Key Performance Indicators on Dairy Farms

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Abstract

The aim of this paper is to present a method for identifying key performance indicators (KPIs), and to present and discuss a set of such indicators suitable for benchmarking on dairy farms.

Data were collected from the Norwegian Dairy Herd Recording (NDHR) and the Norwegian Dairy Financial Recording (NDFR) databases for 2000 and 2001.

KPIs can be used to recognize differences in economic efficiency between farms. To rank farms according to efficiency two indices are calculated using Data Envelopment Analysis (DEA). One is based on gross margins, and the other on gross margins including subsidies less fixed roughage costs. To identify the correlations between KPIs, principal component analysis and multiple regression are applied.

A total of 26-27 KPIs were detected. Some important KPIs were:
-gross roughage costs (variable and fixed roughage costs)
-milk income minus variable feed costs
-meat produced per cow
-consumption articles (detergents, brushes, flypaper and so forth)
-milk yield per cow
-meat income minus variable feed costs
-livestock purchased
-quota filling
-roughage yield

In general both fixed and variable feed costs, and the difference between milk income and variable feed costs were the most important KPIs.

Keywords: Key performance indicators, benchmarking, efficiency, economic performance, gross margin

Introduction

Background

One of the intentions of this paper is to improve the value of the extension service in dairy production in Norway. The service offered by the extension service may be described as performance benchmarking on farms. Benchmarking compares performance with that of others engaged in a similar activity and learning from the comparisons that follow (Ashworth 2002). Benchmarking requires the measurement of aspects of the production process. These are used to generate quantitative key performance indicators (KPIs), which describe the competitive performance and the production process achieved and used by the average and best farms (Collis & Franks 2003). The quality of the work provided by the extension service is dependent on the relevance of the indicators used.

The general intention of benchmarking is to enable profit to be maximised by optimising inputs and outputs (Collis & Franks 2003). An outcome of benchmarking is the adoption of better practices that in turn should result in improved profit. Sufficient KPIs need to be available to allow the competitive status and the process used to achieve that performance to be identified. The focus is on the initial steps, which provide the necessary background for performing the benchmarking on individual farms.

The task is to find KPIs that;

- measure the level of achievement from a specific resource
- are based upon the economic influence they carry
- contain information about an individual business's strengths and weaknesses
- describe the production process achieved and used by the average and best farms

Suitable farms for comparison must have:

- similar types of farms/enterprises
- similar opportunity regarding portfolio of income sources
- similar sized units

In the next section we briefly discuss related studies. Then we divide our task into its two main components; (i) ranking farms according to performance, and (ii) searching for key factors that determine these rankings. Under (i) we also discuss how our ranking method is related to profit maximization. The data is then presented. Then we describe the methods used, both when ranking farms and when determining key performance indicators. Finally the main results from the study are presented and discussed.

Previous studies

Investigating the differences in farming success is not a new issue. Research over more than 90 years has not come up with a good explanation why results differ between farms (Fox et al. 1993). One reason might be that success can be measured in many ways and by many factors, and farmers put different weight on different factors. Success is therefore a subjective measure (Olsson 1989). Alternatively, success depends on subjective alternative-values of resources used in production.

Fixed costs such as labour costs, interest and depreciation vary a lot between Norwegian dairy farms (Giæver et al. 1995). Low variable costs in general, and more specifically low feeding costs such as concentrate costs, variable roughage costs and costs for other purchased

feedstuffs, are important for obtaining a high gross margin (Flaten & Giæver 1998, Rougoor et al 1999, Cunningham et al 1998, McGilliard et al 1989, Williams et al 1987, Pritchard & Smith 1987, Farrar & Franks 1998). In a production system with milk quotas, a reduction in the roughage price will increase the use of roughage and decrease the use of concentrate, and vice versa (Flaten 2001). Pasture use is reported to have a positive effect on variable costs compared to hay and silage (Williams et al 1987). Increased beef production per cow increases profitability (Flaten & Giæver 1998, Hansen et al. 2000). A significant part of the beef production in Norway is from dairy herds. With low profitability in beef production, it is often profitable to reduce the number of bulls to increase milk production through quota purchasing (Flaten et al 2003). In Norway it was possible for farmers to buy milk quota in 2001, but not in 2000.

A moderate level of milk yield per cow can give the highest gross margin per litre of milk under Norwegian conditions (Flaten 2001). Hansen et al. (2000) found no relationship between milk yield and gross margin per litre. Rougoor (1999) reports a negative relationship between milk yield and gross margin per litre, and also a negative effect of large quota per ha and gross margin per litre. Mc Gilliard et al (1990) found an economic optimum at approximately 8200 litres per cow under American conditions, while Pritchard & Smith (1987) report increasing gross margin with increasing milk yield. High milk yield alone does not automatically generate a high net margin (gross margin less fixed costs) (Farrar & Franks 1998). There is little difference in gross margin per litre of milk between groups of farms with different milk yield (Farrar & Franks 1998).

A positive effect of increasing herd size on gross margin per cow is reported by Mc Gilliard (1990), while Hansen et al. (2000) found no such effect. Farrar & Franks (1998) found that the top 25 percent of the farms with respect to gross margin per litre milk were slightly smaller than the average herd size. However, when fixed costs were taken into account, the smaller herds were at a disadvantage because of their relatively high labour input. There is a positive effect on gross margin from good fertility status in the herd (low culling rate due to fertility problems, low age at first calving, high conception rate to first service, short calving interval) (Rougoor et al. 1999, Williams et al 1987, Pritchard & Smith 1987, Dijkhuizen et al 1985, Mourits 2000, Hansen et al. 2000). Reproductive disorders also effect milk yield per cow negatively (Fourichon et al 2000). Gross margin is also positively affected by good health status in the herd (low culling rate due to health problems, few veterinary treatments per cow, low veterinary costs) (Rougoor et al 1999, Hansen et al. 2000, Williams et al 1987) The average yearly loss due to mastitis in Norwegian dairy herds is NOK 0.144 per litre of milk (Forshell & Østerås 2002).

While Hansen et al. (2000) found no significant impact on gross margin from milk quality, a positive impact from low cell count in milk on profitability is reported by Williams (1985). A positive effect on gross margin from high milk price is also reported by Pritchard & Smith (1987).

These studies are based on explaining differences in certain economic variables that we expect are related to profitability. To sum up the following factors might be KPI-candidates under Norwegian conditions:

- low depreciation and interest costs on machinery and buildings
- low feeding costs in general, particularly concentrate costs
- low variable costs in general, including roughage and veterinary/medicine costs
- moderate milk yield

- good fertility status in the herd, with short calving interval
- low cell count in milk
- low culling rate on cows
- low age at first calving
- high milk price.

Efficiency studies applying either data envelopment analysis or stochastic frontier functions typically focus on investigating efficiency changes over time, or the current level of efficiency (Kumbhakar & Heshmati 1995, Bravo-Ureta & Rieger 1991, Thiele & Brodersen 1999, Tauer 2001). However, a literature review shows surprisingly little research undertaken to highlight the underlying causes of efficiency at farm level. Sipiläinen (2004) reports that although profitability and efficiency were related to the size of farms, changes in productivity and efficiency did not necessarily coincide with the growth of farms.

Identifying key performance indicators

KPIs are intended to be tools to understand and explain performance. Before we can identify KPIs, the initial step is to measure farm performance. Our starting point is profitability.

Profitability

The actual profitability of the farms is not recorded in the data sample. The most aggregated economic information in the data source is gross margin including all subsidies and after deducting the fixed cost of roughage production. We have defined this as the "extended gross margin". When comparing gross margins, one can put to one side some of the disadvantages of small herds, particularly the relatively high use of labour (Farrar & Franks 1998). This enables a more critical examination of the efficiency of milk production in relation to the main variable costs over which the farmer has more managerial control (Farrar & Franks 1998). Additionally it might be argued that gross or net margin, when measured per cow, has less relevance when the ultimate limiting factor is not necessarily hectares of land or cowshed capacity, but the amount of milk that can be produced.

Making farm results comparable

One problem with accounting data, as net income or extended gross margin as indicators of short run profit, is that a large part of the variation is due to the scale of the operation. The amount of fixed factors may explain these differences, but such factors are highly correlated, and it is often difficult to determine the actual contribution to profit from the different fixed factors. Therefore the dependent variable is often a result per unit, i.e. gross margin per litre of milk delivered.

As an alternative we have based the ranking of farms on the ratio between observed efficiency values and optimal efficiency values given the fixed factors as shown below. This ratio can be expressed as the efficiency with respect to short term profitability of firm i (E_i):

$E_i \equiv \frac{\pi_i}{\pi_i^*}$, where the numerator is the observed farm efficiency and the denominator is the optimal farm efficiency. The method allows us to compare farms that are similar with respect to several resource uses, instead of using a ranking dependent on one resource (milk quota) only, as gross margin per litre of milk.

In this paper a particular farm is not benchmarked against its potential. The focus here is on factors that in general are essential in explaining differences in efficiency among farms. *In our definition KPIs are synonymous to causes of differences in economic efficiency.* We therefore use E_i as the dependent variable and try to explain differences between firms to identify central KPI candidates. As pointed out in Hansen and Stokstad (2004) the efficiency indices removes the effect of differences in meat production potential between farms, and therefore makes the results comparable.

Material

Data

Data were collected from the National Dairy Herd Recording (NDHR) and the National Dairy Financial Recording (NDFR) databases for the years 2000 and 2001. The NDFR contain both biological and economic data. Approximately 10 percent of the milk producers in Norway participated in NDFR in 2000 and 2001. Both the NDHR and the NDFR are important tools for the extension services in the dairy companies. In the year 2000, 2110 farms participated in NDFR, and 2021 in 2001. Inclusion criteria in the study population was membership in the NDFR either in 2000 or in 2001. Altogether 195 farms were excluded in 2000, and 110 in 2001. The final study population consisted of 1915 farms in 2000 and 1911 farms in 2001. Exclusion criteria were taking part in a joint operation, or leaving such operations, during the study period. Also farms with obvious irretrievable erroneous recordings, of a kind that might affect the results, were excluded. The reference population consists of all Norwegian dairy farmers. This is the goal population to which the results are related. A comparison of the study population and reference population in 2000 showed that a larger percentage of the farmers in the eastern and middle part of Norway took part in NDFR than in the western and southern parts. Only 3.5 % of the farms in Northern-Norway took part, while the average was 10.5 %. The study population was found to be representative of all Norwegian dairy farms.

