# Applicability of Performance Indicators
# to Farms and Orchards

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# Table of Contents

# Executive Summary

The purpose of this study was to establish to what extent the information collected to assess the financial performance of conventional businesses applies to farm businesses. Fifteen performance indicators were identified in the Models of Success literature and these indicators belong to one out of seven categories including structure of firm; business strategy; customer focus; quality; employee relations; innovation; and social/environmental indicators. The applicability of the indicators to sheep and beef farms and kiwifruit orchards was investigated using a questionnaire administered to thirty-four orchardists and thirty-two farmers. The questionnaire contained 22 questions pertaining to 13 performance indicators. An additional two performance indicator measures were derived from the ARGOS database.

The data obtained from the questionnaire and the ARGOS database was compared with financial data gathered as part of the ARGOS project to determine whether the performance indicators had any relation to financial success. Farms and orchard gross revenue per effective hectare and cash surplus per effective hectare were used as measures of financial performance and compared statistically to the performance indicators using cross tabulations of data with chi-square tests of significance and correlation coefficients. Analysis of variance for randomized block design tests were also undertaken to establish whether farms and orchards with different management systems differed in the performance indicator measures.

For most part, the results suggest that many of the performance indicators are not related to the orchards' and farms' financial performance because statistically significant results were only detected for a small number of the indicators. In the kiwifruit sector, orchard size in terms of number of staff appeared to be a relevant indicator as it was positively related to gross farm revenue and cash surplus per effective hectare. In addition, customer focus may be a relevant indictor of orchard success. Orchardists who changed the way they operate their orchard based on information of customer requirements had greater gross farm revenue. In the sheep and beef sector on the other hand, the farm size indicator appeared to have a different effect on financial performance than in the kiwifruit sector. There was a negative relationship between the number of staff working on the farm and cash surplus. Innovation, such as up-to-date plant and machinery, may be an important indicator of financial success in the sheep and beef sector, and so may social indicators, such as obtaining supplies locally.

The results also indicate that farms and orchard with different management systems differed in some of the performance indicator measures. In the kiwifruit sector, Gold orchards appeared to have a higher level of dry matter, have more staff working on the orchard, and have greater gross farm revenue per effective hectare than orchards growing Green and Organic kiwifruit. These results highlights that the properties of the Gold variety are inherently different from the Hayward variety, and different performance indicators may therefore be relevant for Gold orchards and orchards growing the Hayward variety. In the sheep and beef sector, the results revealed differences amongst the different management systems for one of the social indicators. Farmers using a Conventional management system tended to purchase more of their supplies from local businesses than farmers using Organic and Integrated management systems.

Where a farm and orchard is located also influenced the results of many of the performance indicators, especially in the kiwifruit sector. Hence, the geographical location of agricultural businesses may also influence their success, and may be a more important success indicator than conventional performance indicators.

Overall, this study suggests that many of the indicators of financial success relevant for conventional businesses may not be applicable to sheep and beef farms and kiwifruit orchards. It is important to note that the sample sizes in this study were very small and may have reduced the power to detect statistically significant results, and therefore, the identification of performance indicators that may be relevant for agricultural businesses. However, it is important to be cautious when applying conventional performance indicators to farms and orchards.

# Introduction

The purpose of this research project is to establish to what extent the information collected to assess the success or performance of conventional businesses applies to farm businesses. This information is based on models of business success and these models have become important planning, analytical and policy tools. They enable firms to analyse the structure of a particular sector, plan business ventures, and monitor ongoing performance. They also enable policy makers to understand the key elements of business activity within a sector and provide tools to facilitate business development and overall socio-economic growth strategies.

There are many models of business success. Lewis (2006) groups models into four categories, each with different views of how to assess business success and different focus. The four categories are: business management, organisation development, owner personality and business culture, and sector-specific. The models reviewed for this research belonged to three of these four categories. Two examples of models that focus on business management are the Business Practices and Performance (BPP) model (Knuckey et al., 2002) and the Balanced Scorecard (BSC) approach (Kaplan & Norton, 1992, 1996). The BPP model focuses on the practices employed by firms, relating firm performance to external criteria and other firms. The Ministry of Economic Development applied the BPP model to an extensive sample of New Zealand businesses to assess capability and issues around business development in New Zealand. One of the aims was to better inform businesses and government policy makers on the factors that are key in developing successful businesses, and these factors have been used extensively, especially by the Ministry of Economic Development, to establish policies and indicators to enhance and measure business success. The BSC approach, on the other hand, asks a firm to decide its own performance criteria by setting goals and identifying performance indicators for itself. The Five-Stage Growth model is an example of a model with a business development focus and suggests that as firms develop, they pass through a series of defined stages, each with its own challenges. Finally, models that consider business culture and owners' characteristics suggest that the development of a firm does not follow a specific path, but may be influenced by the people in the firm and how they define their own well-being.

Success models focused specifically on agribusinesses are somewhat different from the conventional models, and there are two key reasons for this. The first reason is the biological basis of agriculture, which makes the sector different from other parts of the economy. Agriculture depends on the natural environment, so it is subject to climatic and weather influences, seasonal production patterns, biological risks, and natural physical characteristics of the areas where production is located. The second reason is the size of firms in agriculture. Research that focuses on firms defined by number of employees may not be valid for farm enterprises where economic activity tends to be organised around families and family labour. For example, the model used by the Ministry of Economic Development (Knuckey et al., 2002) focuses on firms with six or more employees, a definition that likely excludes a large number of agricultural firms.

