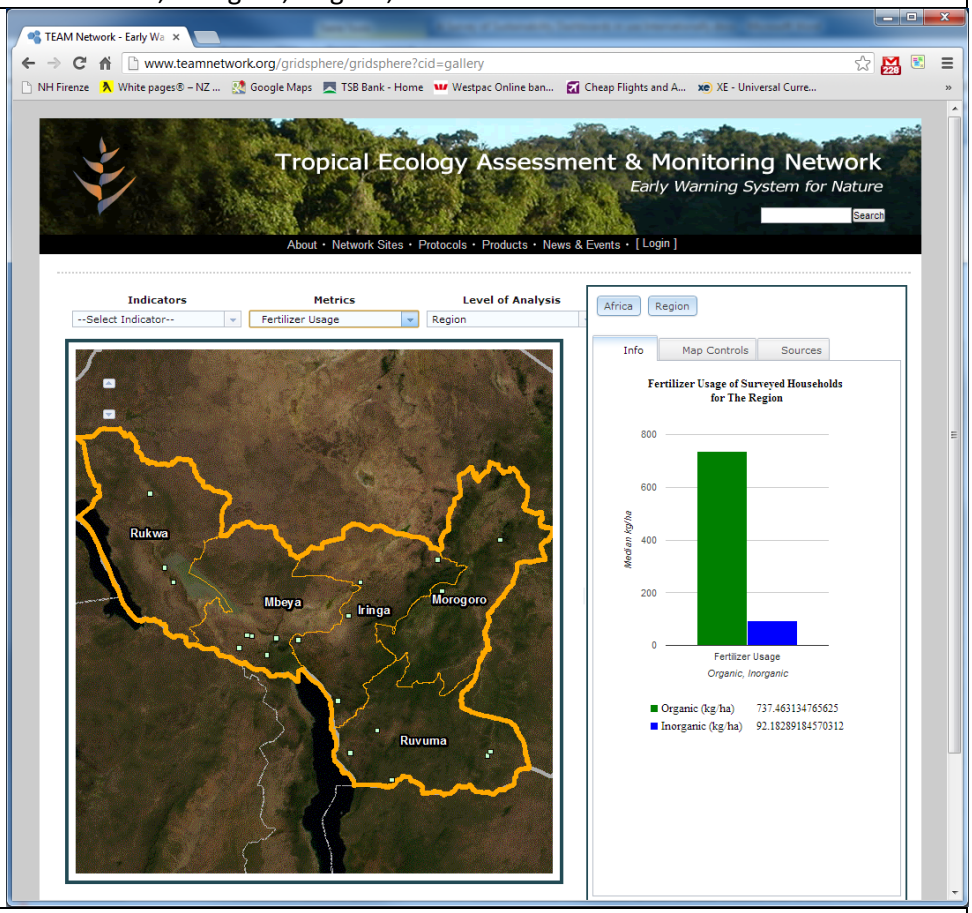
This sub-section presents representative examples of SDs that we think have something of value to contribute that we can learn from for the NZSD project. What is valuable in some of these examples is the approach taken, in others it is the SD's layout and design, and other examples simply serve as good illustrations of what other people are doing in this or similar areas.

These first two examples of SD implementations are of Type (1b): Enterprise level, data presentation only (see Figure 1 above). There are very many examples of this type of SD. As explained in the previous section, this type is not our main focus but, for completeness, we include the following two examples.

Title: (SD Type)	***Sustainability Dashboard – Environmental Stewardship & Sustainability*** (Type 1b: Enterprise level, data presentation only)
Links:	http://f2.washington.edu/oess/profile/SustainabilityDashboard
Created by:	University of Washington, Seattle, USA.
Image:	
What is it?:	This SD reports 12 indicators of sustainability, over time (annual), graphically and textually. It also emphasises the University of Washington's goals with respect to most of these indicators.
Level of data collection:	University overall.
Level of data aggregation:	University overall.
Audience:	University of Washington community.
Level of decision-making:	None
Platform:	Web site with images of *Excel* charts – probably static, i.e., no dynamic data feed.
Educative:	Might encourage university managers and casual observers (e.g. students and staff) to think about sustainability and resource issues.
Visualisation:	Line and bar graphs. Also icons.
What can we learn from this (positive and negative)?	Nothing special.
Does it seem to be used? (Usage metrics?) Why/why not?	Cannot tell.
Our overall assessment (state-of-art v. lemon?):	Visually OK-looking. Very easy to navigate (but unsophisticated overall).
Other information / references:	Other examples of this type of SD: Energy Dashboard (St Mary's University): http://140.184.11.32/EEED/EEED.html#/home

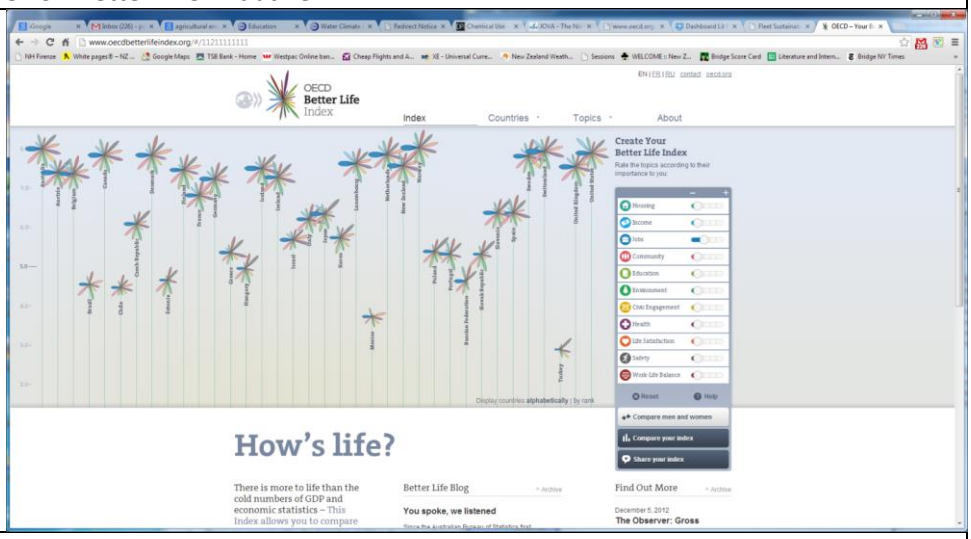
Title: (SD Type)	***Sustainability Dashboard – Sustainability in Surrey (Beta)*** (Type 1b*: Enterprise level, data presentation only)
Links:	http://dashboard.surrey.ca
Created by:	Surrey, British Columbia, Canada
Image:	
What is it?:	This SD reports approximately 15 indicators of sustainability, with many sub-indicators, over time (annual), graphically and textually. It also emphasises the city's "Sustainability Charter", a "comprehensive 50-year vision for a sustainable city".
Level of data collection:	Individuals and businesses and the city authority.
Level of data aggregation:	City level.
Audience:	City of Surrey staff and the community at large.
Level of decision-making:	None
Platform:	Custom-built dynamic web application using current web technologies.
Educative:	Might encourage City staff and casual observers (e.g. community at large) to think about sustainability and resource issues.
Visualisation:	Line and bar graphs. Also icons and maps.
What can we learn from this (positive and negative)?	Nothing special.
Does it seem to be used? (Usage metrics?) Why/why not?	Cannot tell.
Our overall assessment (state-of-art v. lemon?):	Visually OK-looking. Easy to navigate (is more sophisticated overall than the example above).
Other information / references:	Some other examples of city/district level dashboards: www.jcci.org/jcciwebsite/snapshot/atlas.html www.whistler2020.ca/whistler/site/explorer.acds www.vancouverfoundationvitalsigns.ca/ www.geoweb.dnv.org/dashboard/

In addition, the following are two examples of SD implementations of Type (2b): Sector or regional/national level, data presentation only.

Title: (SD Type)	***Baselines: Agriculture, Ecosystem Services and Livelihoods in the southern highlands of Tanzania*** (Type 2b*: Regional/national level, data presentation only)
Links:	www.teamnetwork.org/gridsphere/gridsphere?cid=gallery
Created by:	TEAM (Tropical Ecology Assessment & Monitoring) Network, Conservation International, Arlington, Virginia, USA.
	
What is it?:	This is a working prototype (with parts still under construction) of a dashboard that presents information about agriculture, ecosystem services and livelihoods in the southern highlands of Tanzania.
Level of data collection:	Household and land plot and physical geographical units (e.g. rivers) and field data.
Level of data aggregation:	Regions in Tanzania, with other parts of Africa too.
Audience:	Ecologists. Agencies interested in Tanzania (e.g. NGOs).
Level of decision-making:	None
Platform:	Dynamic web app. Behind the scenes there's a custom build: *PostgresSQL*, *ArcGIS*, *ENVI*, *IDL*, *R*, *Dojo*, *Silverlight*, integrating across various data sourcing.
Educative:	Might encourage casual observers (e.g. community at large) to think about sustainability and resource issues.
Visualisation:	Mostly detailed maps of Africa of various types (e.g. topographic, physical, etc). Also bar graphs.
What can we learn from this (positive and negative)?	The mapping software is impressive. There is discussion of some of the challenges and learnings that we should investigate further in the next phase of this project.

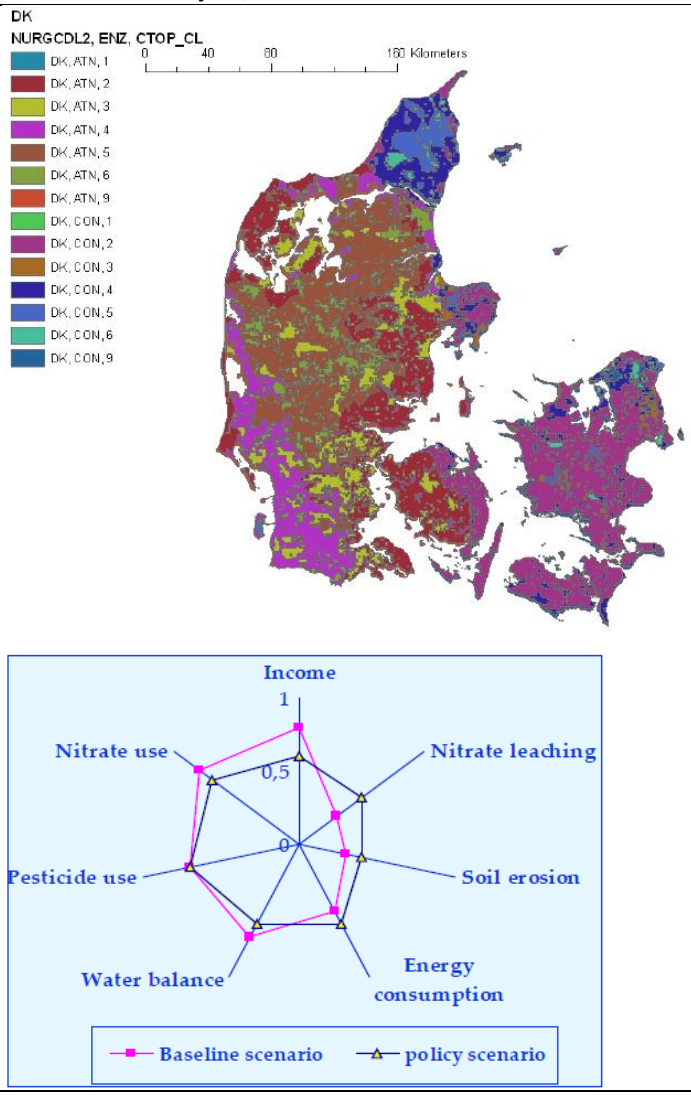
Does it seem to be used? (Usage metrics?) Why/why not?	Cannot tell, but the author says there are plans to continue to build the project and to apply it in other regions.
Our overall assessment (state-of-art v. lemon?):	Visually good-looking. Easy to navigate (and sophisticated overall). Wide range of data presented.
Other information / references:	Fegraus et al (2012)

Here is the only example we could find of an SD implementation of Type (3b): International level, data presentation only:

Title: (SD Type)	***OECD Better Life Index*** (Type 3b*: International level, data presentation only)
Links:	www.oecdbetterlifeindex.org
Created by:	OECD Better Life Initiative.
	