Data source, performance

Previous analyses of the economics of dairy farming has been based on calculated gross margin. Data for gross margin including all subsidies, less fixed costs in roughage production, is also included in NDFR since 2000. This measure is more in line with short run profitability, thus we use it as an indicator of short run profitability, and define it as extended gross margin. In order to compare our results with previous analyses, we also use gross margin as a measure of short run profitability to contrast these two measures.

Short run profitability of a farm does not make sense without relating it to use of fixed resources. We have assumed three fixed resources;
i) milk quota, ii) building capacity and iii) acreage in use.

Acreage includes both tillable land and fields used only for grazing. The database does not record building capacity. Therefore the capacity is measured as the average building acreage necessary to keep the number of cattle reported in the NDHR in the beginning and the end of the year. Unfortunately we lack data on use of labour. Such data should either have been deducted from the extended gross margin, or treated as a fixed resource.
Farm management is found to be a crucial factor in explaining farm production- and financial results (Agger, J.F. et al 2004, Olsson R. 1989, Bigras-Poulin et al 1985, Kay et al 1999, Cowen et al 1989). Unfortunately our database lacks data which describe the managerial abilities of the farmer (Rougoor 1999).

Method

This section is divided in two. First, Data Envelopment Analysis (DEA) used to rank farms, is explained. Then we describe the analysis leading to a regression model that rationalises the variation in ranking of farms.

Data Envelopment Analysis

DEA is used to calculate relative performance of decision-making units. DEA is one way to identify the model farms that perform best, as in Lund & Ørum (1997) and to measure other farms' relative performance given the same use of resources. Ranking of farms by DEA requires that outputs and inputs from the farms are defined. As output we use our proxy for short run profitability (E1 for GM and E2 for extended GM), and inputs are the fixed resources: milk quota, acreage and cowshed capacity. These fixed resources represent key constraints for farms. Farm efficiency indices are explained by a set of economic and production variables. As dependent variables two indices are used:

-E1, based on the profitability measure gross margin
-E2, based on the profitability measure extended gross margin

These are the main variables in this paper.

We calculate product- increasing efficiency. This implies that the efficiency criterion measures the level of short run profitability on the actual farm, compared to the best farms with the same use of resources. The efficiency measures may be calculated with various assumptions regarding returns to scale. Plots of the data show little connection between gross margin per litre of milk and quota size. With no scale- related subsidies or fixed costs included, this is as expected. When computing E1, which is based on gross margin in relation to the three different inputs, we therefore use constant returns to scale. However, when computing E2, which is based on extended gross margin as output, we assume variable returns to scale. In the extended gross margin subsidies are included, and they vary significantly with scale.

The DEA measure used in a two stage process

The computed efficiency values are sensitive to errors in the 'frontier' farms. We assume that these observations are reported without errors and that linear combinations of them represent profit-maximizing behaviour. They are the farms which others are scaled against. A small number of farms are efficient, thus we have made sure that these farms on the frontier represent farms that can be reproduced, for example uses feed that is available to other producers. Further the farms on the frontier were thoroughly checked for missing data, typing errors or obvious erroneous recordings. The DEA-method provides an efficiency score that is easy to relate to for the individual unit. In addition, the initial step in the statistical analysis requires that we can rank farms to study possible nonlinear scale impact. This two-step method allows us to use the main variable of interest (relative performance) as the rank instead of the observed financial result.

Statistical analysis

In order to identify the key performance indicators we build on the ranking obtained in the DEA-analysis. The dataset consists of several variables that are causally dependent. We start

out with 86 variables. These variables are financial variables (per litre or cow) used in the calculation of extended gross margin, and production variables regarding feed use/strategy, product quality, health status, fertility and production method. Due to different levels of aggregation in potential explanatory variables, highly correlated variables, large numbers of variables and interaction effects, we have applied principal component analysis (Johnson & Wichern 1992).

Due to the number of independent variables available compared to the number of farms included, it is necessary to divide the dataset for the farm as a whole into item related categories. These are as follows:

- Strategy milk (litres milk delivered, milk yield per cow etc.)
- Animal health
- Feeding and feedstuffs
- Fertility
- Breeding
- Milk quality
- Meat production
- Incomes
- Variable costs and gross roughage costs
- Milk minus feed and meat minus feed

For each of the two dependent variables, the total material was divided in four equal parts related to the quartiles of the efficiency index. The multivariable analysis then was performed in the following steps:

a) The independent variables within each subject were included in a one- way analysis of variance for comparison of the four efficiency quartiles. Variables obviously increasing or decreasing over the quartiles were specially marked for inclusion in the further analysis.

b) Principal component analysis and correlation analysis within each quartile was used to detect the relationship between the independent variables and between the independent and the dependent variables.

c) Within each set of variables listed above, variables with obvious increasing or decreasing trends in the single variable analysis were included in a multiple regression model (Lewis-Beck M., 1980) with the aim of explaining and expressing the dependent variables E1 and E2. In this analysis, both interaction effects and polynomials of second degree were tried.

d) The selected independent variables from each regression model within subjects were then put together in a final multiple regression model aiming to explain and express the dependent variables E1 and E2. Only variables x_i which contribute linearly were included in the final model as a variable x. In addition to a linear impact both interactions and polynominals of second degree were tried. We also included a short list of other possible interaction variables z_k that we suspected had an impact, or are used as relevant indicators even though they fell out in earlier stages. The total model was reduced to the final model by requiring a significance level of 10 % while reducing the model.

e) In order to determine each variables contribution to the overall R^2, a “leave one out” - technique was applied. One variable, including it`s polynomials and interactions, was withdrawn from the full regression model. The reduced model then was run, and the percentage reduction in R^2 used as an expression of the variables total explanatory power. The full model then was re-established, and the same procedure repeated for each variable. Finally the variables were ranked in descending order.

Results

Models predicting E1 and E2 in 2000 and 2001

In Table I below, variables contributing linearly in the final regression model predicting E1 in 2000 and 2001 are shown. Table II gives the results for the final regression model predicting E2. Each variables contribution to the total explanatory power (R^2) of the model is calculated using the leave-one-out technique described above. The contribution to R^2 in percentage terms is reported in Table I and II.

Table I. Explanatory power (R^2) of variables which contribute linearly to explaining E1 in 2000 and 2001. The effects of the interactions each variable takes part in are also included. The direction of the linear contribution is shown in the rightmost column.

Variable	Contribution to R^2 in 2001 %	Contribution to R^2 in 2000 %	Direction of linear contribution (+/-)
Regional subsidy	24.9	26.1	+
Milk minus feed	12.9	22.1	+
Milk yield per cow	7.5		+
Kg meat per cow	7.2	5.2	+
Livestock purchased	6.2		-
Compensations	3.3	4.1	+
Meat minus feed	3.1	4.7	+
Concentrate costs	2.5		-
Age first calving	2.4	2.6	-
Consumption articles	2.1	7.7	-
Variable roughage costs	2.0	2.5	-
Veterinary/medicine costs	1.4	3.2	-
Roughage yield	1.3	6.5	+
Calves from breeding bulls	0.9		+
Gross roughage cost	0.9		+
Livestock subsidy	0.7	2.1	-
Insemination costs	0.7		-
Protein %	0.5		-
Inseminations per cow	0.5		+
Calving index	0.3		+
Production loss mastitis	0.2		-
Mastitis treatments	0.1		-
Quota filling		6.8	+
Summermilk, %		2.3	-
Culled cows		2.1	-
Fertility status		1.4	+
Quality payment		0.6	+
Total	81.6	72.4	

Table II. Explanatory power (R^2) of variables which contribute linearly to explaining E2 in 2000 and 2001. The effects of the interactions each variable takes part in are also included. The direction of the linear contribution is shown in the rightmost column.

Variable	Contribution to R^2 in 2001 %	Contribution to R^2 in 2000 %	Direction of linear contribution (+/-)
Gross roughage costs	21.3	24.5	-
Regional subsidy	10.3	15.1	+
Kg meat produced	7.7		-
Milk minus feed	6.0	9.1	+
Litre milk delivered	5.5		+
Milk yield per cow	5.5		+
Livestock subsidy	4.9	8.5	-
Acreage subsidy	4.0		+
Quota filling	3.0	4.1	+
Consumption articles	2.2	3.0	-
Insemination costs	1.3	0.7	-
Other feedstuffs	1.2	1.4	+
Veterinary/medicine	1.2	1.2	-
Meat minus feed	0.1	2.1	+
Calving index	0.1	0.9	+
Concentrate deviation	0.1	0.4	-
Calving interval	0.1		+
Production loss mastitis	0.1		-
Protein %	0.1		+
Compensations		1.6	+
Hay %		0.8	+
Fat %		0.7	-
Fertility status		0.6	+
Culling other diseases		0.4	-
Age at first calving		0.4	-
Milk fever		0.3	-
Total	74.7	75.8	

The variable fertility status in the two 2000 -models was substituted by five singular components in the 2001-models. One of these components, number of inseminations per cow, enters the E1-model in 2001, and a second, calving interval, enters the E2-model in 2001.

Discussion

In general there is a high degree of accordance between the models in the two years for both E1 and E2. The majority of the variables are identical, and the direction of the contribution of each variable is the same in most cases. Altogether 11 variables from a total of 16 in the E1-model in 2000 also enter the 2001-model. The corresponding numbers for the E1 and E2-models in 2000 are 19 and 12. The relative importance of each variable varies between years. For instance roughage yield has larger influence on E1 in 2000 than in 2001. However, on average there was little difference between average roughage yield on the studied farms in the

two years. Both models in 2001 have a larger number of variables and therefore are more complex than the corresponding models in 2000. As a result of this, the contribution from each variable is lower in 2001 compared to 2000. Nearly half the number of variables in the E1-model in 2001 contributed less than 1 % each. Year 2000 was a year with a low profitability in general, due to low product prices, while in 2001 both milk and meat prices increased (NILF 2002). In addition, a minor increase in milk quota was also possible in 2001.