Three agricultural success models or frameworks have been reviewed. The first framework investigated is agricultural sustainability, with a sustainable enterprise being considered a successful enterprise. The fundamental concept is from Solow: sustainability is 'non-declining per-capita human well-being (utility) over time' (Solow, 1974), which evolved into the concept of 'a non-declining capital stock over time' (Repetto, 1986; Solow, 1986). In this context, capital stock is understood in its broadest terms to include human capital, social capital, cultural capital, human-made capital and natural capital. Indicators can be used to

determine capital levels and their changes over time. The second model reviewed was the Balanced Scorecard, which has proved valuable for non-farm businesses and modified for application to on-farm businesses. Dunn, Gates, Davis, and Arzeno (2006), for example, developed a BSC model with six perspectives: learning and growth, natural resources, ag commodities/production, customers, financial, and ranch lifestyle. The additional perspectives – natural resources and ranch lifestyle, for example – make the basic BSC model tailored to accurately reflect the specifics of a pastoral agribusiness (Dunn, et al., 2006). The third framework reviewed was the best-practice programmes in agriculture (Martin & Shadbolt, 2005). With best practice, farmers update their basic knowledge as time goes by, hone their skills and attributes, cultivate a learning culture, and have self-knowledge and self-belief.

Both the conventional and agricultural models include information or indicators that can be used to measure the success, or performance, of a firm. Table 1 on the next page categorises and displays these indicators. There is little research revealing the applicability of these indicators to agricultural firms, such as farms. Hence, this study set out to explore to what degree these indictors are related to the financial performance of farms in NZ, specifically sheep and beef farms and kiwifruit orchards. The research also investigated whether farms and orchard with different management systems differed in the performance indicator measures. For kiwifruit, the management systems were 'Green' (Hayward variety grown conventionally), 'Organic' (Hayward grown organically) and 'Gold' (the newer Hort16A variety grown conventionally). In sheep and beef, the management systems refer to whether a farm uses a 'conventional', 'organic' or 'integrated' pest management system.

**Table 1. Business performance indicators**

| Structure of the firm | Business strategy | Customer focus | Quality | Employee relations | Innovation | Social/ environmental factors | Business performance |
|---|---|---|---|---|---|---|---|
| Size | Vision statement | Per cent sales from new products | Quality grades of products | Employee turnover | Number of new products trialled or sold | Pollution measurements (e.g., nitrate pollution) | Shareholder value |
| Ownership structure | Per cent sales exported | Share of key accounts purchases | Waste | Absentee rates / sick leave | Number of new processes or techniques attempted or adopted | Proportion of materials used recycled | Economic value added |
| Industry | | Delivery times | Productivity | Injury rates | | Energy consumed | Return on invested capital |
| Industry structure (e.g. concentration ratio) | | Customer profitability | Member of certification schemes | Productivity | Use of ICT | Water use and source | Gross margin |
| Age of business | | Identification of and contact with customers | Returns as a proportion of total sales | Performance based pay | Investment/change in capital | GHG emissions | Profit after tax |
| | | Processes for receiving feedback from customers | | Skills and qualification | | Environmental certification | Economic value added |
| | | | | Training provision | | Proportion of employees from the locality (e.g., 10 km radius) | Debt/equity ratio |
| | | | | | | Proportion of suppliers locally based | Diversity of revenue sources |
| | | | | | | Participation in local/ public policy making | Per cent of market share for 5 years |
| | | | | | | Contributions to/ donations to/ participation in local groups | |

# Method

To determine the applicability of the indicators identified in prior research (Table 1), a detailed questionnaire was used to survey farmers and orchardists. A draft of the questionnaire was developed by the research team and then reviewed by experienced agribusiness researchers who ensured the questions were adequately framed for the agricultural sector. Only indicators considered relevant for farms/orchards were investigated. Table 2 on the following page outlines the indicators investigated in each category and the measurements used. The final questionnaire (see Appendix A) consisted of 22 questions pertaining to 13 performance indicators. Two questions asked whether the farm/orchard had a business management plan and how frequently it was used. Two questions enquired about the farm's/orchard's information regarding customers, and another four questions focused on innovations, such as information technology, current and future investment in plant and machinery, and management system improvements. Seven questions related to employment relations indicators, including staff turnover, absenteeism due to sickness and injury, training, and performance-based pay. The remaining seven questions enquired about social and environmental factors and included questions about election participation, contributions to charity and local community groups, the proportion of supplies bought locally and proportion of employees living locally.

Responses to this questionnaire were compared with other data from the ARGOS project to further investigate the applicability of these indicators. Principally, the survey information was compared to financial data from the farms and orchards to determine whether the indicators had any relation with financial success. Gross farm revenue and cash surplus per effective hectare were used as financial performance indicators. Financial data for the 2004/2005 financial year was used for the kiwifruit orchards, whilst the financial data for the sheep and beef farms was from the 2003/2004 financial year.

The questionnaire data was also combined with other factors derived from the ARGOS database that may potentially affect success. In the case of kiwifruit orchards, one environmental indicator was included (average number of earthworms between and within rows) and one quality indicator (average fruit dry matter). In the case of the sheep and beef farms, the Argos database provided one environmental factor (the average number of earthworms).

The surveys were administered 'face-to-face' to orchardists and farmers by the ARGOS Field Managers in February 2007.