What is it?:	This is an interactive website for displaying and comparing 11 "topics of wellbeing" – community, education, environment, civic engagement, health, housing, income, jobs, life satisfaction, safety, work-life balance – across 34 OECD countries plus Russia and Brazil. Users are able to apply their own personal weights (via sliders) to the 11 components of the overall wellbeing index.
Level of data collection:	24 individual indicators that make up 11 topics of well-being (as mentioned above), for men and women respectively.
Level of data aggregation:	Country
Audience:	NGOs, general public (global), OECD staff, etc.
Level of decision-making:	None (though users can apply their own weights to the 11 measures comprising an overall index).
Platform:	*Adobe Flash Player* front-end accessing data in CSV files.
Educative:	Overall explanations of each of the 11 topic of wellbeing are available, as well as notes on how each country fares "and examples of *good practice*".
Visualisation:	Nice-looking graphical approach to presenting a range of indicators. Also, there is a simple approach by which users can weight each of these indicators in order to get personalised results (in terms of their weights only).
What can we learn from this (positive	Although this is a website for comparing the quality of life in a number of countries the same approach could equally well be used in the NZSD project for

and negative)?	a farmer/grower to compare her performance against other farmers/growers. The list of topics in the index would be different for the NZSD, but this would be one way of managing the overall data for each farmer, and displaying the data for all farmers/growers; although this display for all countries is not necessarily the best for what we want, even a bar chart could be useful with the same concept. For one thing this enables someone to create and index and compare it but not necessarily to share it. Each sub-page gives more detailed info about that indicator.
Does it seem to be used? (Usage metrics?) Why/why not?	Cannot tell.
Our overall assessment (state-of-art v. lemon?):	State of the art presentation (for its SD type).
Other information / references:	Executive summary: www.oecdbetterlifeindex.org/wpsystem/wp-content/uploads/2012/05/EXECUTIVE-SUMMARY.pdf

Finally, here is the only example we could find of an SD implementation of Type (3a): International level, decision-making tool as well as data presentation:

Title: (SD Type)	***SEAMLESS-IF*** (Type 3a*: International level, decision-making tool as well as data presentation; the technology is probably also applicable to Type 2a*.)
Links:	www.seamlessassociation.org www.seamless-ip.org
Created by:	EU Seamless Project, which has become the Seamless Association.
Image:	
What is it?:	According to the site: "The SEAMLESS project aimed at advancing the science for integrated assessment of agricultural systems and translating this into operational research tools and models. A key deliverable of the project is an integrated framework (SEAMLESSIF) that integrates relationships and processes across disciplines and scales and combines quantitative analysis with qualitative knowledge. It builds on the concept of hierarchical systems theory and attempts to enable the SEA coupling of models and tools."
Level of data collection:	Field/Farm
Level of data aggregation:	Various, up to EU.
Audience:	EU Policy Makers.
Level of decision-making:	EU

Platform:	A range of custom-built, open-source software tools is purportedly available via www.seamlessassociation.org but the subversion source repository is inaccessible.
Educative:	No
Visualisation:	Colour-coded maps and graphics to display data.
What can we learn from this (positive and negative)?	We can probably learn a lot across the full spectrum from engagement with field owners through to politicians, indicators, analysis, limitations, etc. A wealth of documentation is available from: www.seamlessassociation.org/index.php?option=com_docman&Itemid=84
Does it seem to be used? (Usage metrics?) Why/why not?	Clearly, this has been used with respect to many policy questions, e.g., see all the related publications listed here: www.seamlessassociation.org/index.php?option=com_content&view=category&id=39&Itemid=67
Our overall assessment (state-of-art v. lemon?):	Definitely worthwhile enquiring further with them about the status of this project, the technology and any related sub-projects at an industry group level. We don't know the extent to which this is still going and we were unable to try the software ourselves.
Other information / references:	An overview is provided here: www.seamless-ip.org/PDF_files/Seamless7may.pdf And here is a "Science Flyer": www.seamlessassociation.org/index.php?option=com_docman&task=doc_download&gid=135&Itemid=84

3.2 Software for building Sustainability Dashboards (or similar tools)

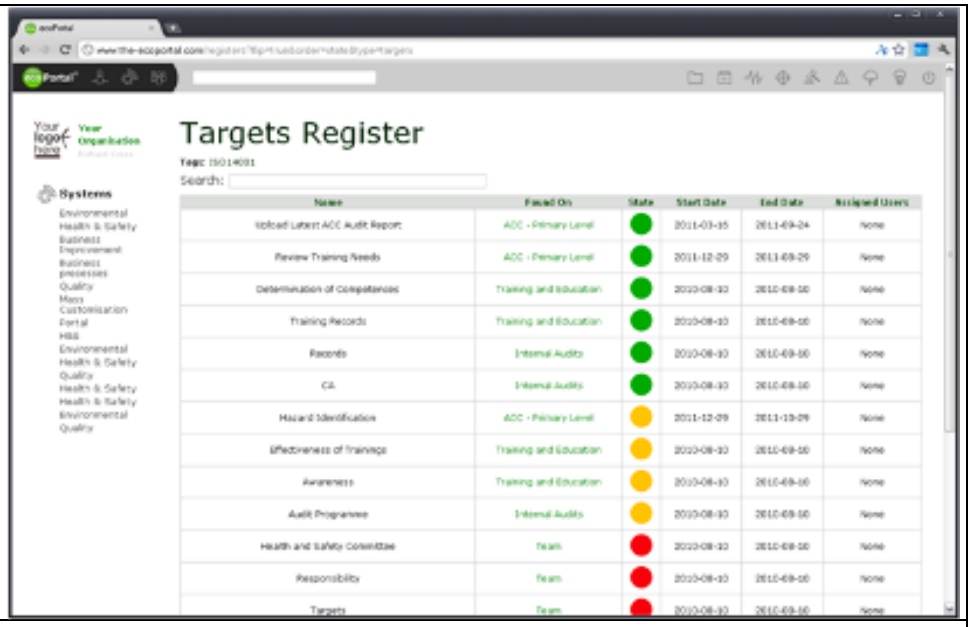
This sub-section reviews software that we have come across that has been used for building SDs, or tools, such as RISE, which although not SDs, are relevant. As explained earlier, our main focus is SDs of Type (2a*): Enterprise level, decision-making tool as well as data presentation, of which we could find just the following three examples.

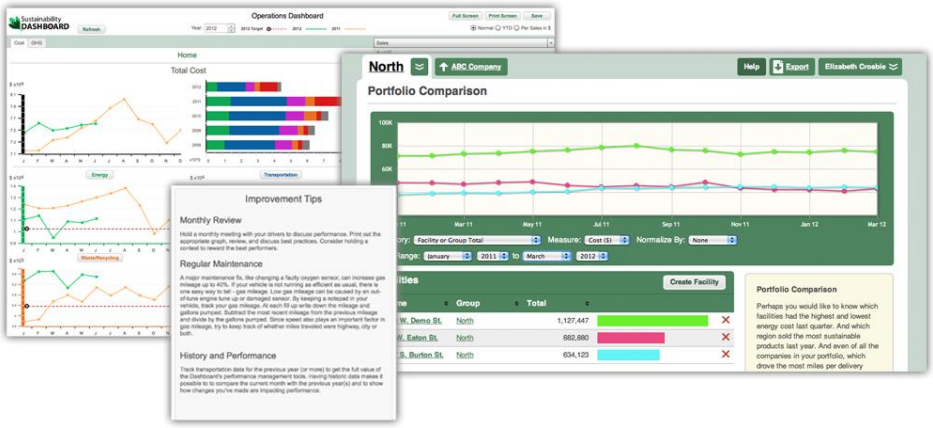
Note that our search was for implementations rather than for software and here we do not attempt to catalogue all software that could be used for building a SD as literally thousands of applications would then appear here! See the summary for further discussion of this topic.

Title: (SD Type)	***A Farm Sustainability Dashboard*** (Type 1b*: Enterprise level, data presentation only)
Links:	www.triplehelix.com.au/documents/FarmSustainabilityDashboard.pdf http://lwa.gov.au http://lwa.gov.au/products/ec071354 (to download demo software)
Created by:	Sage Farmer Group (Land and Water Australia).
Images:	
What is it?:	This is a report about Sustainability Dashboard software. The Farm Sustainability Dashboard is a demonstration tool designed to prototype an on-farm dashboard utility, similar to that used in some corporate environments but adapted for rural use. The software was a prototype only. However, it appears to have a lot in common with our objectives. Users can input for a farm: Environment data (Resource Status – e.g. Ground Cover, Soils, Water Usage, Nutrient Budget, Project Target, Biodiversity, Water Budget, Air (Emissions) and Management Practices & Planning), Social Data (Personal/Family Happiness, Staff Happiness, Staff Longevity, Community Happiness) and Financial Data (Income & Costs, Asset Value, Investment Matrix, Financial Summary) into the application and then view a dashboard visualising this data and their status for each indicator. However, it appears to be a tool for use by each individual farmer, and does not appear to aggregate data from different farms.
Level of data collection:	Farm
Level of data aggregation:	Uncertain
Audience:	Farm
Level of decision-making:	Farm
Platform:	*Windows XP* and *.NET 2* upwards, but doesn't run on newer 64-bit versions of *Windows*.
Educative:	No
Visualisation:	Probably good.
What can we learn from this (positive and negative)?	This software is out-of-date and no longer runs on 64-bit *Windows*, but can be run in a *Windows XP* Virtual Machine. The manual is pretty basic and more of a user guide to the interface than understanding and using the software intelligently. Again this is an example of something which seems to be a good idea at the time but is no longer a 'live' project owing to the funding being discontinued. This, together with other similar projects we have found, is a clear warning that it is very difficult to maintain interest and funding in a project of this type.

Does it seem to be used? (Usage metrics?) Why/why not?	This appears to be a prototype which does not appear to have been used since it was developed.
Our overall assessment (state-of-art v. lemon?):	This is worthwhile looking at to get ideas but probably can't be used for the NZSD project, both because it is only a prototype and doesn't run on 64-bit *Windows*, but also because it is not web-based. Also it is for a single farm only, and would require significant adaptation to allow aggregation of data for many farms. As the project is no longer funded we would not be able to get them to make changes to adapt their software for our needs, and probably the best we can hope for is just learning from what we can see they have done, rather than being able to make use of their software.
Other information / references:	The project was discontinued along with the abolition of Land & Water Australia (refer to Professor Andrew Campbell of Charles Darwin University – see Contacts section at the end of report).