The dependent variable E2 is based on reported gross margin less fixed costs and including direct subsidies related to the resource use. Gross roughage costs is a dominant variable which explains 21.3 % in 2000 and 24.5 % in 2001. Gross roughage cost is a highly aggregate variable which consist of depreciation, maintenance of machinery and roughage store, other fixed roughage costs such as electricity, fuel, machinery insurance and hired labour used in roughage production. The marginal impact of a change in a variable may be measured in the direct impact and the indirect impact, the latter depending on the size of different interaction variables.

Regarding gross margin, the direct and indirect marginal impacts are about the same size and negative. This suggests that to some extent there may be reasons for higher costs, but in general gross roughage cost is a central KPI. Gross roughage cost is also one of the potential variables used to explain variation in E1. Fixed costs in roughage production are not included in the gross margin, however the gross roughage cost enters the final equation in 2001, while the explanatory power is only 0.9 %. A likely explanation for this inclusion is that gross roughage cost is highly correlated with other variables explaining variation in E1.

Comparing fixed costs among farms is not straightforward, and therefore the results have to be interpreted with care. Comparing results require that we make some assumptions regarding comparable labour and capital requirements. Capital can partly substitute for labour, and labour is not included in our study. Including labour in the efficiency index might therefore influence the ranking between farms. Other problems regarded comparing fixed costs refer to which phase the farm and farm family is in, and to natural conditions. Since depreciation is included in the fixed costs, farmers who have made large investments lately are likely to be worse off than farmers who have put their expansion period behind them. Large differences in natural conditions might also effect the level of fixed costs. However, the results tell us that farmers should put effort in keeping their roughage costs low in order to be effective. For a dairy farmer, this stands out as one of the most important subjects to pay attention to. The significance of roughage related fixed costs in dairy production is in accordance with the findings of Farrar & Franks (1998).

Regional subsidy measured in NOK per litre of milk is also an important explanatory variable in all four equations. Regional subsidy paid per litre of milk and kilogram of meat varies between regions, and the value is influenced by the relative amount of meat against milk and the region. Therefore a negative interaction with meat production per cow or variables correlated with meat production per cow is as expected. The intention with this subsidy is to partly level out production costs between regions. These are costs not included in the gross margin (building costs, labour requirement due to lower crop yields). Regional subsidy differences explains a large part of the variation in E1 (24.5% in 2000 and 21.3 % in 2001). These shares are reduced to 15.1 % in 2000 and 10.3 % in the following year when explaining variation in E2. This is as expected since a larger share of the relevant costs are taken into account. Regional subsidy is not a potential variable to use as a KPI, but it is an interesting variable to include to explain differences between regions.

Concentrate use is to a certain extent interchangeable with forage use, so a useful measure of the efficiency of both concentrate use and forage use is milk income less variable feed cost in milk production per litre milk (Milk minus feed). Milk minus feed is a significant variable in all equations. It is the clear number two with 22.9 and 12.1 % of the variation in E1. The marginal impact of this variable is mainly the direct impact. The importance is somewhat reduced regarding variation in E2, with an explanatory power of 9.1 percent and 6.0 percent in 2000 and 2001. The relative importance of milk minus feed increases when milk price is low. In addition, the direct impact of this variable reduces and the indirect impact is negative when interaction with gross roughage cost per litre milk is taken into account. Feed costs include variable roughage costs, concentrate costs and variable costs with other feedstuffs. Under Norwegian conditions, variable roughage costs per Feeding Units milk (FUm) are significant lower than concentrate costs. Normally substitution is therefore profitable. The degree of substitution depends on the roughage quality. Good quality roughage in sufficient amounts appears to be an important strategy to maintain efficient milk production. Farrar & Franks (1998) apply a similar aggregate variable as in the present study, margin over feed and forage. Margin over feed and forage is the value of milk output less the cost of concentrates, bulk feed and forage variable costs. Farrar & Franks (1998) report a significant impact of margin over feed and forage on gross margin per litre. The herds with the highest margin over feed and forage fed fewer concentrates and more roughage per litre milk produced, thus achieving a lower feeding cost. The findings in the present paper indicate that milk minus feed is of significant importance, and therefore strongly support the findings of Farrar & Franks (1998). The results of Pritchard & Smith (1987) also indicate that it is the difference between milk price and feed costs which is crucial, and not so much the milk price or feed costs separately.

In addition to milk minus feed, both concentrate cost per litre of milk and variable roughage costs per litre of milk contribute to efficiency. The negative effects of high concentrate and variable roughage costs support the findings of Rougoor et al (1999), Cunningham et al (1998), McGilliard et al (1989), Williams et al (1987) and Pritchard & Smith (1987).

Consumption articles, often thought of as being unessential, play a significant role in explaining efficiency in all four models. On approximately 25 % of the farms in 2001 consumption articles constituted more than 0.18 NOK per litre of milk. The interaction with other variables suggests that feed production method and more use of roughage for milk production may reduce the negative impact of high expenditure in this cost group. Farrar & Franks (1998) also report relatively large differences between herds in expenditure on dairy sundries per cow.

Milk yield per cow enters the final regression models both for E1 and E2 in 2001, but is suppressed by percentage quota filling in 2000. Flaten (2001) concluded that moderate milk yield per cow often turned out to be the most profitable under Norwegian conditions. In this perspective it is a bit surprising that milk yield explains as much as 7.5 % of the variation in E1 in 2001. In Hansen et al. (2004) it is shown that the 314 farms which increased their efficiency index most from 2000 to 2001, also increased their delivery of milk most. With cowshed capacity as a fixed resource in the short run, there are two main routes to increase milk delivery. One can either increase milk yield per cow, or rebuild stall for bulls to replace bulls with cows, or do both. As mentioned above, Flaten (2004) found it often profitable to buy milk quota and replace bulls with cows. Purchasing of quota did not take place in Norway in 2000, but in 2001 it was possible to buy quota. This might explain why milk yield per cow turned out to be an important variable in 2001. While Rougoor et al. (1999) report a negative effect of milk yield on gross margin per 100 kg milk, no such effect is reported here. When

comparing the findings one must have in mind that the average milk yield in the Netherlands is significantly higher than in Norway, and this might explain the difference. A similar argument can be applied when comparing with McGilliard et al (1990), who report a negative effect on net cash income per cow above 8200 litres per cow.

Meat minus feed and kg meat produced per cow appear to be the two most significant variables with respect to meat production in both years. Meat minus feed is meat income less variable feeding costs, a parallel to milk minus feed in milk production. It is a good proxy for profit per kg meat produced. However, when interpreting the results one has to have in mind that a number of farms were left out in the analysis due to missing data with respect to meat production.

Veterinary costs and insemination costs both contribute linearly and negatively in explaining efficiency in all four models. Of all 12 different health variables tried, the aggregate variable veterinary/medicine cost turns out to be the most significant in predicting efficiency. The reported significance of low veterinary/medicine expenditures is in accordance with findings of Williams et al (1987) and Farrar & Franks (1998). In the present paper both insemination costs and fertility status were found to be important key performance indicators. Fertility status is an aggregate variable consisting of the following elements; number of services per conception, days from last insemination to calving, non return percentage after 60 days, involuntary culling due to fertility problems, and number of inseminated cows and heifers. The negative economic impact of reproduction problems reported in the present paper support the findings of Williams et al. (1987), McGilliard et al. (1990) and Rougoor et al. (1999).

In the NDFR insemination costs are included with extension service costs from TINE*. To interpret the results therefore is not straightforward, one variable presumably negating the other.

Age at first calving is found to have a negative impact on economic efficiency. This finding supports those of Mourits (2000), Williams et al. (1987), Pritchard & Smith (1987) and McGilliard et al. (1990).

Final comments

In an empirical study we are limited to investigating the importance of differences we find in the dataset. We have identified variables that may help explain the variation found in the dataset. Although we found the dataset to be representative for all Norwegian dairy farms, there will always be farms where the relative importance of the KPIs will differ from our ranking. That is, on farms with large acreage and cowshed capacity relative to quota, it might be profitable to put less weight on milk yield per cow than is evident in our study. One might also find farms with severe animal health problems, so the starting point for benchmarking is therefore far more easily perceptible than what our study suggests.

A natural follow up from this study would be to investigate KPIs which describe the managerial processes behind the KPIs identified in the present paper. This would operationalize the KPIs and enable an in depth development of an “improvement action plan”. Therein lies the key to the full utility of benchmarking activities and expanding the use of this technique into practice.

Acknowledgements

The Norwegian Research Council is acknowledged for financial support.

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A Comparison of Farm Incomes and Wealth in Canada

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Abstract

The five major agricultural producing provinces are compared in terms of farm labour and management incomes, return on investment to farm capital, total farm family income, and farm family net worth. In each province, comparisons are made with non-farm incomes, investment returns and net worth levels. The results show that farm family incomes in Canada are much better today than 30 years ago, returns on farmland investment are very comparable to average stock market returns, and average farm family net worth is significantly higher than the average for all families. The conclusion is that Canadian farmers are not in need of more government subsidies but rather need help in managing risk and smoothing out their farm incomes over time.

Key Words: Farm labour and management income, return on invested farm capital, real commodity prices, farm family income, off-farm employment, farm family net worth.