**Table 2. Performance indicators and measures used in ARGOS questionnaire**

| Structure of the firm | Business strategy | Customer focus | Quality | Employee relations | Innovation | Social/ environmental factors |
|---|---|---|---|---|---|---|
| Size<br><br>*Number of paid staff*<br><br>*Total number of staff* | Business management plan<br><br>*Have a management plan*<br><br>*Number of times referring to management plan*<br><br>*Value of management plan* | Contact with and feedback from customers<br><br>*Frequency of customer information*<br><br>*Influence of customer information*<br><br>*Percentage sales directly to customers/end-users* | Quality grades of products<br><br>*Dry matter (kiwifruit only)* | Employee turnover<br><br>*Percentage staff turn over*<br><br>Absentee rates / sick leave<br><br>*Work days lost due to sickness and injury*<br><br>Performance based pay<br><br>*Number of staff on performance based pay*<br><br>*Value of performance based pay*<br><br>Training provision<br><br>*Number of staff participated in training*<br><br>*Number of training days* | Use of ICT<br><br>*Importance of ICT usage*<br><br>Investment/change in capital<br><br>*State of current plant and machinery*<br><br>*Planned investments in technology*<br><br>*Changes to management system* | Proportion of employees from the locality<br><br>*Number of staff members living locally or on-farm*<br><br>Proportion of suppliers locally based<br><br>*Percentage of key supplies obtained locally*<br><br>Participation in local/ public policy making<br><br>*Participation in local and national election*<br><br>*Participation in community groups*<br><br>Contributions to/ donations to/ participation in local groups<br><br>*Donations to community activities*<br><br>*Value of donation*<br><br>Environment<br><br>*Average number of earth-worms* |

# Data analysis

The data were analysed using Excel and SPSS. For the kiwifruit sector, the number of responses was 34, but there was no financial data available for four of the responding orchardists, resulting in only 30 responses being included in the analysis. The 30 responses had an equal distribution of management system with ten Green, ten Organic and ten Gold.

For the sheep and beef sector, the number of respondents was 32. No financial data was availability for one of these, resulting in a sample size of 31 farms. Eleven of the responses were from farms using an organic management system; ten from farms using an integrated management system; and ten with a conventional management system.

The questionnaire data were compared statistically with farms' gross revenues and cash surpluses per effective hectare to determine the implications of the indicators for farm/orchard financial success. Three statistical tools were used: (1) cross tabulations of data with chi-square tests of significance, (2) correlation coefficients, and (3) analysis of variance for randomised block design and relevant post hoc analyses. The cross tabulations assessed whether the farms/orchards in question were above or below the median revenue and cash surplus figures per hectare for the participating ARGOS farms/orchards in the sector. For the chi-square tests, the calculated values are given along with the degrees of freedom (df), and the probabilities and statistical significances noted. For the correlation coefficients, the values and statistical significances are provided. The analysis of variance for randomised block design and relevant post hoc analysis assessed whether the type of management system used has any effect on the results and whether there are any cluster effects. That is, each sector is divided into a number of different clusters which are groups of three farms/orchards located in the same geographical area but with different management systems. It is important to investigate cluster effects to identify whether the farms'/orchards' geographical locations are influencing the results. For the analysis of variance tests, the calculated values (*f*-values) are provided together with the degrees of freedom (df) and the probabilities of statistical significance.

# Results

The data collected in the questionnaires are presented here and organised by category of indicator (the column headings in Table 2 above), and reported separately for the kiwifruit and sheep and beef sectors.

Tables 3-5 in the end of this section display results from the questionnaire that are statistically significant as well as other selected results.

## Structure of the firm

The performance indicator for the structure of the firm category was size of business, and this indicator was measured by two variables: Number of paid employees and total number of staff (paid and unpaid).

*Kiwifruit sector*

The kiwifruit orchards exhibited a relationship between the size of the business and financial data. The correlation between number of paid employees and gross farm revenue per effective hectare was significant (r=0.431, p<0.05), and the correlation between number of paid employees and cash surplus per effective hectare was also statistically significant (r=0.501, p<0.01). It is important to note that less than half of the orchards have paid employees and

these tend to be the larger corporate-type operations. The correlations between the number of total staff and gross farm revenue and cash surplus per effective hectare were also statistically significant (r=0.452, p<0.05; r=0.497, p<0.01). Hence, the more staff working on an orchard, the greater the gross revenue and cash surplus per effective hectare.

The analysis of variance for randomised block design test found a significant difference between the three different management systems and the number of paid staff measure, (*f*=4.528, df=2, p<0.05). A descriptive post hoc analysis showed that Gold orchards have more paid employees than Green and Organic orchards. However, the Games-Howell post hoc comparison test did not reveal any statistically significant differences for pairwise comparisons. The post hoc analysis also revealed a statistically significant cluster effect for the number of paid staff and total number of staff measures (*f(11)*=5.962, p<0.05; f(11)=4.060, p<0.05), so location of orchards is important.

*Sheep and beef sector*

The sheep and beef farms also exhibited a relationship between their size and financial data. The correlation between number of paid staff and cash surplus is significant (r=-0.426, p<0.05) and so is the correlation between the total number of staff and cash surplus (r=-0.382, p<0.05). These results suggest that the more people a sheep and beef farm employs, the lower its cash surplus per effective hectare. The correlations between the two size measures and gross farm revenue were not statistically significant (r=0.099, ns; r=0.052, ns). No management system or cluster effects were found for these indicators.

## Business strategy

As a measure for the business management plan indicator, the participants were asked to indicate whether they have a written business plan, how often they refer to it and how valuable they think it is to have a written management plan.

*Kiwifruit sector*

Only five of the 30 orchardists stated they have a written management plan, and those that have management plans and those that do not had similar gross revenues and cash surplus ($\chi^2(1)$=0.240, ns; $\chi^2(1)$=0.240 ns). The number of times per year that producers consulted their business plans also appeared to have no correlation with gross revenue or cash surplus (r= -0.180, ns; r= -0.274, ns). There was no statistically significant correlation between the value placed on having a written management plan with gross revenue and cash surplus (r= -0.104, ns; r= -0.070, ns).

The value of a written management plan measure did not differ significantly between systems. However, a significant cluster effect was found for this variable (*f(11)*=3.187, p<0.05).

*Sheep and beef sector*

Eleven of the 31 sheep and beef farmers reported having a written business plan. The cross tabulation results showed that a higher proportion of farms with a business plan tended to have gross revenue per effective hectare above the median (63%) than farms without a business plan (35%). However, the difference was not statistically significant ($\chi^2(1)$=2.350, ns). The same trend was not found for cash surplus and the chi-square test was not significant ($\chi2(1)$=0.259, ns).