Title: (SD Type)	***Eco-Portal*** (Type 1a: Enterprise level, decision-making tool as well as data presentation)
Links:	www.the-ecoportal.com
Created by:	issues@ecoportal.co.nz
Images:	

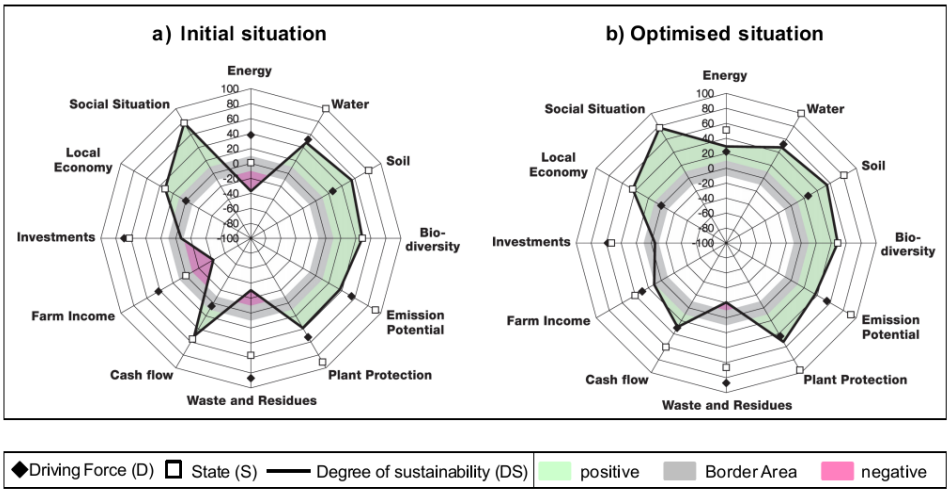
	
What is it?:	This appears to be software to enable an organisation, such as a city council, university, etc, to manage its information, such as data on environmental issues such as recycling, power-usage etc, plus many other things, and assess their performance over time to see what needs improvement.
Level of data collection:	Enterprise
Level of data aggregation:	Enterprise
Audience:	Enterprise
Level of decision-making:	Enterprise
Platform:	Unknown, web-based.
Educative:	Informative; education will depend what is done with the information.
Visualisation:	Quite good.
What can we learn from this (positive and negative)?	This software appears to be for a single organisation to use to monitor its own performance. However, like most other similar software, it is probably not suitable for the NZSD project where we need to have a system for multiple farmers inputting their data so that we can aggregate and display the aggregated data for comparison purposes. However, we can learn from how they display their data.
Does it seem to be used? (Usage metrics?) Why/why not?	It seems to be used by a number of prominent organisations such as Auckland City Council, Autex, Unitec, etc for enterprise-level monitoring and management.
Our overall assessment (state-of-art v. lemon?):	It seems to be a nice system, but as it is enterprise-based looking only at the enterprise's data and not comparing it with others it may not be useful for the NZSD project. It may be too big and complicated a system for what we want, considering it is not even doing what we want. It is possible an industry/sector in the NZSD project may be interested in using such a system for overall management of data for the industry/sector. However, they would still have to set up a separate mechanism to collect and aggregate the data from the individual farmers and would then only be looking at aggregated data, and this would probably not allow an individual farmer/grower to view and compare her data with other farmers/growers.
Other information / references:	Nil

Title: (SD Type)	***Sustainability Dashboard*** (Type 1a: Enterprise level, decision-making tool as well as data presentation)
Links:	www.green2sustainable.com/tour
Created by:	Sustainability Dashboard Tools LLC, Bloomington, Indiana, USA.
Image:	
What is it?:	This is software for monitoring sustainability. From a superficial glance it appears that you can monitor anything you like, but we would need to check it out properly. Generic 'Improvement Tips' and 'Did you know?'s to increase sustainability and reduce costs are also offered.
Level of data collection:	Enterprise
Level of data aggregation:	Enterprise
Audience:	Enterprise
Level of decision-making:	Enterprise
Platform:	Unknown, web-based.
Educative:	Informative rather than educative.
Visualisation:	Mainly line graphs.
What can we learn from this (positive and negative)?	Possibly for how they present their results, but performance for single enterprise is not that relevant to NZSD.
Does it seem to be used? (Usage metrics?) Why/why not?	According to their marketing information, it is used.
Our overall assessment (state-of-art v. lemon?):	Probably not directly useful as it is software for an organisation to monitor various aspects of its own performance, not to compare with others.
Other information / references:	This software has a price, but there is a trial version available for 30 days we could look at.

Title: (SD Type)	***SoFi & GaBi*** (Type 2a*: Sector level, decision-making tool as well as data presentation)
Links:	www.sofi-software.com/international/index/ (enterprise sustainability) www.gabi-software.com/international/index/ (product sustainability)
Created by:	PE International (with eight staff in Wellington, New Zealand).
Image:	
What is it?:	Software that could be useful for building the NZSD.
Level of data collection:	Custom
Level of data aggregation:	Custom
Audience:	Custom
Level of decision-making:	Custom
Platform:	Proprietary, web-based.
Educative:	Could be applied that way.
Visualisation:	Professional and varied visualisations in brochures.
What can we learn	Software and consulting services are available to build something like a SD.

from this (positive and negative)?	Perhaps also learn from examples of their implementations in the wine and dairy industries.
Does it seem to be used? (Usage metrics?) Why/why not?	The software is used by a large number of clients internationally including Meridian, Villa Maria and Australian Dairy.
Our overall assessment (state-of-art v. lemon?):	This may be an expensive solution but it is cheaper for 'research' applications. They would probably have the resources and experience to deliver what we need, and the solution would outlive the SD project.
Other information / references:	www.pe-international.com/index.php?id=417 Examples of its application to Dairy Australia and Meridian: http://preview.tinyurl.com/dairyaustralia http://preview.tinyurl.com/pemeridian

The next example is not itself an SD, but is a useful tool for educating farmers which has considerable similarities to what we intend to do in the NZSD project.

Title: (SD Type)	***RISE, a Tool for Holistic Sustainability Assessment at the Farm Level*** (Type 1b*: Enterprise level, data presentation only)
Links:	www.hafl.bfh.ch/index.php?id=146&L=0&no_cache=1&sword_list%5B0%5D=response&sword_list%5B1%5D=sustainability The RISE tool can be accessed at: http://risequest.cloudapp.net/Rise.ClientTestPage.aspx#/HomeView (However, you first need to register by clicking the login button and registering, but cannot access any data unless authorised by the RISE admin team, and they will only authorise people who have completed the RISE training.) A manual for the RISE tool is available at: http://webb.afca.ch/rise/quest/help/rise_manual_en.pdf
Created by:	Swiss College of Agriculture (SCA), University of Applied Sciences Bern. University of Guelph, Ontario, Canada.
Images:	 **Figure 2:** Swiss mixed livestock and crop farm: 19 ha; 1.5 Large animal units/ha; 2.5 Full Time Employees (FTE).