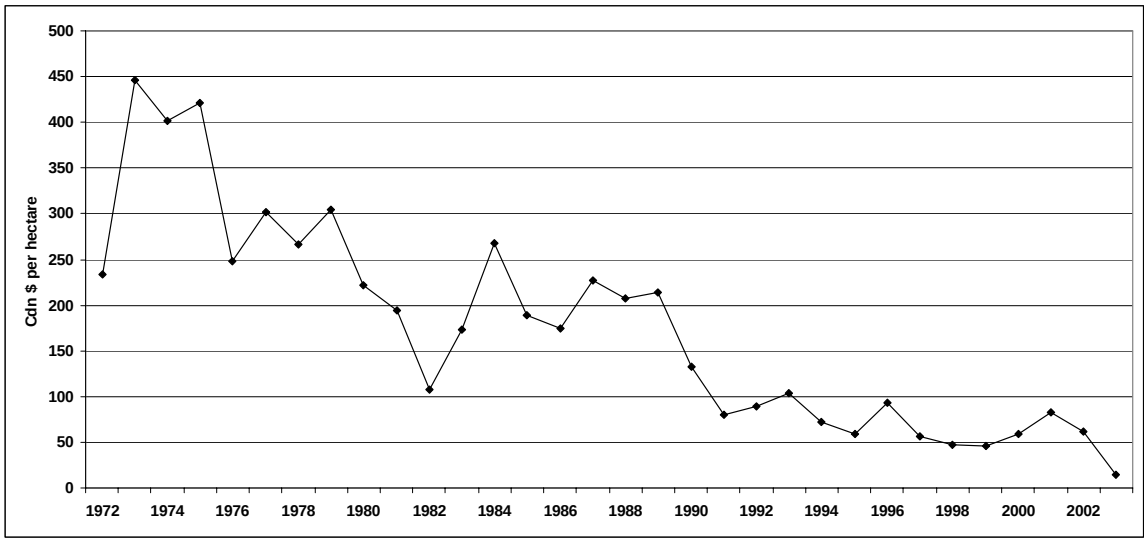
Introduction

Each year, Canadian farm lobby groups produce new charts and figures that indicate there is a growing farm income crisis in Canada. Usually the information compares farm incomes or farm commodity prices from the 1970's with incomes and prices today and the comparisons would lead most observers to conclude that farmers are going broke, or at least living in poverty. For example, a common presentation made by Canadian farm lobby groups includes the 1973 price of wheat[1] ($161 per tonne for hard red spring and $236 per tonne for durum)

[1] Source: Saskatchewan Agriculture, Food and Rural Revitalization. These prices are Canadian Wheat Board Final Prices, basis in store Saskatoon, Saskatchewan. All figures are reported in Canadian dollars.

inflated to the present day using the Canadian consumer price index (CPI). If wheat prices had increased by the average CPI each year since 1973, in 2003 hard red spring wheat would have been priced at $695 per tonne and durum at $1,020 per tonne. But actual prices in 2003 for hard red spring and durum were only $202 and $212 per tonne, respectively. Similarly, Figure 1 illustrates the change in average net farm income in the province of Ontario[2] over the last 30 years, showing average net farm income of $446.15 per hectare in 1973 but only $14.06 per hectare in 2003 (comparison in 2003 Cdn $). Both of these illustrations make it appear that Canadian farm families have faced a severe downward slide in family incomes. Farm lobby groups use these illustrations to press their case for larger farm subsidies from both the federal and provincial governments.

Figure 1: Average Net Farm Income/hectare in Ontario (2003 Cdn $) 1972 - 2003



There are several problems associated with using commodity prices and net farm incomes as indicators of farm financial health. First, declining real commodity prices have been offset by increasing technological efficiencies, such as new fertilizers and seed varieties that have increased average yields, and improved machinery and equipment that allows individual farmers to manage many more hectares than they could have 30 years ago. Secondly, the lobby groups usually do not report the extent to which farm families have adapted to declining commodity prices by increasing farm size and/or by diversifying to off-farm sources of income. And thirdly, reported net farm income in Canada can be misleading and is not an accurate reflection of returns to farm labour, management and capital invested. For

[2] Ontario has been illustrated here but each of the other provinces in this study show a similar pattern for net farm incomes.

Canadian farm financial data, net farm income is calculated as follows:

Gross farm cash receipts (including Government program payments)

Less: Gross cash operating expenses

Equals: Net farm cash income

Less: Depreciation on building and equipment

Equals: Realized net farm income

Less: Value of inventory changes (can be plus or minus, depending on whether inventories have increased (+) or decreased (-))

Equals: Net farm income

It is important to note that in the calculation of net farm income, no allowance is made for farmers' labour and management efforts, although one of the expenses is wages, which may be paid to family members or hired hands. Also included in expenses are rents, interest on land and building debt, property taxes, and depreciation on buildings, all of which are associated with the return on capital invested in land and buildings. Therefore, the first step will be to calculate adjusted net farm income, of which part will represent farm labour and management income and the rest the return on invested farm capital. Then, the analysis will assess the financial health of Canadian farm families, for the major agricultural producing provinces of Alberta, Saskatchewan, Manitoba, Ontario, and Quebec. The study objectives are;

1. Calculate adjusted net farm incomes in each province and disaggregate into two streams; a) labour and management income, and b) return to invested capital in land and buildings.
2. For each province, average farm labour and management income is compared to average employment income for the province for the past 30 years to assess whether farmers are being underpaid for their labour and management efforts. Similarly for each province, the average yield (%) on invested farm capital is compared to average yields on various stock and bond markets, domestically and internationally, to assess whether farmers have kept pace on the investment side.
3. Total income comparisons are made between the average for farm families and that average for all families to determine whether farm families are relatively better or worse off today than they were 30 years ago. This comparison is also used to discuss what farm families have done to offset declining commodity prices.
4. Average farm family net worth is compared to average net worth for all families to assess whether farm wealth levels have been improving or getting worse, relative to the population average.

Methodology and Data[3]

Data for farm income and expenses, farmland values, average farm size and number of farmers for each of the provinces throughout the study period (1972 – 2003) is derived from the provincial departments of agriculture; Alberta Agriculture, Food and Rural Development, Saskatchewan Agriculture, Food and Rural Revitalization, Manitoba Agriculture and Food, Ontario Agriculture and Food, and Ministere de l'Agriculture in Quebec[4]. The main part of the methodology is in disaggregating adjusted net farm income into two components; labour and management income and return to capital invested.

Return on Invested Farm Capital (ROI)

The return on investment[5] to farmland ownership[6] is based on a standard crop share lease agreement which provides one-third of the gross receipts to the lessor (farmland owner) up to 1985, after which the crop share is reduced to one-quarter. The reduction in crop share to the lessor was a market reaction to increasing input costs without corresponding increases in commodity prices (Painter, 2000). The lessor[7] is then responsible for paying property taxes and depreciation on farm buildings. The crop share lease agreement represents the most common form of rental agreement in western Canada over the past 35 years.

The net lessor crop share/hectare (NCS) in each province is calculated as follows:

$$NCS_t = CS_t - PT_t - BD_t \quad (1)$$

where,

NCS_t = net crop share/hectare in year t;

CS_t = average lessor crop share/hectare in year t[8];

PT_t = average property tax/hectare in year t; and

BD_t = average building depreciation/hectare in year t.

[3] The methodology employed here is from Painter (2005), where labour, management and capital returns were compared for Alberta, Saskatchewan and Manitoba.

[4] Other data sources that were used include Agriculture and Agri-Food Canada, Canada Grains Council, Canadian Wheat Board, Canadian Grain Commission, Canadian Transport Agency, Farm Credit Canada, and Statistics Canada.

[5] 'Return on Investment' is used interchangeably with 'yield'.

[6] The return on invested farm capital is the return on farmland and buildings investment. The expenses associated with owning, leasing and maintaining equipment are considered operating expenses and are deducted to arrive at net income available for labour, management and invested capital.

[7] The lessor, or farmland owner, may or may not be the farmer operator. In many cases, farmers operate a combination of owned and leased land. For this purpose, all farmland is treated as if it is leased.

[8] In the data set and calculations, a one-third crop share is used up to 1985 after which a one-quarter crop share is used for the remaining years.

Then, the return on investment, or yield, is calculated as:

$$ROI_t = \frac{NCS_t}{V_{t-1}} + \frac{V_t - V_{t-1}}{V_{t-1}} \quad (2)$$

where,

ROI_t = average return on farmland and buildings investment in year t;

V_t, V_{t-1} = average value of farmland and buildings/hectare in year t and t-1;

$\frac{NCS_t}{V_{t-1}}$ = farmland owner's operating yield on farmland investment in year t; and

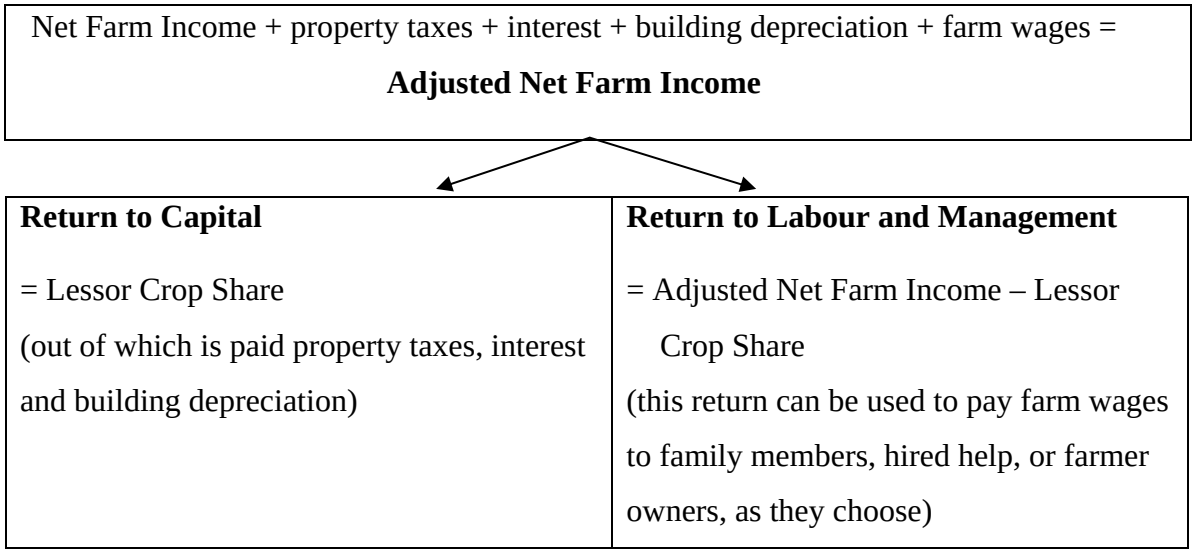
$\frac{V_t - V_{t-1}}{V_{t-1}}$ = farmland owner's capital gain yield in year t.

Farmer Labour and Management Income (L&M)

With this approach, the farmer's labour and management income is the residual left after all other expenses and returns to capital have been paid. In Canada, close to 50% of all farmland is leased. The farmer lessee must pay the lease payment just like any other expense, leaving the residual as the return to labour and management. In the case where the farmer owns the land, the farmer's opportunity cost is the lease revenue that could otherwise be obtained by leasing out the land, leaving the residual as the return to labour and management.