The number of times per year that farmers consulted their business plans also appeared to have no correlation with gross revenues or cash surplus (r= -0.373, ns; r= -0.022, ns) and neither did the value they placed on having a written management plan (r= -0.175, ns; r= -

0.295, ns). Management system effect was analysed for the value placed on having a business plan, but none was found.

## Customer focus

The questionnaire probed the customer focus of producers by asking how often they received customer feedback, to what extent this feedback influenced how they operate their farm/orchard, and how much of their sales were directly to customers.

*Kiwifruit sector*

The frequency of customer feedback had no impact on gross revenue or cash surplus for kiwifruit orchards ($\chi^2(2)=1.20$, ns; $\chi^2(2)=3.467$, ns). It is important to note that 80 per cent of orchards received information about customer requirements at least once a month. The low differentiation amongst orchards on this performance indicator made it difficult to ascertain the importance of customer requirement information in the kiwifruit sector. There was a significant correlation between the extent the information respondents receive about customer requirements influences the way they operate their orchard, and gross farm revenue ($r=0.456$, $p<0.05$) but not for cash surplus ($r=0.340$, ns). None of the orchards made sales directly to consumers, but marketed their full production through ZESPRI.

An analysis of variance for randomised blocked design was conducted for the frequency of customer feedback measure to establish any management system effects, but none were detected.

*Sheep and beef sector*

Sheep and beef farmers tended to receive information about customer requirements less often than kiwifruit orchards, as only 61 per cent of farmers received this type of information at least once a month. The chi-square results showed that there are no differences in the proportion of farms who have above median gross revenue and cash surplus between farmers who receive information at least once a month and those who receive information less frequently ($\chi^2(1)=1.106$, ns; $\chi^2(1)=0.54$, ns). In addition, there was no statistically significant correlation between the extent the information respondents receive about customer requirements influence the way they operate their farm and gross farm revenue or cash surplus ($r=0.041$, ns; $r=-0.133$, ns).

Only 8 out of the 31 sheep and beef farms made sales directly to consumers and there was no significant difference in the number of farms with above median gross revenue or cash surplus between these eight farms and the farms that do not make any sales directly to customers ($\chi^2(1)=0.102$, ns; $\chi^2(1)=0.011$, ns).

Potential management system effects for the frequency of customer feedback indicator were explored, but no management system effects were detected.

## Quality

*Kiwifruit sector*

Kiwifruit dry matter was the only quality indicator used and it was only relevant for the kiwifruit sector. Orchards were divided into those whose average dry matter was above and below the median score for the participating ARGOS orchards. When these orchards were compared on their gross revenues and cash surpluses, 63 per cent of orchards with above median dry matter also had above average gross revenues and cash surplus compared to only

36 percent for orchards with below median dry matter. However, the results were not statistically significant ($\chi^2(1)$=2.143, ns; $\chi^2(1)$=2.143, ns).

A significant management system effect was found for this variable ($f(11)$=15.819, p<0.01), and the Games-Howell post hoc pairwise comparison test revealed that the Gold orchards produce fruit with significantly more dry matter than both Green and Organic orchards. However, given the properties of Gold kiwifruit this is not surprising.

## Employee relations

The questionnaire examined a number employee relations indicators including staff turnover, sickness and injury rates, pay for performance schemes and training provisions.

*Kiwifruit sector*

Thirty-three per cent orchards that completed in the questionnaire had paid staff (includes paid employees and paid family members working full-time or part-time). The number of staff members per orchard varied from one to eight, with a median value of zero and mean of 1.27. Twenty-eight of the 30 orchards participating in the questionnaire used contract labour on their orchard. There was insufficient variability in the responses from orchards on the employee relations measures to conduct a meaningful analysis. One of the 30 orchards had a staff member resign in the last 12 months; one orchard lost workdays of paid staff in the last 12 months due to sickness or injury at work; and two of the 30 orchards had a staff member on a pay for performance scheme.

Information on participation in training programmes was also collected. There was no statistically significant difference in gross farm revenue and cash surplus between orchards that had either the orchardist or a staff member participate in external/formal training in the last 12 months and those that did not have any staff members participating in external/formal training ($\chi^2(1)$=.536, ns; $\chi^2(1)$=0.00, ns). There was no significant correlation between number of training days and gross revenue or cash surplus (r= -0.059, ns; r= 0.029, ns).

Management system effects was analysed for the number of staff participating in external/formal training and training days measures, but no statistically significant results were identified. On the other hand, significant cluster effects were found for the number of staff participating in external/formal training measure ($f(11)$=4.735, p<0.05).

*Sheep and beef sector*

The sheep and beef farms used paid labour and contractors differently to the kiwifruit sector. Seventy-seven per cent of sheep and beef farms that completed the questionnaire had paid staff (paid employees and family members). The number of staff members per farm varied from one to ten, with a median value of two and mean of 2.16. Twenty-six of the 31 sheep and beef farms used contractors for labour requirements.

For turnover, seven of the 31 sheep and beef farms had paid employees resign in the last 12 months, but there was no significant correlation between turnover and gross revenue or cash surplus per effective hectare (r= -0.170, ns; r= 0.325, ns). Sickness and injury rates were also assessed and no significant correlation was found between gross revenue or cash surplus per effective hectare and workdays of paid staff lost in the last 12 months due to sickness or injury at work (r=0.151, ns; r= -0.244, ns). Pay for performance schemes were only used by 3 of the 31 farmers, so their relationship to financial performance could not be assessed. In terms of how valuable the availability of a "pay for performance scheme" would be for the farms, the results showed that there was no significantly correlation between this variable and gross revenue or cash surplus (r= 0.029, ns; r= 0.037, ns).