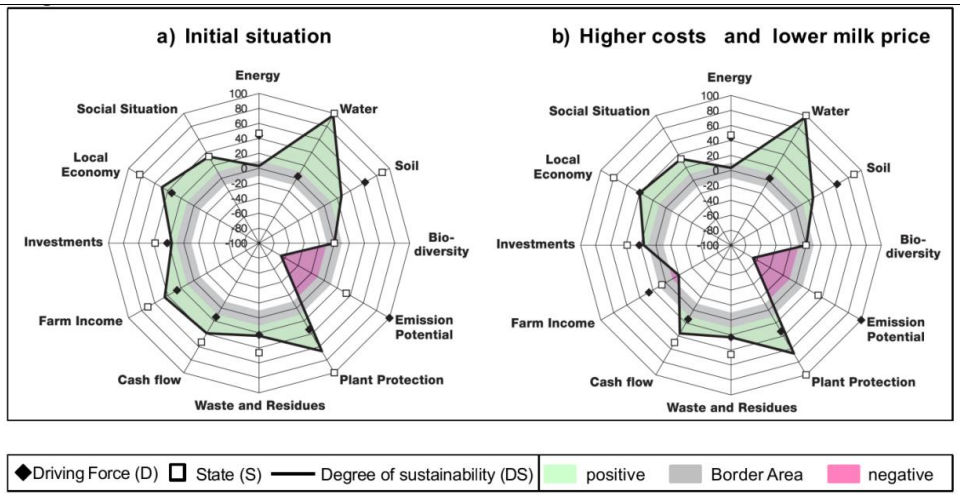


Figure 3: Dairy cattle farm in China: 0.7 ha; 4.3 Large animal units/ha; 2.0 FTE

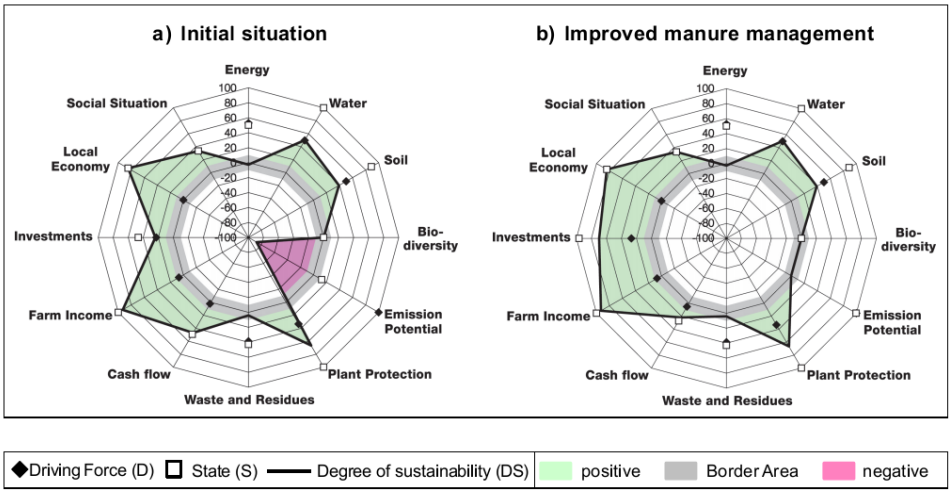


Figure 4: Dairy cattle farm in China: 1.4 ha; 25 Large animal units/ha; 6 FTE

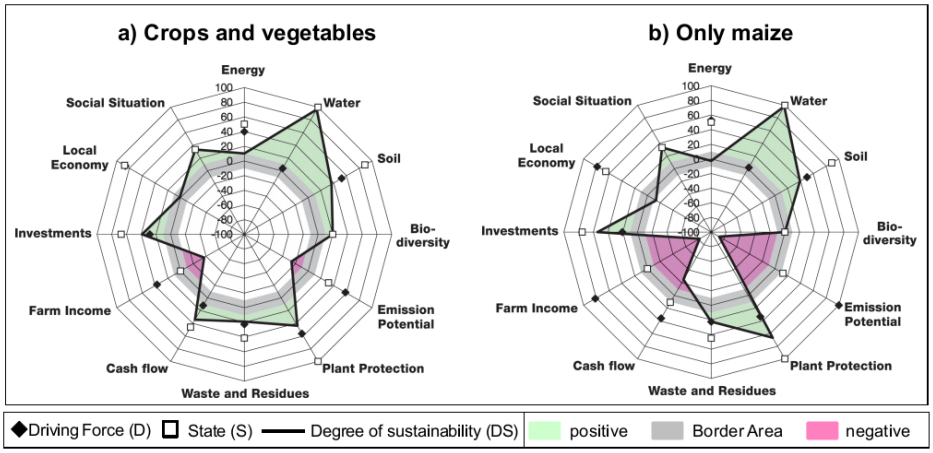
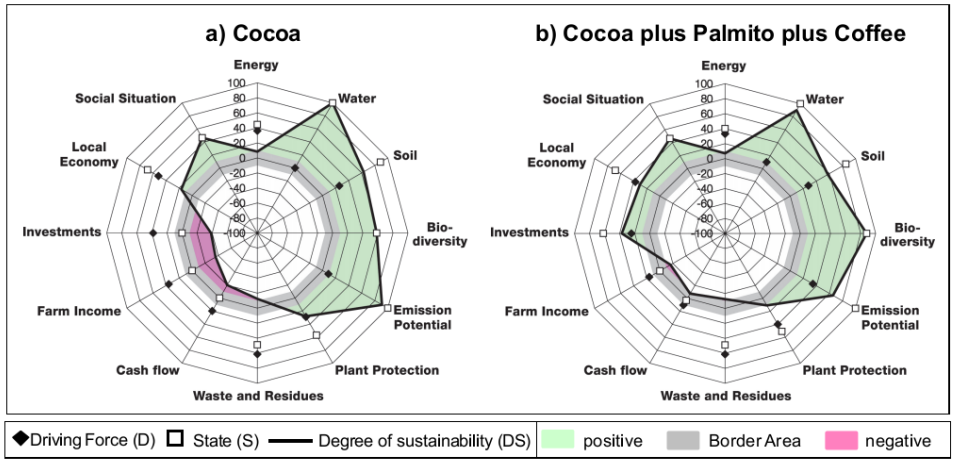
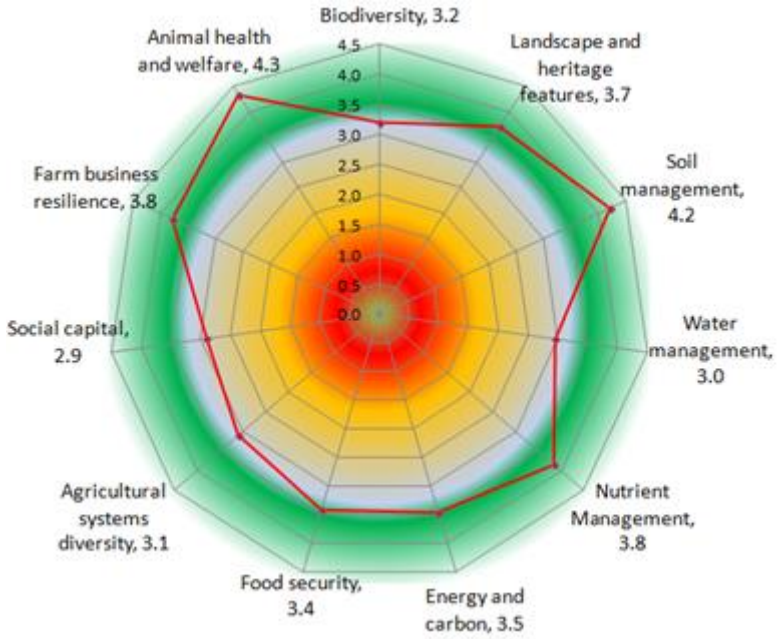
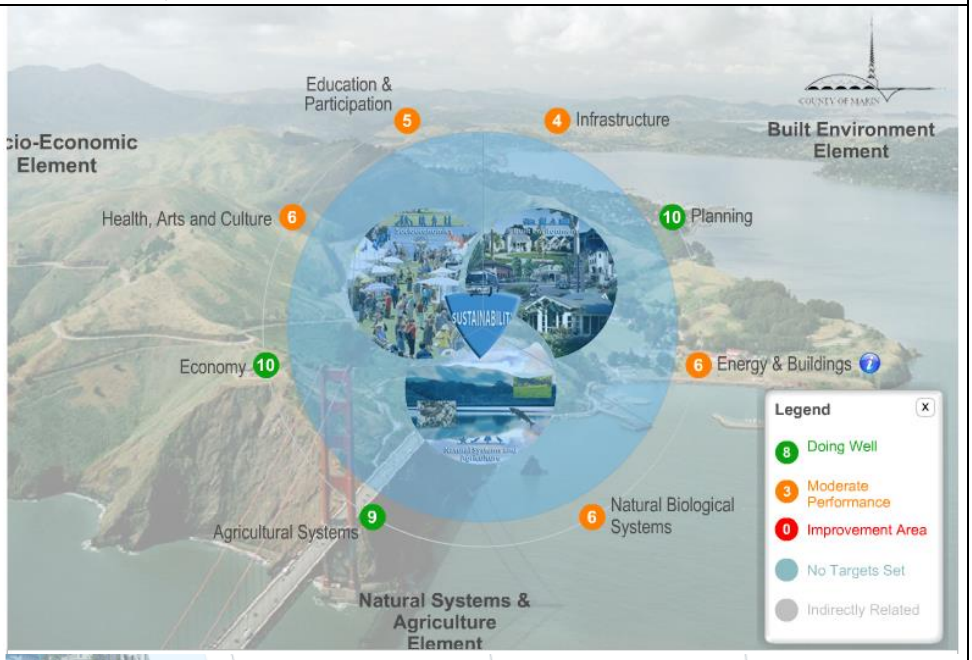
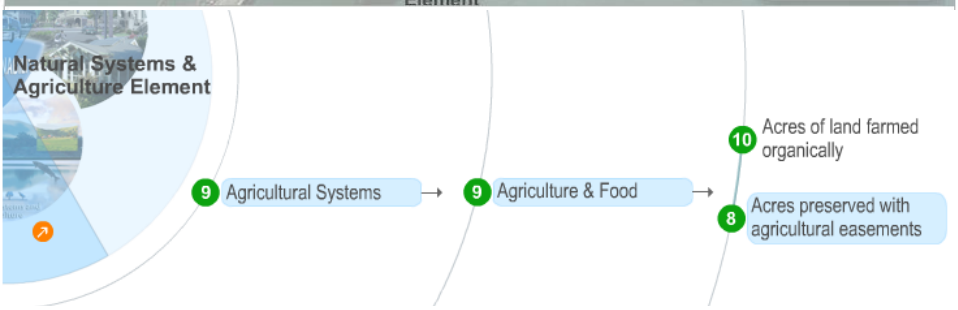
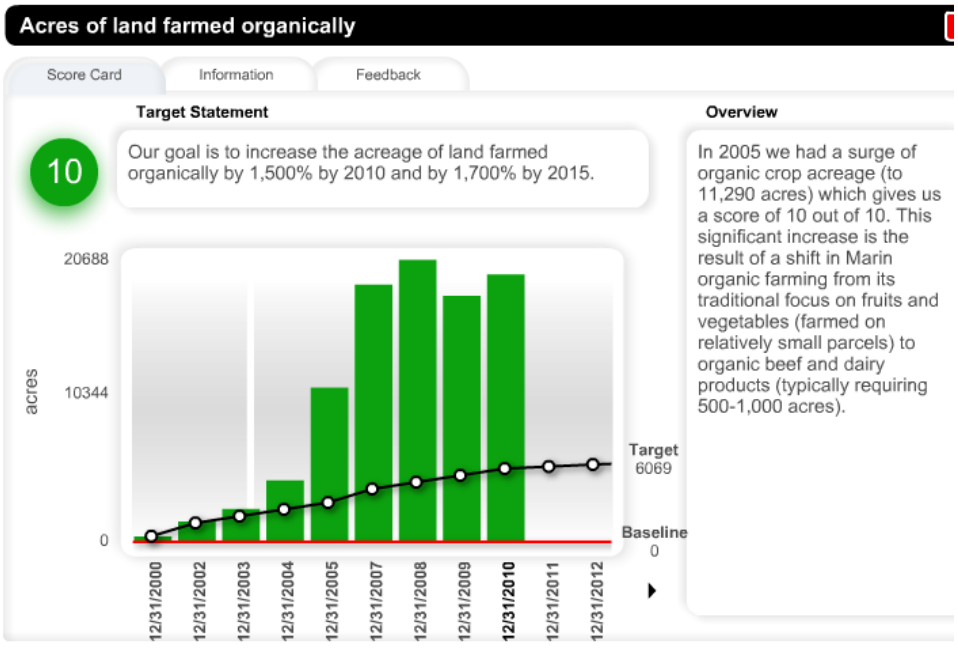


Figure 5: China; a): Mixed crop (maize flax cabbage spinach) farm, 5.4 ha; 5 FTE b): maize operation only 0.6 ha, 1.8 FTE

	 Figure 6: Brazil, large cocoa, palmito and coffe producer: 1940 ha cocoa, 359 ha palmito, 122 ha coffe, 682 FTE.
What is it?:	This is a tool, the "Response-Inducing Sustainability Evaluation" (RISE), which, according to their paper: "allows an easy assessment at the farm level. It is system-oriented and offers a holistic approach for advice, education and planning. The model covers ecological, economical and social aspects by defining 12 indicators for Energy, Water, Soil, Biodiversity, Emission Potential, Plant Protection, Waste and Residues, Cash Flow, Farm Income, Investments, Local Economy and Social Situation. The degree of sustainability yields values between –100 and +100. Individual indicators are considered sustainable if the degree of sustainability is above +10, the whole farm/system is considered sustainable if no indicator has a degree of sustainability below –10." It appears to be based on an Access database, although the latest version is an online web application, and the data for 10 different indicators are collected from the farmers during (long – maybe 1-2 days) on-site interviews with trained advisers, who then enter the data in the database and do the assessment, including producing a spider-chart summarising the farmer's performance. They then later provide feedback to the farmer during a second interview, both of her current performance, and also of potential performance if she made some changes. It appears to be possible to average data over a number of farms in a sector and view the averaged results in a similar spider chart.
Level of data collection:	Farm. According to their paper: "The spatial boundary of the system is therefore defined by the agriculturally productive land area of a farm, i.e. private parts of the family farm and secondary profits are not included in the calculations. RISE aims at producing relevant and correct results by employing simple and easily comprehensible assessments. It favours results and trends that are "approximately right" rather than striving for "absolute accuracy". To reduce time and financial inputs required for the assessment to an acceptable/reasonable level, data collection on the enterprise is simple and reduced to a scientifically justifiable minimum. It seems some of the data is collected through interviews."
Level of data aggregation:	Industry sector and supply chain. "In a last development step for RISE and as a first expansion towards C-RISE, the system boundaries are extended horizontally, allowing identification of sector wide information (about dairy, coffee, or cash crop production) through amalgamation of individual data. In a next step within C-RISE, the system boundary is extended vertically to give a better picture about the sustainability of the entire supply chain. The temporal system boundary of RISE is given by

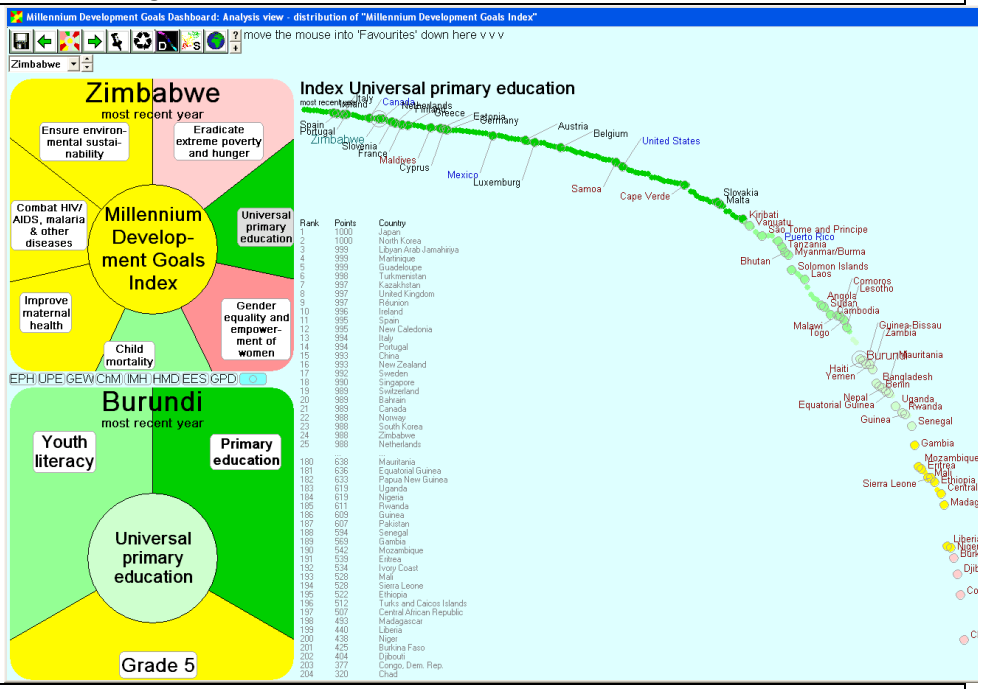
	the period of one year, usually the accounting year (bookkeeping year). To visualise trends this system boundary should be extended through annual reviews and provides the C-RISE model with a third dimension."
Audience:	Various, including individual farmers, advisers and sector groups.
Level of decision-making:	"The database, growing with each evaluation of a farm will allow for local, national and global comparison or benchmarking. Farm and agri-food manager using RISE will be able to compare their own operation with similar ones on a global scale regarding sustainable production of agricultural raw material."
Platform:	The original tool was based on *Microsoft Access*. However, the current version is also an online web-based tool (users can still use a standalone version if they prefer, and synchronise with the online database later).
Educative:	The indicators were selected in a way that the farm manager (and eventually other relevant entities) can exert direct influence on the level of sustainability.
Visualisation:	Spider-graph (sustainability polygon), which allows for an easy identification of strong and weak aspects of the farm and can thus induce steps to improve the situation (decision-oriented, response-inducing approach).
What can we learn from this (positive and negative)?	It seems from experiences they have had with RISE in different countries and across farms of different types that there are both difficulties in getting buy-in and cooperation from farmers and also getting data suitably consistent across different farms and different countries to be able to make proper assessments. The way RISE has solved this is to use trained advisers to collect the data during on-site interviews with farmers. It may be important to learn from the RISE team's experiences here.
Does it seem to be used? (Usage metrics?) Why/why not?	It has been used in a number of projects internationally, including Canada, Brazil and China as well as in Switzerland. There are a number of organisations that offer training in use of various tools, such as RISE, ORC, Bioland (a paper checklist for organic farmers to comply with to be part of Bioland, www.bioland.de/bioland/startseite.html (in German)) etc. These organisations include the Organic Research Centre at Elm Farm in England (www.organicresearchcentre.com/?i=articles.php&art_id=573), Scotland Rural College (www.sruc.ac.uk/, www.sruc.ac.uk/info/120263/erasmus/533/erasmus_partners/16) Swiss College of Agriculture (SHL) – Switzerland (the producers of RISE)(www.educations.com/Swiss_College_of_Agriculture_79081.htm, www.livestockdialogue.org/fileadmin/templates/res_livestock/docs/2011_Phuket/presentations/03_12_RISE_international_Phuket-122011.pdf). With so many places offering training to use RISE, this suggests it is being used.
Our overall assessment (state-of-art v. lemon?):	This project has definite similarities with the NZSD project and it is worthwhile investigating further. We need to note the differences, such as that in their project a farmer is presented with paper copies of current and potential spider-charts and possibly also a spider-chart of averaged aggregated sector data. However, in our the NZSD we want the farmer to be able to view all this directly on the website. Also, their project is based mainly on data collected by advisers during interviews and hosted in a project database, whereas we currently plan to have farmers directly contribute data online through web-based software, and present the results viewable in the website. Also in their project it appears the farmer gets to see her own results and how she does over time or after making improvements, but not necessarily to compare with other farmers in the sector, although the sector with the database can aggregate the data and view averaged results. There were difficulties due to lack of interest from participating farmers, large amounts of data needing to be collected, inconsistency of indicators across different operations, and differences resulting from different farming methods