The residual return to labour and management is the net income left after paying all cash *operating* expenses and deducting the crop share paid to the lessor. The accounting for net farm income does not provide an indication of returns available to labour, management or capital. Adjustments need to be made to arrive at the total net income each year that is available to pay a return to labour and management and a return to capital. The expenses that need to be adjusted in the calculation (added back to arrive at adjusted net farm income) are; 1) land rent, building depreciation and interest expenses, as they are paid out of the return to capital, and 2) paid hired and family labour expenses (often paid to family members for tax purposes) as they are part of the overall farm labour and management income. Although there are other acceptable methods of disaggregating total farm returns into returns to labour, management and capital, this method has been employed in a number of cases: Painter and Schoney (1994), Painter (2000), and Painter (2005).

As Painter (2005) pointed out, the adjustments to farm net income must determine what is *available* to pay the two returns. In the calculation of net farm income, property taxes, interest on land and building debt, building depreciation and paid hired and family labour[9] have all been deducted as expenses. Therefore, these expenses need to be added back to arrive at annual adjusted net income, which can then be divided into return to capital and return to labour and management, as follows:



Therefore, the calculation of the return to labour and management excludes all paid hired and family workers and any imputed value for unpaid family work and represents labour and management income available to the farm family. The net dollar return to labour and management per hectare (L&M) is calculated for each year in the study period and for each province, as follows.

$$L\&M_t = ANFI_t - CS_t \qquad (3)$$

where,

$ANFI_t$ = adjusted net farm income/hectare in year t; and

CS_t = lessor crop share/hectare in year t.

Results and Analysis

Average Farm Labour and Management Income

[9] All paid hired and family labour must be added back in order to determine the total amount *available* to be paid to labour and management efforts. How the farm owners choose to pay out this portion is their choice, as they can pay themselves a wage, or a wage to other family members, or they can hire workers if the farm owners decide to engage in off-farm employment. Regardless of who it is paid to, it represents the return available to the labour and management effort.

Table I shows provides average farm labour and management incomes per hectare for each province over the last 30 years along with the average real growth in labour and management income per hectare. In all of the provinces, except Quebec, there has been zero or negative real growth in average farm labour and management income generated per hectare. However, this does not take into account that farmers in all provinces have adapted to new machinery technology by increasing average farm size. Larger and more efficient machinery has allowed each farmer to operate more hectares with fewer labour hours required. Table II shows that real labour and management income per farm has been increasing in each province because the positive growth in average farm size has been greater than the negative growth in labour and management income per hectare. For example, in Alberta the average labour and management income/hectare has decreased by 0.1% per year since 1972, but during the same period, Alberta farmers have increased their average hectares farmed by 0.7% per year so that overall, average farm labour and management income has increased by 0.6% per year. This illustrates one of the ways in which Canadian farmers have adapted to falling commodity prices and lower returns per hectare.

Table I: Average Annual Real Labour and Management Income per hectare (2003 C$) and Average Real Growth (1972 – 2003)

	Labour & Management Income/hectare	**Average Real Growth in L&M Income/hectare**
Alberta	$ 74.89	-0.1%
Saskatchewan	$ 59.44	-1.0%
Manitoba	$ 86.86	0.0%
Ontario	$ 394.36	-0.6%
Quebec	$ 476.45	1.3%

Table II: Average Real Growth in Farm Labour and Management Income/hectare, Average Farm Size, and Labour and Management Income for the Average Farm (1972 – 2003)

	Labour & Mgt Income/hectare	Average Farm Size (hectares)	Farm Labour and Mgt Income
Alberta	-0.1%	0.7%	0.6%
Saskatchewan	-1.0%	1.4%	0.3%
Manitoba	0.0%	1.6%	1.6%
Ontario	-0.6%	0.9%	0.4%
Quebec	1.3%	1.3%	2.6%

Farm labour and management income represents the farmers' salaries for their labour and management efforts. To assess how well farmers have been paid over the past 30 years, average farm labour and management income is compared to average employment income in each province. Table III shows average real farm labour and management income and average real provincial employment income, along with average real growth rates, for each province. In all provinces, except Quebec, average farm labour and management income is less than average provincial employment income, indicating that farmers have received less for their labour and management efforts than others in the province. The growth rates indicate that in Quebec and Manitoba, farmers' labour and management incomes have been growing at a faster rate than other employment income, while Ontario farmers have matched other employment growth, but in Alberta and Saskatchewan, farmers' labour and management income growth have lagged the rest of the provincial economy. Figures 2 and 3 illustrate average real farm labour and management earnings and average real provincial employment earnings for the study period for two of the provinces; Saskatchewan, where farm income has lagged provincial employment income, and Quebec, where farm income has surpassed provincial employment income. As Figures 2 and 3 illustrate, farm labour and management income in both provinces is more variable than average provincial employment income, especially in Saskatchewan. Table III also provides the coefficient of variation[10] for average real farm labour and management income and average real provincial employment income. The coefficient of variation indicates that Saskatchewan farmers experience the greatest

[10] The coefficient of variation is a standardized measure of variability and is the standard deviation of the income stream divided by the average income.

variability in farm labour and management income while Ontario and Quebec farmers experience the least.

Figure 2: Average Farm Labour and Management Income and Average Provincial Wage and Salary Income for Saskatchewan (2003 C$) 1972 – 2003

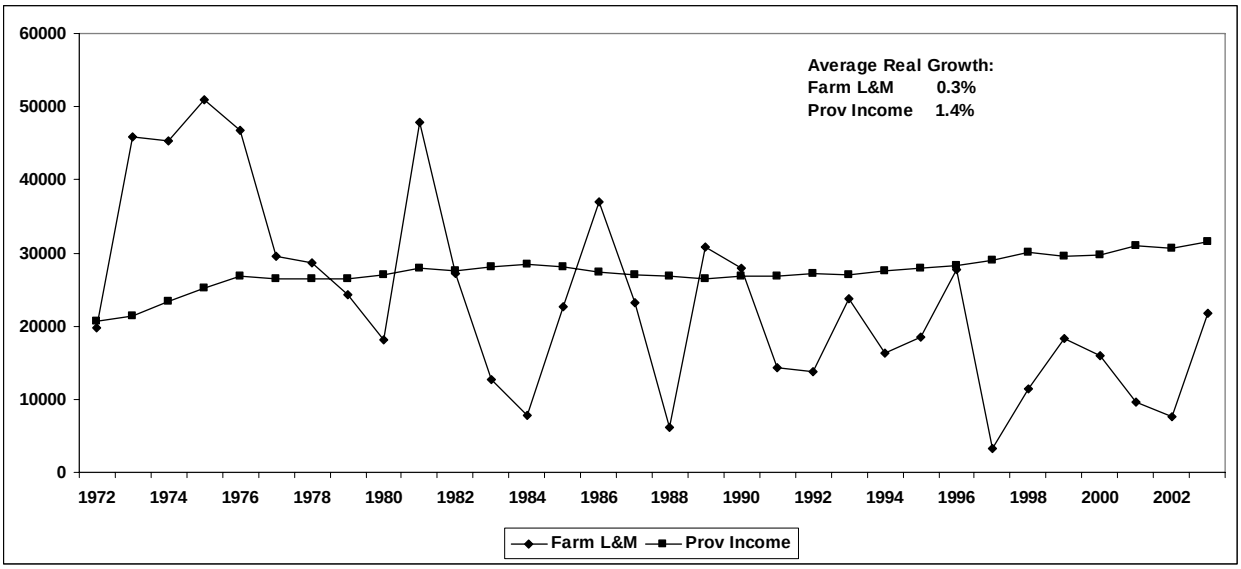


Figure 3: Average Farm Labour and Management Income and Average Provincial Wage and Salary Income for Quebec (2003 C$) 1972 – 2003

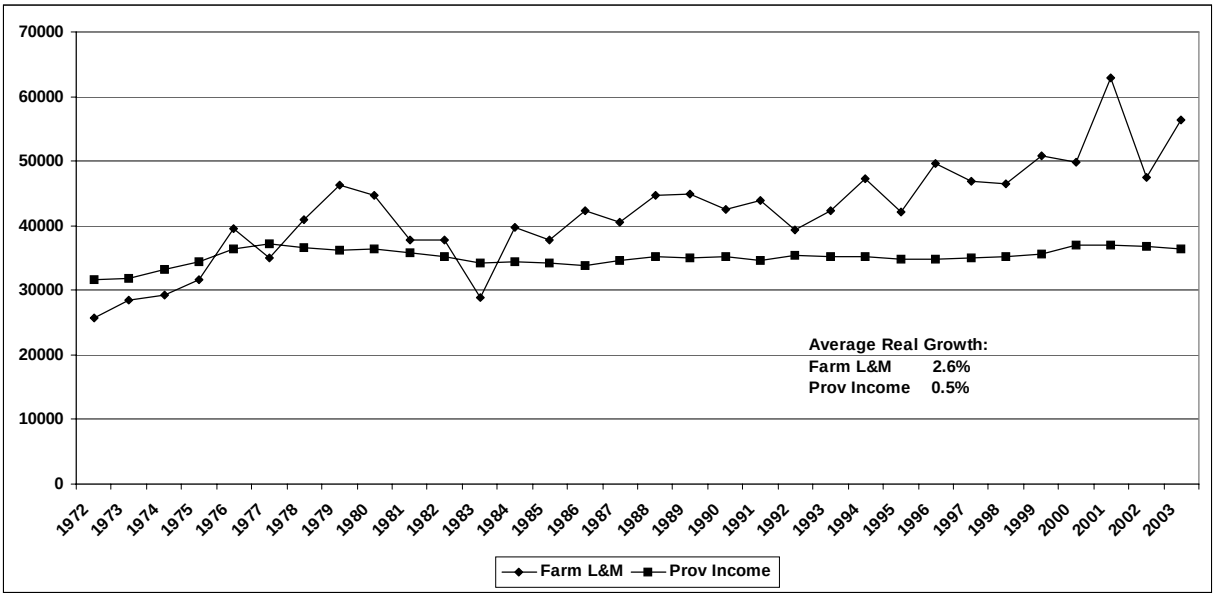


Table III: Comparison of Average Farm Labour and Management Income and Average Provincial Employment Income (2003 C$), Average Real Growth in Incomes (1972 – 2003), and Coefficient of Variation of Incomes

	Average Farm Labour and Management Income	Average Provincial Employment Income
Alberta	$ 25,911	$ 36,678
Average Growth	0.6%	1.2%
Coefficient of Variation	0.33	0.09
Saskatchewan	$ 23,603	$ 27,348
Average Growth	0.3%	1.4%
Coefficient of Variation	0.55	0.09
Manitoba	$ 23,984	$ 31,793
Average Growth	1.6%	0.5%
Coefficient of Variation	0.42	0.03
Ontario	$ 30,633	$ 39,120
Average Growth	0.4%	0.4%
Coefficient of Variation	0.17	0.06
Quebec	$ 41,988	$ 35,125
Average Growth	2.6%	0.5%
Coefficient of Variation	0.19	0.04

Source for Average Provincial Employment Income: Statistics Canada's Canadian Economic Observer.