Finally, whether a farmer or staff members had participated in external/formal training in the last 12 months did not have a statistically significant relationship with gross revenue or cash surplus ($\chi^2(1)=0.009$, ns; $\chi^2(1)=0.045$, ns). There was no significant correlation between number of training days and gross revenue or cash surplus($r=-0.029$, ns; $r=-0.050$, ns). In addition, no management system effects were found for either of the two training measurements.

## Innovation

The questionnaire asked about several specific areas of innovation. They were asked to rate their current plant and machinery against commonly available best technology; about their plans for future investment in technology, machinery and/or equipment; whether the farm or orchard had made changes to their management system in the last two years with the aim of improving any aspect of their operation; and about the importance that they put on using information technology and computers for different purposes.

*Kiwifruit sector*

For orchardists, their perception of whether their plant and machinery was up-to-date with the best commonly available technology had no relationship with either gross revenue or cash surplus ($\chi^2(2)=1.167$, ns; $\chi^2(2)=0.00$, ns). In terms of future investment in technology, machinery and/or equipment, there was no significant difference in gross revenue or cash surplus between those orchards that planned to invest in new technology, machinery and/or equipment in the next two years and those that did not ($\chi^2(1)=0.240$, ns; $\chi^2(1)=0.240$, ns). The existence of changes in management systems in the last two years had no relationship with gross revenue or cash surplus ($\chi^2(1)=0.00$, ns; $\chi^2(1)=0.00$, ns).

The level of importance that the orchardists put on using information technology and computers for different purposes was correlated with gross revenue and cash surplus per effective hectare. No significant correlations were found between the two financial measures and financial recording ($r=0.271$, ns; $r=0.175$, ns), information seeking ($r=0.133$, ns; $r=0.116$, ns), or e-mail purposes ($r=0.268$, ns; $r=0.239$, ns).

Management system effects were explored for two indicators: to what extent plant and machinery is up-to-date with the best commonly available technology, and level of importance that the orchardists put on using information technology and computers for different purposes. No significant management system effects were revealed. However, significant cluster effects were found for the plant and machinery indicator ($f(11)=2.889$, $p<0.05$) and the importance of using ICT for information seeking ($f(11)=3.312$, $p<0.05$).

*Sheep and beef sector*

In contrast to orchards, sheep and beef farmers' perceptions of whether their plant and machinery was up-to-date with the best commonly available technology had a significant relationship with gross revenue ($\chi^2(2)=6.575$, $p<0.05$), but not with cash surplus ($\chi^2(2)=2.362$, ns). This suggests that farmers who perceive their plant and machinery to compare favourably with best commonly available technology tend to have above median gross revenue. An analysis of variance with randomised block design test was performed explore any management system effects for this measurement, but this test did not reveal a significant result.

When asked about plans to invest in technology, machinery and/or equipment in the future, there was no significant difference in gross revenue or cash surplus between those farmers

who planned to invest in the next two years and those that did not ($\chi^2(1)=0.533$, ns; $\chi^2(1)=3.044$, ns).

In terms of whether the farmers had made changes to their management system in the last two years with the aim of improving any aspect of their operation, there was no significant difference between farmers who had made changes and those who had not in the proportion of farmers having above median gross revenue or cash surplus ($\chi^2(1)=0.533$, ns; $\chi^2(1)=0.059$, ns).

The three innovation questions about the importance farmers place on using information technology and computers for different purposes did not appear to be related to gross revenue or cash surplus. The correlations between gross farm revenue and cash surplus per effective hectare, and financial recording ($r=-0.198$, ns; $r=-0.141$, ns), information seeking ($r=-0.181$, ns; $r=-0.110$, ns), and e-mailing $r=0.020$, ns; $r=0.012$, ns) were not statistically significant. In addition there were no management system effects for the three information technology measures.

## Social/environmental indicators

Social and environmental indicators cover a range of characteristics of businesses and the people involved. The indicators that were explored are reported in Table 2.

*Kiwifruit sector*

One set of questions covered the producer's support of community activities through sponsorship, monetary donations, or time. The cross tabulation results indicated that a higher proportion of orchardists who engaged in sponsorship or donation activities tend to have above median gross revenue and cash surplus (56%) than orchardists who do not engage in sponsorship or donation activities (20%). However, these results were not statistically significant ($\chi^2(1)=2.160$, ns; $\chi^2(1)=2.160$, ns). There was no significant correlation between the value placed on supporting community activities and gross revenue or cash surplus ($r=0.351$, ns; $r=0.295$, ns).

Orchardists were also asked about their participation in community groups. The cross tabulations results suggested that a higher proportion of orchardists who were involved in a community group had above median gross revenue and cash surplus (56%) than those that did not participate (20%), but this difference was not statistically significant ($\chi^2(1)=2.160$, ns; ($\chi^2(1)=2.160$, ns).

Participation in the local economy has been linked to business success. The orchardists were therefore asked about where they sourced their chemical, fertiliser, veterinary and seeds supplies. Eighty percent of orchardists obtain all their supplies locally and the variation in the dataset was thus insufficient to analyse statistically.

They were also asked whether the staff lived locally. Twenty-six of the 30 orchards had all their staff (orchardist, family, employees) living either on the orchard or locally. Another indicator of participation in society is the level of participation in national and local elections. All but one orchardist generally participated in national elections and all but three orchardists generally participated in the local elections. There was insufficient variability in the responses to conduct any meaningful analyses of these measures.

Finally, the ARGOS database contained environmental data in the form of number of earth-worms within and between rows of kiwifruit vines. For each orchard, it was established whether the average count of earth-worms was above or below the median count for all ARGOS orchards completing the questionnaire. The chi-square results did not reveal a

significant difference in gross revenue or cash farm surplus between orchards with above and below median counts of earth-worms between rows ($\chi^2(1)=0.536$, ns; $\chi^2(1)=0.536$, ns) or between orchards with above and below median counts of earth-worms within rows ($\chi^2(1)=0.00$, ns; $\chi^2(1)=0.00$, ns).