	in different countries. It would probably be good to collaborate with the RISE group, attempt to make use of what they have done and learn from their experiences, and perhaps get their cooperation, perhaps in using what they have already done, in making our web-based tool which they may also be able to use. However, their experience may be to suggest that what we want to achieve won't work, which is also valuable input.
Other information / references:	There appear to be a number of similar tools and programs available. e.g. see ORC (Organic Research Centre in England) (another (*Excel*-based) tool that appears to be very similar to RISE) www.organicresearchcentre.com/?go=Research%20and%20development&page=Resource%20use%20and%20sustainability&i=projects.php&p_id=20,  www.organicresearchcentre.com/?go=Information%20and%20publications&page=2013%20Conference%20O4, www.organicresearchcentre.com/manage/authincludes/article_uploads/annual_producers_conference/2013/Smith-other-Sus%20tools-ORC%20Conf%202013.pdf

Title: (SD Type)	***SEE-IT*** (Type 1b or 2b: Enterprise or Sector or regional/national level, data presentation only)
Links:	www.fuseforward.com/web/guest/see-it http://marin.fuseforward.com/ (County of Marin – implementation of SEE-IT)
Created by:	Fuse Forward, Canada.
Images:	  
What is it?:	Software as a Service.
Level of data collection:	Custom

Level of data aggregation:	Custom, but probably the same as that of data collection, i.e., unlikely to have aggregation capability.
Audience:	Typically citizen.
Level of decision-making:	n.a.
Platform:	Web-based *Flash* client accessing *.Net / SQL Server* platform.
Educative:	Yes
Visualisation:	Visualisation is simple and clear.
What can we learn from this (positive and negative)?	NZSD could potentially use tools such as this to handle presentation and focus our efforts more on data collection and analysis.
Does it seem to be used? (Usage metrics?) Why/why not?	Various cities, districts and companies use the software (www.fuseforward.com/web/guest/see-it), but the degree to which it is accessed by customers and citizens is unknown. Other cities appear to have used and stopped doing so.
Our overall assessment (state-of-art v. lemon?):	Flash is a little passé as a technology, and the functionality is pretty basic, but it is another example of COTS (Commercial Off-The-Shelf) software potentially playing a useful role in the NZSD project.
Other information / references:	Some implementations can be viewed here: http://novex.fuseforward.com/ (a delivery company using the software) http://marin.fuseforward.com/ (a county using the software)

There are relatively few examples of SDs of Type 3b: International level, data presentation only. They all seem to be related to (i.e. built using) the "Dashboard of Sustainability" software reviewed first below. (Note also, as mentioned below, that this software has been used to build SDs of Type (2b) as well.)

Title: (SD Type)	***Dashboard of Sustainability*** (Type 5: International level, data presentation only)
Links:	http://esl.jrc.ec.europa.eu
Created by:	Jochen Jesinghaus and Peter Hardi.
Image:	
What is it?:	According to the developers: "Dashboard of Sustainability is free, non-commercial software which allows to present complex relationships between

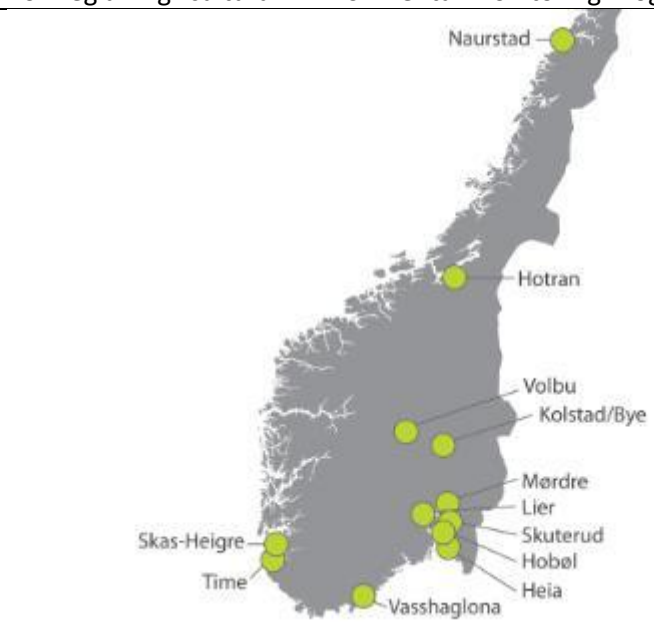
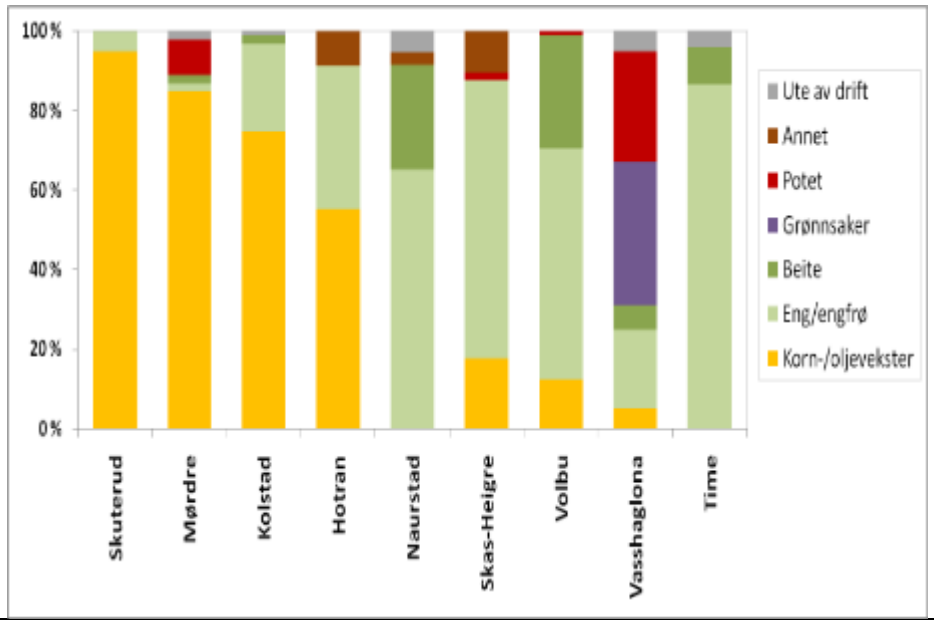
	economic, social and environmental issues in a highly communicative format aimed at decision-makers and citizens interested in Sustainable Development." It is an Excel-based tool that allows the users to create an Excel Spreadsheet of a number of indicators for a number of countries, with annual data over several years. The data can then be displayed for comparative purposes, showing the status of the country for that indicator and also for all countries.
Level of data collection:	Country
Level of data aggregation:	Country – but allows comparison between multiple countries.
Audience:	NGOs, general public (global), United Nations staff.
Level of decision-making:	None
Platform:	Custom build on *Excel* (see http://esl.jrc.it/envind/dashbrds.htm)
Educative:	Shows state of progress towards the UN's Millennium Development Goals.
Visualisation:	Colour coded maps and graphics to display data.
What can we learn from this (positive and negative)?	The software is freely available for download but out-of-date (contains 16-bit code) and will not run on 64-bit *Windows* (which means probably anything after *Windows XP*). We could consider this as a possible resource (although see comments below). The software comes with a manual (http://esl.jrc.it/dc/manual.htm) for transforming spreadsheet data into a SD. We probably can't use it but can maybe learn something by looking at what they have done.
Does it seem to be used? (Usage metrics?) Why/why not?	According to the Wikipedia article (link below), the software is used as the basis of 4 "applications with global scope" and 22 with "national scope". The SD reviewed next is an example of one of the former applications.
Our overall assessment (state-of-art v. lemon?):	The software is amateurish looking (out-of-date) and no longer runs on 64-bit Windows. There are plans to update the software but this hasn't happened yet. This is another example of something which looked good at the time but appears to have suffered from lack of interest or lack of funding or both in that there is no longer a working version.
Other information / references:	"Dashboard of Sustainability" *Wikipedia* article http://en.wikipedia.org/wiki/Dashboard_of_Sustainability http://esl.jrc.it/dc/mdg_unsd (browser version for Africa) This is an application of the Dashboard of Sustainability software. According to the site (http://esl.jrc.it/dc/): "We provide over 60 MDG indicators for ca. 200 countries and 21 years (1990-2010) based on original data from the UN MDG database, updated in August 2012." http://esl.jrc.it/dc/mdg_download.htm (downloadable version for all UN countries)