Average Return on Farm Capital Investment

Table IV shows a comparison of farm capital investment yields in each province and average investment yields for stocks and bonds[11]. The comparison is done for two time periods (1972 – 2003 and 1990 – 2003) to illustrate that farm capital investment yields have declined in recent years. During the period 1972 – 2003, the return on investment for Canadian farmland has been very competitive with stock market yields. In the more recent time period of 1990 – 2003, farmland yields have been lower than stock yields, however, Figures 4 and 5 illustrate an interesting comparison. When risk is included in the comparison, the risk-return tradeoff for farmland is relatively good in both time periods. Figure 4 (1972 – 2003) shows farmland yields almost as high as stock yields but with significantly less risk than stocks. Based on the

[11] Average bond yields are from Statistics Canada (The Canadian Economic Observer) and average stock market yields are from Morgan Stanley Capital International.

Capital Market Line, farmland investment in all five provinces performed as well as or better than the average stock market portfolio in the world. Figure 5 (1990 – 2003) shows lower farmland yields in recent years but again shows significantly less risk than stocks. Therefore, declining farmland investment yields may have been a market reaction to lower perceived risk associated with farmland investment. In both figures, farmland performs very well on a risk-return basis, relative to most stock markets, and much better than some stock markets.

Figure 4: Risk – Return Comparison for Canadian Farmland and Stock Market Investment Yields (1972 – 2003)

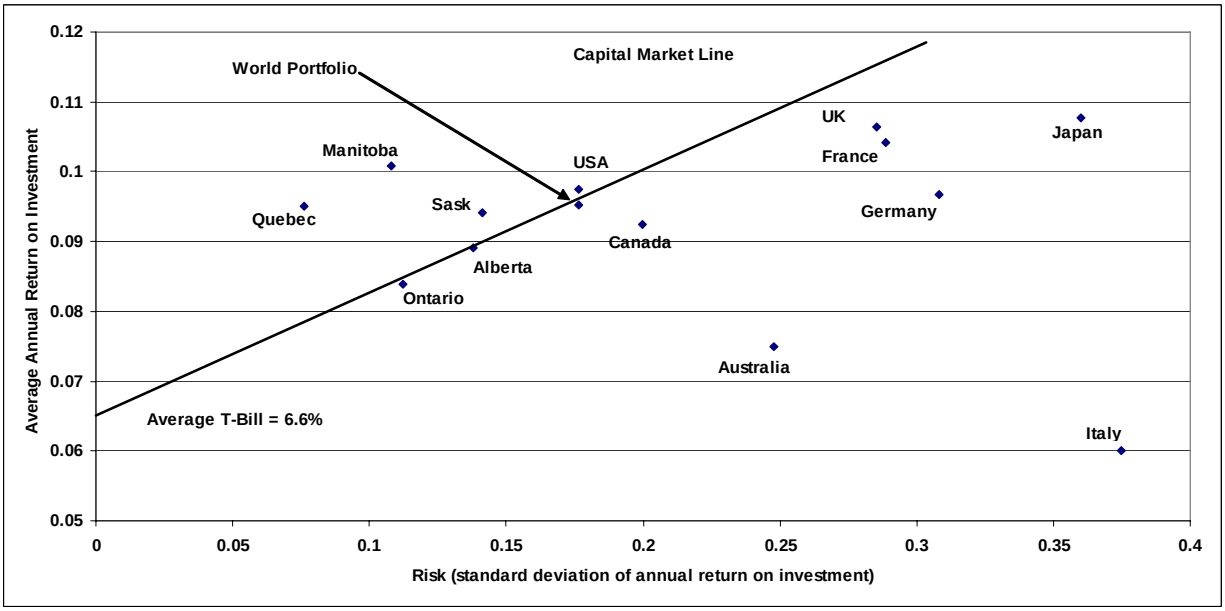


Figure 5: Risk – Return Comparison for Canadian Farmland and Stock Market Investment Yields (1990 – 2003)

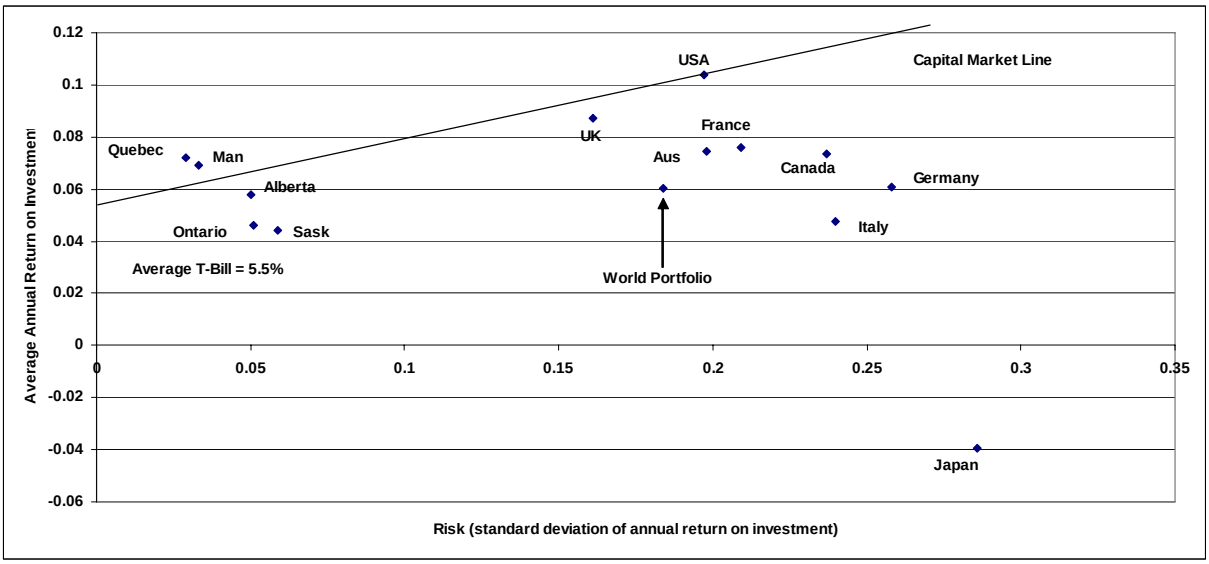


Table IV: Average Nominal Investment Yields for Farm Capital, Stock Markets, and Bonds (1972 – 2003) and (1990 – 2003)

Farmland	**1972 - 2003**	**1990 - 2003**
Alberta	8.9%	5.8%
Saskatchewan	9.4%	4.4%
Manitoba	10.1%	6.9%
Ontario	8.4%	4.6%
Quebec	9.5%	7.2%
Bonds		
Canada 3-mth T-bills	6.6%	5.5%
Canada Long Bonds	7.6%	7.3%
Stock Markets		
Australia	7.5%	7.5%
Canada	9.2%	7.3%
France	10.4%	7.6%
Germany	9.7%	6.1%
Italy	6.0%	4.8%
Japan	10.8%	-4.0%
UK	10.6%	8.7%
USA	9.7%	10.4%
World Portfolio	9.5%	6.0%

Sources: Bond Yields – Statistic Canada's Canadian Economic Observer; Stock Market Yields – Morgan Stanley Capital International

Comparison of Average Total Farm Family Income with Average Provincial Family Income

Table V compares average family income (all families) with average farm family income[12], for each province. In 1971[13], average total farm family income was 70%, 77%, 64%, 82%

[12] Average family income and average farm family income, by province, was provided by Statistics Canada, and derived from census data.

and 78% of average provincial family income for Alberta, Saskatchewan, Manitoba, Ontario and Quebec, respectively. By 2001, average farm family income as a % of average provincial family income had risen to 94%, 96%, 85%, 100%, and 99%, for Alberta, Saskatchewan, Manitoba, Ontario and Quebec, respectively. This was accomplished by farm families even as the labour and management returns from the farm (especially in Alberta and Saskatchewan) were declining relative to overall employment earnings in the province. Farm families have been able to narrow the income gap by increasing average farm size and, most importantly, by increasing off-farm sources of income. In every province the off-farm income as a proportion of total farm family income increased between 1971 and 2001, the largest increase being from 62% to 78% in Saskatchewan and the smallest being 78% to 84% in Ontario.

Table V: Comparison of Average Total Farm Family Income (with % from farm sources) and Average Provincial Family Income (2003 C$) 1971 – 2001

Year	1971	1981	1991	2001
	Alberta			
Farm Families	$ 33,608	$ 63,911	$ 57,112	$ 71,644
% Farm Source	29%	30%	11%	18%
All Families	$ 47,678	$ 70,365	$ 68,156	$ 76,526
	Saskatchewan			
Farm Families	$ 28,347	$ 59,075	$ 52,969	$ 58,730
% Farm Source	38%	49%	22%	22%
All Families	$ 36,814	$ 58,899	$ 57,516	$ 61,098
	Manitoba			
Farm Families	$ 27,810	$ 48,177	$ 50,440	$ 53,827
% Farm Source	30%	37%	22%	22%
All Families	$ 43,499	$ 56,624	$ 60,012	$ 63,242
	Ontario			
Farm Families	$ 43,648	$ 61,958	$ 72,740	$ 79,343
% Farm Source	22%	22%	12%	16%
All Families	$ 53,521	$ 64,836	$ 74,511	$ 79,152
	Quebec			
Farm Families	$ 36,459	$ 56,254	$ 59,523	$ 63,171

[13] For this comparison, census data is used, which means that the years do not correspond exactly with the 1972-2003 study period.