Management systems effects were explored for the earth worm and local purchasing of supplies indicators, but none were found. Cluster effects were found for the between and within rows earth-worm measure ($f(11)=6.115$, $p<0.01$; $f(11)=2.993$, $p<0.05$).

*Sheep and beef sector*

The sheep and beef farmers were also queried about social and environmental indicators. When asked whether they participate in community groups or support community activities through sponsorship, monetary donations, or time, nearly all farmers reported that they were doing this, so there was insufficient variation to conduct a statistical analysis. As in the kiwifruit sector, there was no significant correlation between the value placed on supporting community activities and gross revenue or cash surplus ($r=-0.112$, ns; $r=-0.166$, ns).

To establish to what extent the farmers participate in the local economy, they were asked about where they sourced their chemical, fertiliser, veterinary and seeds supplies. Farmers reported purchasing 70 per cent of their supplies locally, 27 per cent regionally and three per cent nationally and overseas. There was a significant correlation between percentage of supplied purchased locally and gross revenue ($r=0.419$, $p<0.05$), but not for cash surplus ($r=0.177$, ns). There was also a significant management system effect for this measurement ($f(2)=4.086$, $p<0.05$). The descriptive post hoc analysis revealed that Conventional farms purchase a higher percentage of their supplies locally than Organic and Integrated farms, but the Games-Howell pairwise post hoc comparisons was not statistically significant.

In terms of whether farmers, their families and employees lived locally, there was no significant correlation between gross farm revenue or cash surplus per effective hectare and the percentage of people working on the farm living locally and/or on the farm ($r=-0.75$ ns; $r=-0.017$, ns).

All the farmers who participated in the survey generally participated in national elections and all but one of the farmers generally participated in the local elections. The lack of variability for this performance indicator precluded a meaningful statistical analysis.

Finally, the results for the environmental indicator, measured by the average counts of earth-worms in the soil, showed that there was no significant relationship between farms' gross revenues or cash surplus and the number of earth-worms in their soil ($\chi^2(1)=1.165$, ns; $\chi^2(1)=2.286$, ns).

## Financial performance

Management system effects were explored for the financial performance data for both the kiwifruit and sheep and beef sectors. Analysis of variance for randomized block design tests revealed a statistically significant management system effect for gross farm revenue for the kiwifruit orchards ($f(2)=3.718$, $p<0.05$). Descriptive post hoc data indicate that Gold orchards have higher revenue than Green and Organic orchards, but pairwise post hoc comparison tests did not show statistically significant results. A cluster effect was also found for the cash surplus variables for the kiwifruit orchards ($f(11)=2.952$, $p<0.05$).

On the other hand, there were no management system effects for the financial data in the sheep and beef sector. Cluster effects were found for both gross farm revenue and cash surplus per effective hectare ($f(10)=9.267$, $p<0.01$; $f(10)=4.724$, $p<0.01$).

**Table 3. Cross tabulations of selected performance indicators and financial measures**

| Performance indicator | Performance indicator value | Gross revenue | | | Cash Surplus | | |
|---|---|---|---|---|---|---|---|
| | | Below median | Above median | Chi-square value | Below median | Above median | Chi-square value |
| **Kiwifruit sector** | | | | | | | |
| Social/environmental *factors* | | | | | | | |
| *Support of community activities (financial/time)* | No | 4 | 1 | $\chi^2$=2.160, | 4 | 1 | $\chi^2$=2.160, |
| | Yes | 11 | 14 | (p=0.142) | 11 | 14 | (p=0.142) |
| *Participation in community groups* | No | 4 | 1 | $\chi^2$=2.160, | 4 | 1 | $\chi^2$=2.160, |
| | Yes | 11 | 14 | (p=0.142) | 11 | 14 | (p=0.142) |
| Quality | | | | | | | |
| *Level of dry matter* | Above median | 9 | 5 | $\chi^2$=2.143, | 9 | 5 | $\chi^2$=2.143, |
| | Below median | 6 | 10 | (p=0.143) | 6 | 10 | (p=0.143) |
| **Sheep and beef sector** | | | | | | | |
| Business strategy | | | | | | | |
| *Has management plan* | No | 13 | 7 | $\chi^2$=1.165, | | | |
| | Yes | 4 | 7 | (p=0.125) | | | |
| Innovation | | | | | | | |
| *Comparison of plant and machinery with best available technology* | Badly | 11 | 3 | $\chi^2$=5.806* | | | |
| | Well | 6 | 11 | | | | |

*=p<0.05

**Table 4. Correlations of selected performance indicators and financial measures**

| Performance indictor measure | Correlation w/ | |
|---|---|---|
| | Gross revenue | Cash surplus |
| **Kiwifruit sector** | | |
| Structure of the firm - Size of business | | |
| *Number of paid employees* | 0.431* | 0.501** |
| *Total number of employees* | 0.452* | 0.497** |
| | | |
| Costumer focus | | |
| *Influence of customer information* | 0.456* | |
| | | |
| **Sheep and beef sector** | | |
| Structure of the firm - Size of business | | |
| *Number of paid employees* | | -0.426* |
| *Total number of employees* | | -0.382* |
| | | |
| Social/environmental factor | | |
| *Supplies purchased locally* | 0.419* | |