3.3 Other relevant resources

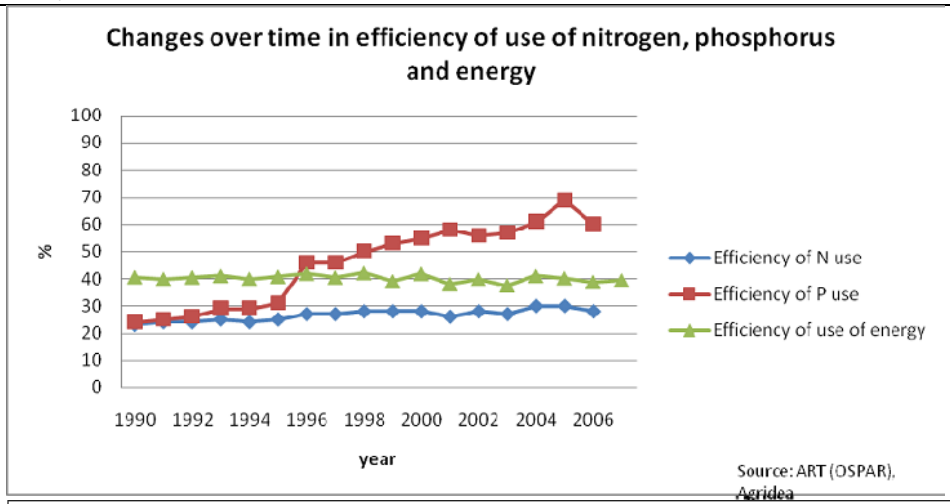
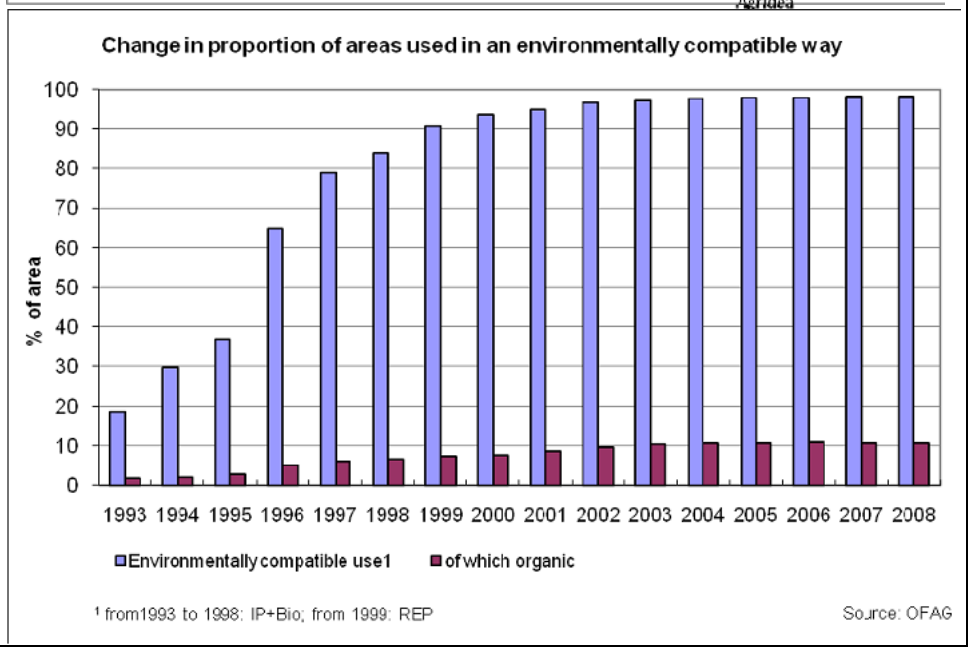
This sub-section includes other resources that are neither SD implementations nor software for building SDs but that are, nonetheless, relevant to the NZSD project. These resources include descriptions of agricultural monitoring programmes in other countries, descriptions of some certification programmes in other countries, educational websites with tools and material for educating farmers about how to improve their performance, etc.

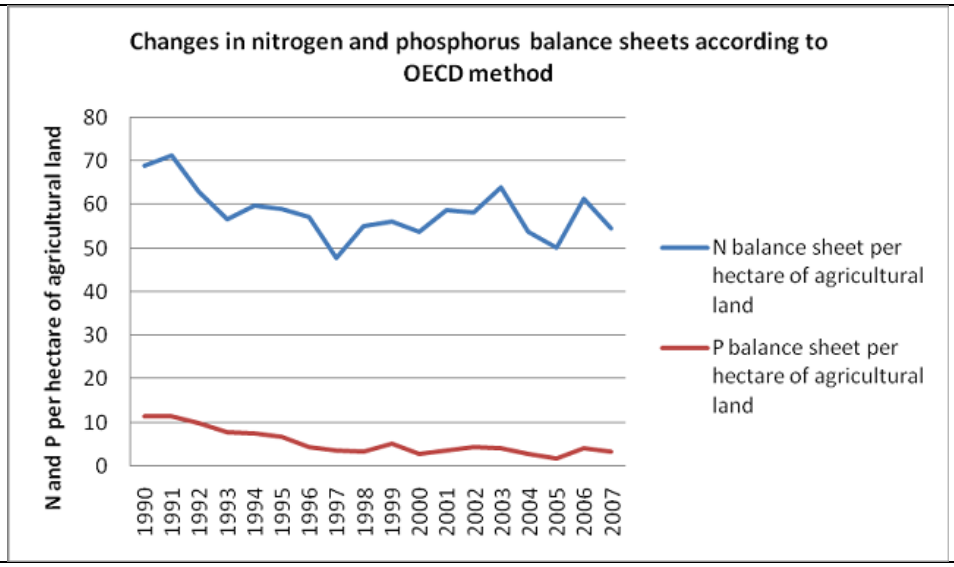
3.3.1 Agricultural/Environmental Monitoring Programmes

These reviews describe a few national projects in Europe that albeit they are not SDs have some similarities to the NZSD project, and so we can learn from what and how they are doing things. There are many such projects internationally.

Title:	***JOVA - The Norwegian Agricultural Environmental Monitoring Programme***
Links:	www.bioforsk.no/ikbViewer/page/prosjekt/tema?p_dimension_id=18844&p_menu_id=18851&p_sub_id=18845&p_dim2=95415
Created by:	Norwegian Agricultural Environmental Monitoring Programme.
Images:	 

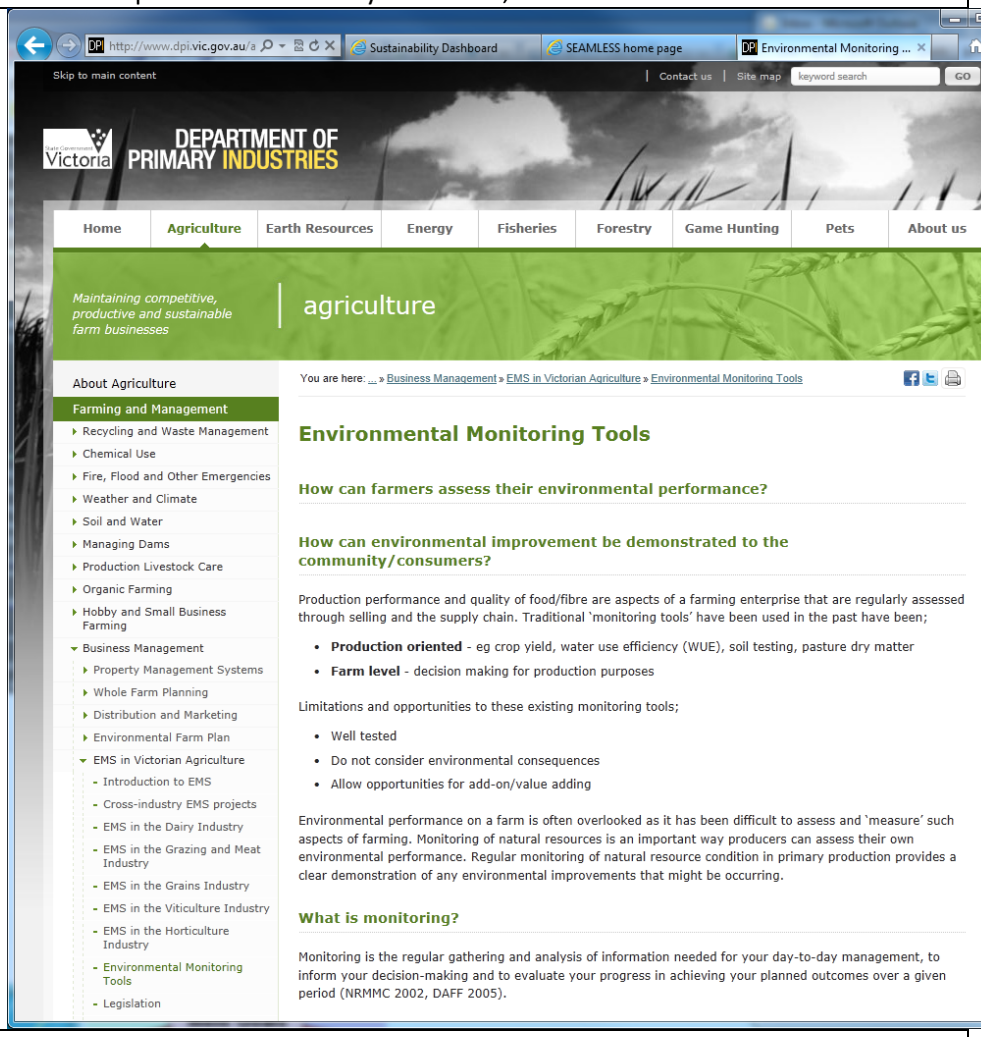
What is it?:	JOVA is a national environmental modelling programme, not software, although they clearly use software in their data gathering and processing. According to the instigators: "JOVA was initiated in 1992 with the aim to document the effects of agricultural practices and measures on runoff and water quality. In total 13 catchments are monitored. In most of them there is a continuous record of water-flow and sampling for analysis of nutrients, particles and pesticides."
Level of data collection:	"In 9 of the catchments (4 to 680 ha) farm data are collected from the farmers themselves, as they report all activities on their various fields throughout the year. This includes the smaller catchments. Information on farming in the four largest catchments (20-330km2) is obtained from Statistics Norway (SSB). JOVA has established a nationwide network of monitoring stations in small catchments dominated by agriculture. Data from monitoring of runoff and water quality are supplemented by registrations of the farmers' agricultural activities in the catchment area. The data collection on management practices is done in close co-operation with the farmers, and provides a basis for correlating soil and crop management in the catchments with the observed water quality in the streams. In many of the catchments the monitoring includes nutrients / soil erosion as well as pesticides, while in some localities only nutrients / soil erosion or pesticides is monitored."
Level of data aggregation:	Catchments (regions) and nationally.
Audience:	"The aim of JOVA is to document the environmental effects of agricultural management practices through the sampling and processing of data from the monitored catchments and other relevant data sources. The catchment areas being monitored represent various agricultural areas in Norway, with particular focus on regions with intensively cropped areas and areas with high density of livestock where there is a high risk of pollution of recipients by runoff from agriculture and other sources. JOVA-results ensure a good knowledge base for national and regional water management, as well as for the agricultural advisory services."
Level of decision-making:	"The results from JOVA are used by the government in their national and international reporting, and in their follow-up of the agricultural policy and general agreement with the farmers. The national bureau of statistics (Statistics Norway, SSB) use these results to report annually on the national environmental status including the effects of agriculture on the water quality. The Norwegian Food Safety Authority (Mattilsynet) use the results in their work with the approval of pesticides. The results are also important for the monitoring in connection with the implementation of the Water Framework Directive (WFD) in watersheds affected by agriculture."
Platform:	Not clear where it is hosted and who gets to see it.
Educative:	Certainly for government and policy makers; not clear if for farmers.
Visualisation:	Presumably, but not on website which is information about project only.
What can we learn from this (positive and negative)?	Appears to be directly relevant as farmers input their individual data which is aggregated. Also their use of monitoring tools for collecting environmental data is worthwhile investigating.
Does it seem to be used? (Usage metrics?) Why/why not?	Appears to be funded at least until 2015 and to be used at least by government departments and policy makers.
Our overall assessment (state-of-art v. lemon?):	Worthwhile following up. This is not obviously a dashboard but clearly has a lot in common with the NZSD project.