% Farm Source	28%	30%	22%	19%
All Families	$ 46,508	$ 58,128	$ 60,665	$ 63,555

Source: Statistics Canada (from Census 1971, 1981, 1991, and 2001)

Comparison of Average Farm Family Net Worth with Average Provincial Family Net Worth

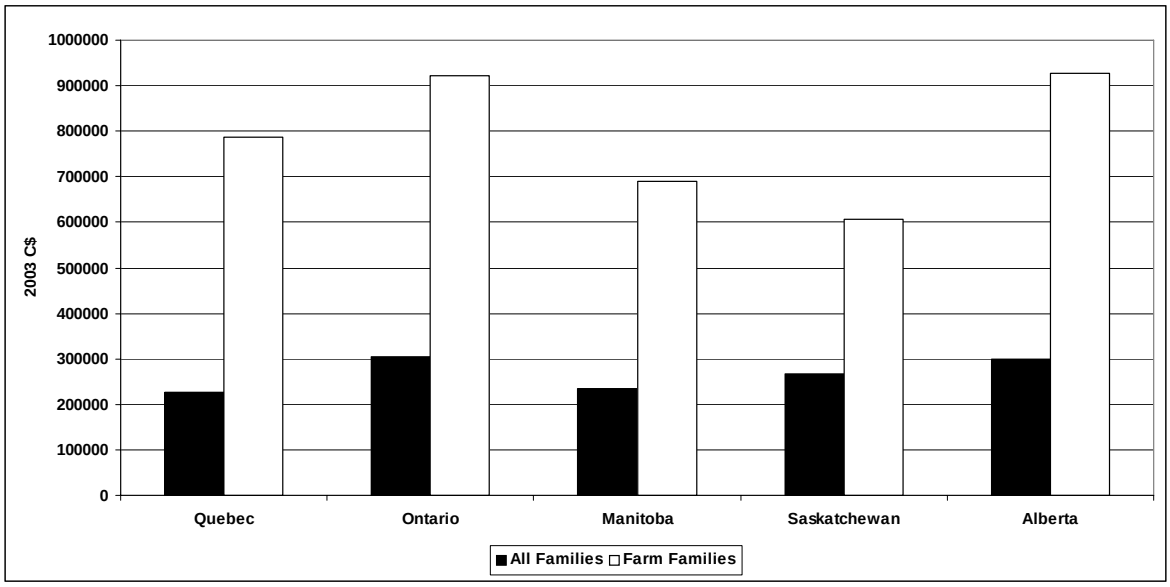
Table VI compares average farm family net worth with average family net worth, by province. The data for family and farm family net worth is not available in time series, which means a comparison can be made at one point only. In 1999, Statistics Canada conducted a nationwide survey to determine average family net worth (all families). This was compared to average farm family net worth for 1999, which was collected in an annual farm financial survey by Statistics Canada. Table VI shows that, on average, farm families have a significantly higher net worth than the average family, in every province studied. In Alberta and Ontario average farm family net worth is the highest, and in each case it is over three times the average family net worth in those provinces. Even in Saskatchewan, where average farm family net worth is the lowest amongst the five provinces, it is over twice as large as average family net worth. This indicates that farm families, on average, have done very well in accumulating wealth, relative to all families in the province. Figure 6 illustrates the comparison of net worth and shows farm families with significantly higher levels of wealth in all provinces.

Table VI: Average Net Worth for Farm Families and All Families, by Province (1999)

	Average Net Worth (2003 C$)	
	Farm Families	**All Families**
Alberta	$ 926,695	$ 299,513
Saskatchewan	$ 607,466	$ 267,151
Manitoba	$ 689,696	$ 233,468
Ontario	$ 923,128	$ 304,026
Quebec	$ 786,736	$ 225,873

Source: Statistics Canada: The Assets and Debts of Canadians (1999) and Farm Financial Survey (2003)

Figure 6: Average Net Worth for Farm Families and All Families, by Province (2003 C$)



Conclusions

Average farm labour and management incomes have been lower than average provincial employment incomes, over the past 30 years, in all provinces studied except Quebec. Saskatchewan farmers have the lowest average labour and management incomes and the lowest growth (-1.0% per year) in labour and management income per hectare. Quebec has the highest farm labour and management income (almost double Saskatchewan's level) and is the only province with positive growth (1.3% per year) in labour and management income per hectare. All provinces have positive growth in average farm size, which offsets the low and negative growth in labour and management income per hectare. When growth in labour and management income per hectare is combined with growth in average farm size, there is positive real growth in farm labour and management incomes in all provinces, with the lowest growth in Saskatchewan and the highest in Quebec. In Manitoba and Quebec, growth in farm labour and management income exceeds growth in provincial employment income, indicating that farm income is improving relative to other sectors in the economy. However, in Alberta and Saskatchewan, average farm labour and management incomes are lower and growing at a slower rate than average employment incomes, which implies that the gap may be widening in those provinces. It is also important to note that, in all five provinces, the variability of farm labour and management income is greater than average employment income, which must be considered when comparing farm incomes with average provincial incomes.

Average capital investment returns for farmland compare very favorably with average stock and bond yields. Over the past 30 years (1972 – 2003), average returns on farmland investment have outperformed many stock markets in the world, and have performed at least as well as the World Portfolio and the United States stock markets. In the shorter term (1990 – 2003), Quebec, Manitoba and Alberta farmland has continued to perform as well as the stock markets, even though their investment yields have fallen, because their risk levels have also decreased. Saskatchewan and Ontario farmland investment risk levels have also declined but their investment yields have fallen to levels that make them somewhat less attractive than some leading stock markets.

When average farm family incomes are compared to the average incomes of all families, it is clear that farm families are better off today than they were 30 years ago. The once large gap between farm family and other incomes has been mostly eliminated. Farm families have achieved this by increasing average farm size and by significantly increasing their off-farm incomes. This shows that farm families have adapted to falling commodity prices by being adapters of and investors in new technologies, allowing them to increase farm size (increased cost efficiencies) and by diversifying their income sources to include more off-farm income.

While farm families are closing the income gap with non-farm families, farm families have clearly exceeded non-farm families in wealth accumulation. In all five provinces, average farm family net worth is significantly greater than the average for all families. This implies that when all sources of income are considered, including farm labour and management income, off-farm employment income, and farmland investment returns, farm families have done very well, relative to non-farm families. The higher net worth comparison implies that farm families are significantly better off today (financially) than others.

Given the financial health of farm families in Canada, can a case be made for having governments provide greater farm subsidies? From a government policy perspective, based on the income and especially the net worth comparisons, it is difficult to justify providing non-repayable transfers to farmers. Certainly, like other businesses, farmers face significant risks and should be compensated in the market place for taking those risks. In the last few years Canadian farmers have faced some serious setbacks, including severe droughts and frosts in western Canada, the closed United States border to beef due to the BSE scare, and recently, United States tariffs on pork. These risks have led to greater uncertainty and variability associated with farm incomes. However, it is not the level of income or wealth that

is the problem; it is the risk and variability of farm income that is the problem. The implication of the analysis is that cash subsidies are not needed, but rather, good risk management programs that help to reduce the variability of farm incomes over time.

In conclusion, farm lobby groups have exaggerated the problem associated with the level of farm family income and wealth. Farm family income levels have increased relative to non-farm incomes and farm family net worth is significantly higher than the provincial average. Handing out non-repayable transfers to farmers may solve their current problems, but the assessment of farm financial health does not warrant it. However, governments can help farmers to reduce their risk levels by providing programs that reduce the variability of farm incomes and enable farmers to better weather any short term financial crises that are bound to occur.

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A Comparison of Farm Incomes and Wealth in Canada

Early Flood Events and Their Impact on Poor Smallholders in Rice-Based Floodplain Farming Systems in Bangladesh

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Abstract:

Floodplain agriculture in Bangladesh is characterised by smallholders operating marginal parcels. Early flood arrival may damage the standing winter rice crop. Using data from a micro area, we investigate: (a) patterns of damage caused by one and two week early floods, (b) whether poorer households stand more exposed to such risks, and (c) opportunities for risk reduction. The methodology employs GIS methods combined with simple water-yield damage parameters. Results indicate that lower elevation plots are inundated by floods arriving even a week or two early, and significant crop loss may result. The factors causing late harvesting, leading to early flood risk exposure, are (i) preceding winter rice with mustard, and (ii) using older, long duration, varieties. Planting mustard (to finance inputs for the following rice crop) delays planting of winter rice sufficiently to expose it to flood damage risk. Poorer classes are found to operate disproportionately large amounts of lower elevation land, which exposes them more to early flood risk. We find that 'squeezing' the crop calendar is best achieved within the rice calendar itself. Smallholders are using the earlier generation of rice varieties, while shorter duration varieties providing better yields are available. Thus available technology is failing to reach vulnerable smallholders.

Keywords: Early flood risk, Bangladesh, Floodplain, Rice.

1. Introduction

The management of flood risk in Bangladesh has been largely focussed on control of water levels in the peak flood season. This focus is not surprising, since extreme flood events such as in July-October 1998 due to overspill from the major rivers cause widespread loss of life, habitat and agricultural livelihoods. In some parts of the country, however, even in 'normal' flood years (characterised by typical or average flood depths on the plains), early local rainfall and/or early discharge of floodwaters from upstream catchments can cause damage to standing Rabi (winter/dry season) or Kharif-1 (early flood season) crops prior to their harvest. Much of floodplain agriculture in Bangladesh is characterised by smallholders operating and depending on very small holdings of land, and therefore scope for diversification of such risks is correspondingly low. Since early flooding can often wipe out a crop completely, understanding contributory factors and devising solutions to mitigate early flood risk is of great importance.
Where overbank flooding from main river channels is the principal source of early flood risk, structural means of flood control, such as the use of submersible embankments or sluice gate management practices can be effectively employed.