*=p<0.05, **p<0.01

**Table 5: Management system effects for selected performance indicators**

| Performance indicator | *f*-value | Description |
|---|---|---|
| **Kiwifruit sector** | | |
| Structure of the firm – size | | |
| *Number of paid staff* | 4.528* | Gold orchards have more paid staff than green and organic orchards |
| | | |
| Quality | | |
| *Level of dry matter* | 15.819** | Gold orchards produce fruit with higher dry matter than green and organic orchards |
| | | |
| Financial performance | | |
| *Gross revenue per effective hectare* | 3.718* | Gold orchards have higher gross revenue than green and organic orchards |
| | | |
| **Sheep and beef sector** | | |
| Social/environmental factors | | |
| *Supplies purchased locally* | 4.086* | Conventional farmers purchase a higher percentage of supplies locally than organic and integrated farms |

*=p<0.05,

# Discussion and Conclusions

These results suggest that caution should be used when applying conventional performance indicators to the agricultural sector. For the most part, the indicators did not appear to be related to financial performance. There are several potential explanations for this result. First, the farms and orchards in the questionnaire sample did not represent a random selection of businesses (although ARGOS research does suggest they are representative in some dimensions). If they are able to participate in the ARGOS project because they are more financially secure, then any indicator linked to more successful firms may not have sufficient variation within the sample. For example, if community participation and involvement in ARGOS are both indicative of more successful farms, then one would expect to find few ARGOS farms with low rates of community participation.

A second possible explanation is that the sample size is too small. If data were to be collected on one hundred or several hundred farms, trends in the data might become clearer and more often statistically significant.

The third possible explanation is that these indicators are not particularly useful for identifying successful farms/orchards. It may be the case that the differences between the agricultural sectors and other sectors make these indicators less relevant for agricultural businesses. In particular, farms and orchards are geographically tied, small in size and frequently family run. This limits the growth of such business. Moreover these farms/orchards are tied to the physical environment over which there is limited control. Another important factor for many farms and orchards is that their output is part of a larger supply chain and the end product is often exported. The degree of control that a single farm and orchard can have on its product is limited.

Despite these difficulties and reservations, there were suggestions of potentially significant indicators from the questionnaire, but these indicators differ between the kiwifruit and sheep and beef sectors. In the kiwifruit sector, orchard size in terms of number of staff appears to be a relevant indicator as it was positively related to gross farm revenue and cash surplus per effective hectare. In addition, customer focus may be a relevant indictor of orchard success. Orchardists who change the way they operate their orchard based on information of customer requirements had greater gross farm revenue. In the sheep and beef sector on the other hand, the farm size indicator appears to have a different effect on financial performance than in the kiwifruit sector. There was a negative relationship between the number of staff working on the farm and cash surplus. Innovation, such as up-to-date plant and machinery, may be an important indicator of financial success in the sheep and beef sector, and so may social indicators, such as obtaining supplies locally.

The results also indicate that farms and orchard with different management systems differed in some of the performance indicator measures. In the kiwifruit sector, Gold orchards appears to have a higher level of dry matter, have more staff working on the orchard, and have a greater gross farm revenue per effective hectare than orchards growing Green and Organic kiwifruit. However, whether the Hayward variety was grown conventionally or organically had little bearing on most indicators. These results highlights that the properties of the Gold variety are inherently different from the Hayward variety, for example, the Gold variety is naturally higher in dry matter than Green and Organic kiwifruit.  Hence, different performance indicators may be relevant for Gold orchards and orchards growing the Hayward variety. In the sheep and beef sector, the results revealed differences amongst the different management systems for one of the social indicators. Farmers using a Conventional

management system tend to purchase more of their supplies from local businesses than farmers using Organic and Integrated management systems.

Where a farm/orchard is located also influenced the results of many of the performance indicators, especially in the kiwifruit sector. Hence, the geographical location of agricultural businesses may also influence their success, and may be a much more important success indicator than standard business indicators.

In summary, this study indicates that many of the indicators of success relevant for conventional businesses may not be applicable to agriculture firms. Hence, there is a need to identify alternative indicators that are more relevant to agribusinesses. At the same time, it is important to recognise that different agribusiness sectors may require different performance indicators. The differences between kiwifruit orchards and sheep and beef farms presented in this study suggest that a broad-brush approach to establishing performance indicators may be misguided.

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# Appendix A – Performance Indicator Questionnaire

**1.** Does your farm/orchard have a written management/business plan?     Yes  /  No

    **1b)** If yes, approximately how many times per
year do you refer to the business plan?           _____ times/year

**2.** How valuable do you think it is for a farm/orchard to have a written management/business plan?

| Not valuable | 1 | 2 | 3 | 4 | 5 | Very valuable |
|---|---|---|---|---|---|---|

**3.** Please indicate approximately what proportion of your total sales (by value) is made directly to customers (exclude processing/distribution companies) located:

    a) Locally (less than 50 km away):            _____ %

    b) Regionally (50-150 km away):            _____ %

    c) Nationally (rest of New Zealand):           _____ %

    d) Overseas:           _____ %

**4.** How regularly does your farm/orchard get any direct or indirect information about customer requirements (this includes information directly from customers, processing/distribution companies and/or marketing companies)?

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Weekly | Monthly | Six monthly | Yearly | Less than yearly |

**5.** How much does the information you get about customer requirements influence/change how you operate your farm/orchard?

| Not at all | 1 | 2 | 3 | 4 | 5 | A lot |
|---|---|---|---|---|---|---|

**6.** Please write numbers in the table below to indicate how many people are employed to work on your farm/orchard in a full-time or part-time capacity? **DO NOT INCLUDE CONTRACTORS.**

| | | **Full-time**<br>(30hrs or more/week) | **Part-time**<br>(less than 30hrs /week) |
|---|---|---|---|
| **Paid employees** | Permanent | | |
| | Casual | | |
| **Paid yourself/family** | Permanent | | |
| | Casual | | |
| **Unpaid yourself/family** | Permanent | | |
| | Casual | | |
| **Other** | Permanent | | |
| | Casual | | |

Please note that an owner farmer/orchardist who takes drawings and does not receive a salary from the business is considered unpaid.