Other information / references:	Elizabeth Post's understanding of Norwegian is limited but she has a translator handy if needed.
Title:	***Agro-environmental Monitoring: A Tool for Evaluation and Support of Decision-making for Swiss Agricultural Policy***
Links:	www.oecd.org/tad/sustainable-agriculture/44806857.pdf
Created by:	Brigitte Decrausaz, Federal Office for Agriculture, Strategy and Evaluation Unit, Bern, Switzerland.
Images:	 

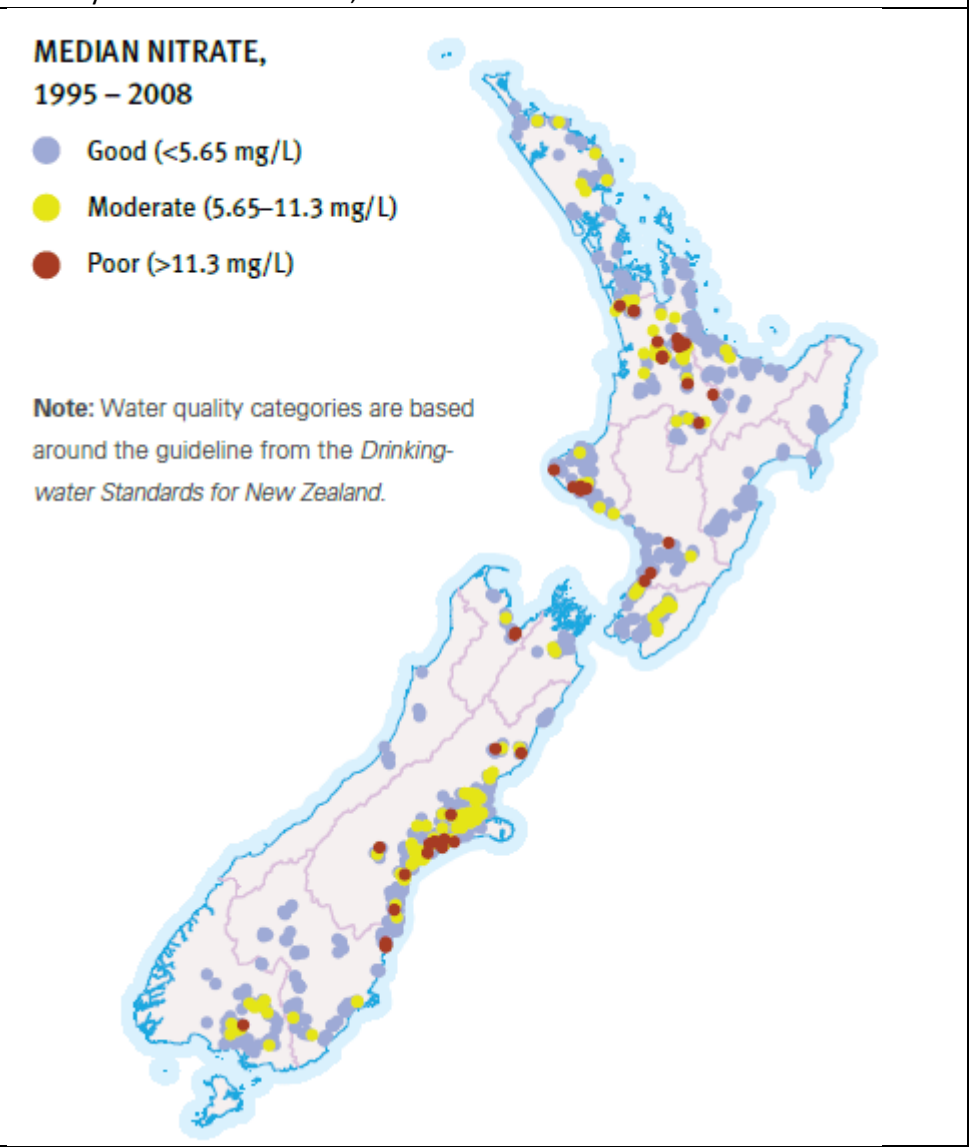
	
What is it?:	This is a report describing how the Swiss are using tools for agro-environmental monitoring. They have a number of indicators and use the results for information and evaluation, to support decision-making for Swiss agricultural policy.
Level of data collection:	Some data gathered from environmental monitoring (water quality, etc), other data from evaluation surveys. Data are regionalised.
Level of data aggregation:	Regional and national level as well as farm.
Audience:	Probably primarily policy makers and enforcers.
Level of decision-making:	These data are observed at international level (allowing comparison with other countries), national level (to see changes in the agricultural sector within Switzerland), regional level (lowlands, hills and mountains), and farm level, pooling the results by type of farm.
Platform:	Unknown
Educative:	Informative to policy makers which may flow-on to educating farmers to improve performance.
Visualisation:	Unknown, apparently maps and charts.
What can we learn from this (positive and negative)?	This seems to have similarities with what the NZSD project plans to do and we may learn from their experiences, including how they enforce compliance.
Does it seem to be used? (Usage metrics?) Why/why not?	This seems to have been benefiting Switzerland over several years.
Our overall assessment (state-of-art v. lemon?):	This is not software nor an obvious implementation of a SD, but it does contain useful information that may be helpful in the NZSD project.
Other information / references:	In Switzerland agro-environmental monitoring is established in law. They have instituted a system of direct payments which include contributions for the cultivated landscape, for security of supply, biodiversity, landscape quality, and the well-being of animals, where payments are based on whether farmers meet a required ecological performance (REP).

3.3.2 Educational Websites

These reviews describe a few examples of websites where the focus is on educating farmers to help improve their performance. We can learn from their approach and possibly make use of some of their tools and educational materials.

Title:	***Environmental Monitoring Tools***
Links:	www.dpi.vic.gov.au/agriculture/farming-management/business-management/ems-in-victorian-agriculture/environmental-monitoring-tools
Created by:	Victoria Department of Primary Industries, Australia.
Image:	
What is it?:	This appears to be a website with a collection of tools for farmers to monitor their performance and learn how to improve it, and a lot of educative material on various topics.
Level of data collection:	Individual
Level of data aggregation:	Individual
Audience:	Individual
Level of decision-making:	Individual
Platform:	Collection of tools, but many of them seem to be a description of manual process only, not computerised. However, at least some of them would be easy to computerise. Some are in *Excel*.
Educative:	Yes
Visualisation:	Presumably within each tool if it is a computerised tool.

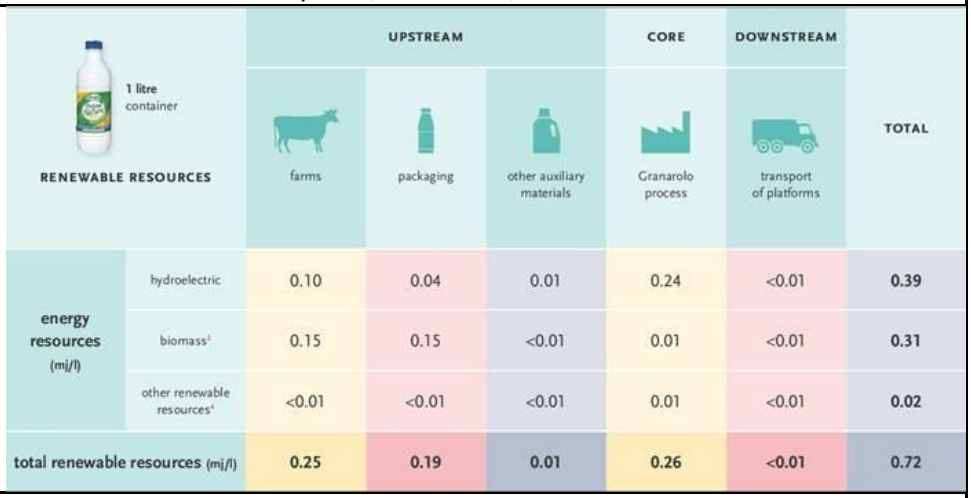
What can we learn from this (positive and negative)?	We can see which tools they provide for various types of agriculture and how the farmers can use them to evaluate and improve their performance. Some of them may be good tools for us to computerise as useful tools for the NZSD project. There is also a lot of educative material.
Does it seem to be used? (Usage metrics?) Why/why not?	The website appears up-to-data and relevant and probably at least some people are using these tools, but there is no direct evidence of usage without contacting them to find out.
Our overall assessment (state-of-art v. lemon?):	Worthwhile looking at some more.
Other information / references:	Though not a dashboard, this seems to be very relevant to what the NZSD project wants to do, and we may well want to use or provide links to some of these tools. Also, as it is Australian, and in Victoria, probably more relevant to NZ than much other resources.

Title:	***The Sustainable Development reporting programme***
Links:	www.mfe.govt.nz/environmental-reporting/index.html www.mfe.govt.nz/environmental-reporting/about/sus-dev.html
Created by:	Ministry for the Environment, New Zealand.
Image:	
What is it?:	The Sustainable Development reporting programme is a link from MfE's main

	website. However, much of this MfE site is focussed on education, with material on indicators and report cards.
Level of data collection:	Not part of website, done elsewhere.
Level of data aggregation:	Not part of website, done elsewhere.
Audience:	General public.
Level of decision-making:	Information only.
Platform:	Website
Educative:	Yes
Visualisation:	Normal maps and charts.
What can we learn from this (positive and negative)?	Useful for illustrating an approach to education.
Does it seem to be used? (Usage metrics?) Why/why not?	Unable to predict usage.
Our overall assessment (state-of-art v. lemon?):	Well worthwhile a look to see how the educative aspects are handles, and what we can learn from it for implementing the educative bits of our SD.
Other information / references:	Nil

3.3.3 Environmental Certification Programmes

These reviews, although not of SDs, include descriptions of some of the certification programmes we have found which may have relevance to the NZSD project, such as with respect to the things they measure. There appear to be several such certification programmes internationally, and this describes just some of what is being done.

Title:	***Environmental Product Declaration EPD and Life Cycle Analysis (LCA or ACV in French)***
Links:	www.environdec.com/en/ http://fr.wikipedia.org/wiki/Analyse_du_cycle_de_vie#Standardisation_de_l.27analyse_de_cycle_de_vie_.28ACV.29
Created by:	The International EPD® System, Stockholm, Sweden.
Image:	
What is it?:	This appears to be a European programme for certification of environmental

	performance. A product can get an EPD® which, according to the website, is a "certified environmental declaration developed in accordance with the standard ISO 14025. EPDs are an effective tool in communicating the environmental impact of goods services. On this website you can find information on how to develop and certify environmental declarations according to ISO 14025. The Product Category Rules (PCRs) are vital for the concept of environmental declarations and climate declarations. The PCRs enable transparency for the EPD-development and also comparability between different EPDs based on the same PCR. On this website you can find information about PCR development, search among PCRs (free to download) and also discuss PCR related issues."
Level of data collection:	Per product.
Level of data aggregation:	n.a.
Audience:	Consumers
Level of decision-making:	Consumer
Platform:	n.a. (i.e. is a programme, not software)
Educative:	Informative
Visualisation:	n.a
What can we learn from this (positive and negative)?	This is not a dashboard, nor software, but a certification programme. However, it appears to be directly relevant to the NZSD project and we need to learn how we can work in with such certification, as this could be a factor that could influence the uptake of our system.
Does it seem to be used? (Usage metrics?) Why/why not?	It is unclear how much it is used, but there are pictures of a number of products on their website. One user of EPGs is Zeus Kiwi S.A., and "all kiwi marketed by Zeus Kiwi S.A. are compliant with EU regulation EU Reg. 543/2011 and to UNECE Standard FFV-46 concerning minimum maturity requirements and marketing and commercial quality control of Kiwifruit at the export control stage, after preparation and packaging." "The right to use the present EPD is exclusive to the kiwifruits traceable to the registered kiwi growers and kiwi orchards of Zeus Kiwi. All kiwi fruit packages marketed under this EPD will bear the mark shown here."

ENVIRONMENTAL PRODUCT DECLARATION
for
1 kg of kiwifruit (inclusive of peel) eaten by the consumer,

produced by ZEUS KIWI SA in Greece, according to the EPD PCR 2011:02; UN CPC 01342 Version 1.0 - KIWI FRUIT.

PERIOD OF VALIDITY
Original approval date: **3 January 2012**
This certificate is valid until: **2 January 2015**

to the normal blood cholesterol levels in the context of a varied and balanced diet and a healthy lifestyle.

Table 1	Green kiwi fruit raw (100 g)
Energy	61 kcal
Protein	1 g
Carbohydrates	14.66 g
of which Sugars	8,99 g
Total lipid (fat)	0.52 g
of which Saturated fat	0 g
Cholesterol	0 mg
Dietary Fibre	3,61g* (14%RDA)
of which pectins	0,8 g*
Sodium	3 g*

Table 2	Green kiwi fruit raw** (100 g)	% RDA***of 100 g of kiwi fruit
Vitamin C	92.7 mg	115,9%
Vitamin K	40.3 mcg	53,7%
Potassium	312 mg	15,6%

** 1 ZEUS KIWI fruit nominal weight 100g
***RDA:Recommended Daily Allowance in accordance to 2006/100 EU Regulation

(Reference: ZEUS Environmental Product Declaration for Kiwi Fruits according to the EPD PCR 2011:02 UN CPC 01342 Version 1.0 – Kiwi Fruit.)

Information on environmental performance

Table 5 A. Performance per Functional Unit

10.1 USE of RESOURCES			Upstream	Core		Downstream
USE of RESOURCES / F.U.	Unit	Total	Inputs	Field	Packing	Transportation storage & use
Non renewable material resources	kg	0.179	0.085	0.024	0.032	0.038
Non renewable energy resources	MJ	13.335	8.752	0.615	1.690	2.278
Renewable material resources	kg	$4.85x10^{-3}$	$7.56x10^{-4}$	$1.56x10^{-4}$	$4.71x10^{-3}$	$4.42x10^{-4}$
Renewable energy resources	MJ	1.328	0.287	0.003	1.015	0.023
Water use	m^3	0.367	0.005	0.358	0.003	0.001
10.2 Potential environmental impact						
IMPACT CATEGORIES	Unit	Total	Inputs	Field	Packing	Transportation storage & use
Global warming (GWP100)	kg CO_2-eq.	0.831	0.542	0.035	0.094	0.160
Ozone layer depletion (ODP)	kg CFC-11-eq.	$1.58x10^{-4}$	$3.13x10^{-8}$	$6.99x10^{-10}$	$1.06x10^{-8}$	$1.54x10^{-4}$
Acidification gases	kg SO_2-eq.	$4.63x10^{-3}$	$2.72x10^{-3}$	$8.25x10^{-4}$	$2.54x10^{-4}$	$8.30x10^{-4}$
Photochemical oxidation	kg C_2H_4-eq.	$4.08x10^{-5}$	$1.83x10^{-5}$	$3.27x10^{-5}$	$1.04x10^{-5}$	$8.87x10^{-5}$
Eutrophication	kg PO_4-eq	0.0058	0.0045	0.0007	0.0002	0.0004
Human toxicity	kg 1,4-DB-eq.	0.594	0.504	0.022	0.037	0.031
10.3 Other indicators						
INDICATOR	Unit	Total	Inputs	Field	Packing	Transportation storage & use
Electricity consumption	kWh	1.157	0.854	0.034	0.143	0.126
Primary energy	MJ	14,672	9.040	0.627	2.704	2.301
Material subject for recycling	kg	0.073	0.000	0.013	0.060	0.000
Waste	kg	$2.06x10^{-3}$	$4.29x10^{-4}$	$1.26x10^{-3}$	$3.25x10^{-3}$	$4.67x10^{-3}$
Land area occupied	m^2a	0.652	0.006	0.460	0.185	0.001
Land use change since 1990	ha	81.23	--	78.23	3.0	--
Ecological footprint	Pt	3.49	1.46	1.10	0.50	0.43

The French are also becoming involved with certification of products regarding environmental efficiency with many organisations (such as those producing kiwifruit) seeking voluntary certification. They claim this certification is two-part: partly to educate consumers to purchase products produced in an environmentally friendly way, and partly to educate producers to ameliorate their impact on the environment by improving their practices. (Source: DETAIL fruits et legumes, Juil/Aout 12 Mensuel, 22 Rue Bergere, 75009 Paris, "L'Affichage Environnemental sure le point de vente") The French appear to use a system called ACV ("l'Analyse du cycle de vie" (An analysis of the cycle of life) Wikipedia says: The life cycle analysis (LCA) is based on the concept of sustainable development by providing an effective means to assess systemic and environmental impacts of a product , a department , a business or a process.

	 Sur les barquettes de kiwis, Sikig communique à propos des impacts environnementaux de sa production
Our overall assessment (state-of-art v. lemon?):	These are likely to become a part of the NZSD project as perhaps the 'carrot' to encourage participation.
Other information / references:	Nil

4 Summary of Main Things Learned

As reviewed in the previous section, we discovered five SD implementations, seven examples of software that can be used for building SDs, and five other resources that we believe are relevant to the NZSD project. So, what have we learned from our survey?

Perhaps surprisingly, none of the SD implementations is a close match to what we envisage for the NZSD. Nonetheless, we can still learn from them.

The SD implementation that came closest to the intended NZSD is the TEAM Network (Tropical Ecology Assessment & Monitoring Network) dashboard. The RISE (Response-Inducing Sustainability Evaluation) project, though not a SD, has aspects in common with the NZSD, and we can learn from their experiences. A lot can probably also be learned from SEAMLESS-IF, which, albeit it is focussed up to an EU level of aggregation, could be applied to the NZSD, and potentially its technology could be 're-used' as well.

With respect to software for implementing SDs we found three main categories. The first category arose from research projects similar to the NZSD project. Their software was sometimes amateurish and unsophisticated, such as implementations in *Microsoft Excel*, *Microsoft Access* and some old *Windows* applications that no longer run under 64-bit *Windows*. Sometimes software in this category was a custom mash-up of more modern technologies, such as TEAM Network. In most cases we can learn something from these applications, but we may not be able to make direct use of them, either because they are too limited to achieve what we want or the technology is out-of-date.

The second main category of software for implementing SDs was professional, high quality software, such as Eco-Portal, SEE-IT and Sustainable Dashboard Tools. However, such software was primarily designed for organisations like companies, universities or public agencies interested in monitoring and communicating their performance on various indicators over time to evaluate whether or not they are improving. This software is not designed for large numbers of participants (e.g. New Zealand farmers or growers) to enter their own data, have the data aggregated, and to be able to compare it with others.

The third category of software for implementing SDs was also professional, high quality software, but *is* designed for use with large numbers of participants (e.g. farmers or growers) to enter their own data, have the data aggregated, and to be able to compare it with others. The only example that we found in our search for SD implementations was the SoFi and GaBi software from PE International (e.g. as applied to Dairy Australia).

PE International is attractive as a potential collaborator given the company's local presence (in Wellington), the apparent suitability of its software across the spectrum of what is intended for the NZSD project, and its experience in NZ and internationally. It may be possible to partner with such a company as well as industry sectors to deliver large amounts of the NZSD project's technology side (at least) with more confidence and certainty of both initial delivery and ongoing support and improvement after the NZSD project ends.

Of course, other potential collaborators and partners, with their own software offerings, are likely to exist too. Mandatory sustainability reporting regulations in some EU countries are encouraging accounting software to incorporate triple-bottom-line information (e.g. see Dochuk, undated); likewise, applications of Business Intelligence to sustainability reporting for companies can be

expected to increase as well. Such applications may even start to have international consistency due to the impact of regulations and standards (Ivancic 2013).

As recently reviewed by Groom Energy Solutions (2012),[3] a wide range of software for Enterprise Carbon Accounting (ECA) is available. Potentially, such ECA software – and others related to Sustainability Reporting & Management and Product Lifecycle Assessment – could be used to build the NZSD. The SoFi/GaBi software was rated in the top five by this report. Further investigation is likely to be worthwhile.

The SDs reviewed in our survey include good ways of visualising data, and some will be able to be used in the NZSD project. We also found good examples of where education, such as of farmers/growers, is part of the goal of the project, and we can make use of these approaches too. One example is the Victoria (Australia) Department of Primary Industries website,[4] which contains extensive information and tools for farmers to assess their performance and consider alternative actions; albeit many are manual 'pen and paper'-based tools, they include one or two applications based on *Excel* spreadsheets. We can probably learn a lot from further studying their approach.

The RISE project also includes feedback to farmers showing them their performance and also potential performance if they made changes. There were also some other community-oriented SD implementations that had an educative component, such as Sustainable Seattle, which may have something we can learn from.

One important finding – returned to in our final section below – is that many projects related to agricultural or environmental modelling or community sustainability projects, despite having been launched with initial enthusiasm and potentially good work having been done, have apparently been discontinued and are no longer used. In some cases this appears to be due to a lack of participant buy-in and/or because funding support ceased.

Sustainability seems to have been very topical about 10 years ago, but most of the projects started then are no longer active. The RISE project in particular details the difficulties involved in getting information from farmers. It is also noteworthy that in Europe, in particular Switzerland and Norway, various types of agricultural and environmental monitoring have become mandatory, and this appears to be an effective way to get farmers to contribute their data (farmers are also penalised for not meeting the required performance levels).

5 Conclusions and Recommendations

From what we have been able to discover, there are no SD implementations in use internationally that are directly similar to what is intended for the NZSD. Nonetheless, we can learn a lot from what is included in this survey (and from what will subsequently emerge as the NZSD project progresses). There is also a lot we can learn from the various examples with an educational focus.

[3] Available for purchase for US$995.

[4] See www.dpi.vic.gov.au/agriculture/farming-management/business-management/ems-in-victorian-agriculture/environmental-monitoring-tools.

Most SD projects internationally, whether research- or community-based, seem to have been discontinued for one reason or another. We need to understand and address these reasons to try to ensure the NZSD project does not end up buried in the same graveyard. Getting buy-in from participants and maintaining their enthusiasm will be essential for the ultimate success of the NZSD project.

As the NZSD project gains focus about what it hopes to achieve specifically for farmers/growers and industry groups we will be better placed to advise on appropriate technologies to apply to meet these goals as a result of this survey. If possible, it would be good to integrate with technology platforms already used in participating industry sectors in order to maintain visibility, to normalise sustainability dimensions as areas of interest, and to reduce the risk of technological obsolescence.

However, where no suitable technology platform exists the NZSD project will need to choose whether to build something customised, to apply and collaborate with commercial software (such as SoFi/GaBi, EcoPortal, etc), to re-purpose open source software such as developed for SEAMLESS-IF, or some combination of these options. We may also be able to make more or less use of external parties to perform software customisation and development depending on budgets and the complexity of the NZSD project's aims. It would be imprudent to suggest a specific path or technology choice until we have more clarity of what is being aimed for in each industry involved in the NZSD project.

If agricultural and environmental monitoring regulations were imposed by the government (as in Europe, as mentioned in the previous section) this would likely increase industry buy-in for the NZSD. The industries involved in the NZSD project may also make some reporting mandatory for their members (e.g. farmers or growers). In some countries commercial entities such as supermarket chains (e.g. Tesco, Walmart) are becoming increasingly involved in promoting sustainability principles to their suppliers, sometimes even requiring sustainability information from suppliers, which might be another motivation for farmers/growers to remain engaged in the NZSD project.

We strongly recommend that everyone involved in the NZSD project continues to reflect on the ultimate purpose of the project. Is the primary objective to create a sustainability dashboard per se – with emphasis on *environmental* sustainability? Or is it to improve the triple bottom-line – in terms of *environmental* and *social* performance as well as *financial* performance – of individual farmers/growers (or equivalent business units) and industry sectors overall via better information and feedback loops?

Answers to the questions above will influence the technology direction of the NZSD project. The project is budgeted for six years; what do we expect to live beyond that horizon? Will it be a SD or will such information then be just part of standard industry management accounting? What long-term changes can we hope the NZSD to be part of?

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E Post, *Scoping Sector Information Systems and ICT Resources*, Prepared for The AgriBusiness Group, Report 1029-1-R1, December 2012.

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Contacts

We contacted the following people during the course of our survey.

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