**7.** Do you use contract labour on your farm/orchard          Yes  /  No

**7a)** If yes, please specify the work activities (e.g. pruning, fencing) the contractors perform:

_____

_____

_____

_____

**7b)** Have you experienced any problems with your contractors (e.g. not showing up for work, poor performance) in the **last two years**? If so, please describe the problems you have experienced:

_____

_____

_____

_____

_____

**Instructions**

- In the following questions, please only consider **paid labour**.
- Please **exclude** contractors.
- **Skip to question 12 if there is no paid labour.**

**8.** How many of your permanent and casual staff members have resigned in the **last 12 months** and have they been replaced?

|  | **Replaced** |
|---|---|
| a) Number of *permanent* staff resigning: _____ | Yes / No |
| b) Number of *casual* staff resigning: _____ | Yes / No |

**9.** Please indicate approximately how many workdays were lost in the **last 12 months** due to the absence of permanent and casual staff members for the following reasons of absence?

*Permanent staff*

a) Sickness: _____ days per year

b) Injury at work: _____ days per year

c) Any other reason except bereavement
leave, annual leave and public holidays: _____ days per year

*Casual staff*

a) Sickness: _____ days per year

b) Injury at work: _____ days per year

c) Any other reason except bereavement
leave, annual leave and public holidays: _____ days per year

**10.** How valuable do you think it is for a farm/orchard to have a "pay for performance scheme" (e.g. productivity based incentives, bonuses etc.)?

| Not valuable | 1 | 2 | 3 | 4 | 5 | Very valuable |
|---|---|---|---|---|---|---|

11. How many of your permanent and casual staff members are on a "pay for performance scheme" (e.g. productivity based incentives, bonuses etc.)?

    a) Number of *permanent* staff on "pay for performance scheme": _____

    b) Number of *casual* staff on "pay for performance scheme": _____

12. In the **last 12 months** please estimate (use the table below):

a) the number of staff members who have participated in external/formal training (includes training run externally and formal training conducted on the farm/orchard).

b) the number training days for staff members (e.g. 2 days training for 3 permanent staff members= 6 days training for permanent staff).

| | Number of staff who have participated in training | Number training days |
|---|---|---|
| **Orchardist/farmer(s)** | | |
| **Other family members** | | |
| **Other staff:** **Permanent** staff (paid/unpaid) | | |
| **Casual** staff (paid/unpaid) | | |

13. How many of the individuals who work on your farm/orchard live (use the table below):

a) on your farm/orchard?

b) locally (within 10 km radius)?

| | Live on farm/orchard | Live locally (<10km) |
|---|---|---|
| **Orchardist/farmer(s) with family** | | |
| **Other staff:** **Permanent** staff (paid/unpaid) | | |
| **Casual** staff (paid/unpaid) | | |

14. In your opinion, how does your farm and orchard's plant and machinery compare with the best commonly available technology?

    Badly    1    2    3    4    5    Well

**15.** In the **next two years** are you planning to invest in new technology,     Yes  /  No
machinery and/or equipment?

**15a)** If yes, please specify what you plan to invest in and the main reason for this
investment:

| Type of investment | Main reason for investment |
|---|---|
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

**16.** In the **last two years**, have you made significant changes to your
management system with the aim of improving any aspects of your     Yes  /  No
operation (e.g. profitability, environment, working conditions)?

**16a)** If yes, please specify what you have changed and the main reason for the change(s):

| Type of  change | Main reason for change |
|---|---|
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

**17.** For the following questions, please indicate how important is it for your farm/orchard to use information technology and computers for the following purposes:

**a) Software for financial recording?**

   Not important    1    2    3    4    5    Very important

**b) Internet to obtain information used to manage your farm/orchard?**

   Not important    1    2    3    4    5    Very important

**c) Send and receive emails for business purposes?**

   Not important    1    2    3    4    5    Very important

**d) Other business purposes (1)?**
Please specify: _____

   Not important    1    2    3    4    5    Very important

**e) Other business purposes (2)?**
Please specify: _____

   Not important    1    2    3    4    5    Very important

**f) Other business purposes (3)?**
Please specify: _____

   Not important    1    2    3    4    5    Very important

**18.** Please indicate approximately what percentage of the following supplies/services your farm/orchard obtains from each of the four types of area:

| Area type | Chemicals | Fertilisers | Veterinary | Seeds | Other Specify: |
|---|---|---|---|---|---|
| a) Locally (less than 50 km away): | % | % | % | % | % |
| b) Regionally (50-150 km away): | % | % | % | % | % |
| c) Nationally (rest of New Zealand): | % | % | % | % | % |
| d) Overseas: | % | % | % | % | % |

**19.** Approximately what distance would you have to travel from your farm/orchard to each of the following:

a) Source of general household supplies that you run out of or are not delivered: _____ km

b) Your bank: _____ km

c) The nearest post office: _____ km

d) Your family's medical services: _____ km

**20.** In the **last 12 months** has your farm/orchard put any money into sponsorship of, and/or donations to, and/or time into any community activity?          Yes  /  No

**20a)** If yes, how important is it to you to put any money into sponsorship of, and/or donations to, and/or time into any community activity?

Not important          1          2          3          4          5          Very important

**21.** Do you generally participate in local and national elections?

a) Local elections:                    Yes  /  No

b) National elections:                    Yes  /  No

**22.** Do you participate in any of the following (please tick):

Service clubs (e.g. Rotary, Lions): _____

PTA, school associations or fundraising for school(s): _____

Business organisations: _____

Local council meetings: _____

Hospital/medical organisations/trusts: _____

Festivals, shows (e.g. A&P): _____

Fire service: _____

Senior citizen or other care agencies: _____

Church participation: _____

Sports coaching: _____

Community hall activities (e.g. maintenance): _____

Other:_____ _____