In many areas, however, early floods may arise from early local precipitation events rather than overbank river flooding, and structural methods may not prove effective in early flood risk control. In such situations, it is important to understand the entire crop cycle in order to ascertain what factors may determine exposure to early flood risk and what non-structural means are available to reduce exposure. In this paper, we use primary data on cropping, water depths and socio-economic variables at the plot level in a floodplain micro area in North-central Bangladesh in an effort to seek answers to the early flood risk problem posed.

2. Flood and Crop Seasons

The timing of typical *Kharif-1* and *Rabi* crop schedules and flood timings for the Northcentral region are illustrated in Table I below. Overbank river flooding typically commences between mid-June and early July, usually after the harvest of the Boro rice crop. With the lower lands given over to Boro, if the flood arrival is even a week or two early, it has the potential to damage those Boro areas that remain unharvested.

Table I: Flood and Kharif-1/Rabi calendar for Northcentral Bangladesh

Seasons/Crops/Flooding	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Kharif-1 Season			←	—	—	—	—	→				
Kharif-2 Season						←	—	—	—	—	—	→
Rabi Season	→	→	→	→	→	→					←	←
Aus Rice				═	═	═	═					
Jute			═	═	═	═	═	═				
Aman Rice						═	═	═	═	═		
Boro Rice	═	═	═	═	═							═
Normal Flood						┈	┈	┈	┈			
Early Flood					┈	┈	┈	┈	┈			

With the rapid replacement of the *Kharif-1* season with an extended *Rabi* season, the impact of early flood events is thus felt most by the Boro crop. While *Aman* crop damage due to heavy flooding in the peak flood season can be sometimes mitigated by re-transplanting, early flood arrival often means considerable damage to Boro. Early floods are most characteristic of the *haor* regions of Northeast Bangladesh, but Boro crop damage due to early flooding is not exclusive to the northeast. In a recent research project on floodplain livelihoods (Barr, 2000), a problem census conducted at the Charan *beel* site in northcentral Bangladesh revealed that Boro damage in low elevation lands was perceived as a significant problem. With an increasingly '*boro*-centric' agricultural economy, the implications of damage to the *Boro* crop can be substantial.

In what follows, we simulate the arrival of an early flood in the Charan beel area, using Geographic Information System (GIS) methods and data from the research project (Barr, 2000) mentioned above. By simulating the effect of an early flood arrival, and combining the simulated inundation levels with plot level cropping-pattern, plant growth-stage information and crop damage factors, rough plot-level crop damage estimates are calculated. These estimates are combined with socio-economic information to provide insights into the vulnerability of poorer households to early flood risk. The current choice of crop varieties is then examined in conjunction with information on available alternatives, to determine whether there is scope for managing early flood risk by using shorter-duration alternatives.

3. The Charan beel and floodplain Area: Background

Charan *beel* (a shallow saucer-like floodplain depression), is situated in Tangail district in Northeast Bangladesh. It lies between two distinct river systems, the Dhaleswari and the Bangshi. The *beel* comprises a small perennial waterbody of 44.5 ha at its centre, surrounded by arable land that is seasonally flooded as the waterbody expands to cover 394 ha during the monsoon. Settlements are located on higher land around

the margins of the depression. The earlier part of the *Rabi* season at Charan experiences very little rainfall and cropping is irrigation dependent.

Following a reconnaissance social survey that served as a mini-census to provide a basis for social stratification, a sample of households from three villages around the *beel* was selected by the project. Stratification was on the basis of landholding, which is recognised as a reliable proxy for wealth in rural Bangladesh. The stratification is presented in Table II below; this is based on categories used by the Bangladesh Bureau of Statistics in the Agricultural Census and other reports. From this larger stratified sample, a sub-sample of 210 households was selected for more detailed study, with 30 households belonging to each stratum. Basic socio-economic data were collected for each household in the subsample, including information on landholding.

Table II: Classification of households on the basis of land-holding

Stratum	Land owned (acres)	Socio-economic category
1.	<0.049	Landless - Categories I & II
2.	0.05 - 0.49	Landless - Category III
3.	0.5 - 0.99	Marginal
4.	1.0 - 2.49	Small
5.	2.5 - 4.99	Medium – I
6.	5.0 - 7.49	Medium – II
7.	>7.5	Large

The project also collected data on a set of biophysical variables over 1997-98. These included flood depth measurements and areal extent of flood spread at approximately monthly intervals during the year, and an inventory of plots belonging to the sample households. A subset of plots was chosen for crop pattern monitoring, recording crops grown during the year, and some basic information on crop growth stages at discrete points in time (a recording taken once a month). This and other information was gathered together in a project GIS, with linkages established between households and plots[1]. The research reported here utilizes these data in a modelling exercise designed to throw light on the early flood risk problem.

4. Methodology

(i) Sample selection: In order to analyse the effects of an early flood, it is necessary to have a basic understanding of the cropping system for the entire year. For example, some Boro plots may be harvested in April, while others not until May, with the latter plots being more susceptible to damage from early flooding. The reasons for this asymmetry in harvesting times may lie in the use of the particular plots in the previous season or in the flooding status of the plot in previous months. For instance, allowing the plot to lie fallow prior to the Boro crop allows for earlier transplanting and thereby earlier harvesting.

[1] The intersection between plots and households is not complete. In other words, some plots cannot be linked to household-level socio-economic information, and for some plots owned by the sample households, cropping pattern information is not available. However, there is a significant enough intersection to make our analysis possible.

Alternatively, some plots may drain too late for an early *Rabi* crop to be squeezed in before the Boro, which in turn encourages earlier transplanting of the Boro. Knowledge of the transplanting date is important for this analysis, and so plots without sufficient information were dropped from the analysis. The final sample of plots retained comprised 20 very low (VL), 38 low (L), 72 medium low (ML), and 107 medium high (MH) plots[2], 237 in all.

(ii) Establishing crop damage parameters: A literature search was undertaken to establish damage parameters for the Boro crop in relation to inundation levels. The existing literature was by-and-large found to be based on experimental studies, with results conditional on a number of control factors such as age of the seedlings at the time of transplanting, temperature regimes prevailing during the growing season, etc. No data on such factors are available for this site[3]. In the end, simple damage parameters established by the Master Plan Organisation (MPO) of Bangladesh were found to be the most synthetic and most easily integrable with the rest of the analysis. These parameters have been used in several previous studies of flood impacts on agriculture in Bangladesh. Since the MPO table only provides information at discrete growth stages and water depths, linear interpolations were established between these discrete data points so that damage estimates could be more continuous with respect to water levels.

(iii) Computing baseline damages: The water heights for the last month prior to harvest in each of the 237 plots were analysed to establish whether the levels were high enough at any time to potentially cause damage to the crop. This had to be done for each plot individually due to the differences in harvesting dates.

(iv) Simulating early flood arrival and crop damages: The project GIS stores empirical information on flood spread at the plot level for the period August 1997 to August 1998. A 'water theme time shift' GIS tool can de-couple the flood data, thereby lagging or advancing the flood in relation to production activities at the plot level. Two early flood onset scenarios were thus simulated – flood onset one and two weeks early respectively[4]. The water heights on individual plots were again used in conjunction with the crop damage parameters to establish crop damage for the early flood scenarios, as in (iv).

(v) Livelihoods and poverty dimensions:

The design of the GIS gives the ability to interrogate it about the impact of various management scenarios on floodplain residents as a group, and disaggregated according to different wealth (land-ownership) classes. By combining the analysis of elevation-specific early flooding risk with socio-economic information from the GIS on elevation-specific land-ownership by different wealth classes, it is possible to inquire whether the effects of early flood onset are felt uniformly across the socio-economic classes. Thus the hypotheses of linkages between poverty and increased vulnerability to environmental risks in the livelihoods of the poorest classes can be tested.

(vi) Examining the role of short-duration varieties: Finally, in seeking possible management interventions that might significantly reduce the risk posed by early floods, the question is posed as to whether the use of

[2] 'High' plots are not considered here since they are flood-free by definition.

[3] At any rate, the objective of this modelling exercise is not to establish such biophysical precision, but rather to generate broader lessons and to capture the bigger picture.

[4] The probability of floods arriving earlier than two weeks is quite low, and hence this analysis restricts itself to one and two week early floods.

alternative short-duration varieties in place of the existing varieties would enable harvests early enough to avoid flood damage. This is done simply by comparing varieties currently in use with available alternatives.

5. Cropping patterns at Charan beel

As is the trend in several parts of Bangladesh, the traditional *Aus-Aman-Boro* system, corresponding to the *Kharif-1 – Kharif-2 – Rabi* seasons, has been replaced by a *Kharif-rabi-1-rabi-2* pattern in Charan. *Aman* is broadcast or transplanted with the start of the flood in July, and is harvested with the beginning of the drawdown in mid-October//November. The extended *Rabi* season commences after the drawdown, with a short fallow in some plots and a short *Rabi* crop such as mustard in others. Boro is omnipresent, and is transplanted between December and early March, coming off the land in April/May, prior to the arrival of the next year's floods in June.

The elevation-specific breakdown of major cropping patterns in the sample plots is shown in Table III below. The table clearly illustrates that elevation plays a significant role in cropping pattern choice at Charan. Very low plots are completely given over to *Rabi* season production, being too deeply flooded for *Aman* production in the *Kharif* season. 55% of the VL plots are devoted to a single Boro crop, while the other 45% manage to include a short mustard crop prior to boro. Mustard is a low-input cash crop that grows quickly, the proceeds from which are used by farmers to finance the input-intensive Boro crop. It is sown right after flood drawdown using residual soil moisture and minimal inputs. Subsequent to the mustard harvest, the land will be soaked and puddled in advance of transplanting.

The increase in cropping intensity in response to elevation increases is clearly seen. Low plots are still dominated by fallow/fallow/Boro and fallow/mustard/Boro rotations, but some *Aman* production is also present. The incidence of single Boro cropping declines sharply as elevation increases. ML and MH plots are predominantly double or triple-cropped. Transplanted *Aman* is more easily damaged by flooding than broadcast *Aman*, and hence is observed only in MH land.

*Table III: Cropping patterns on sample plots at Charan beel**

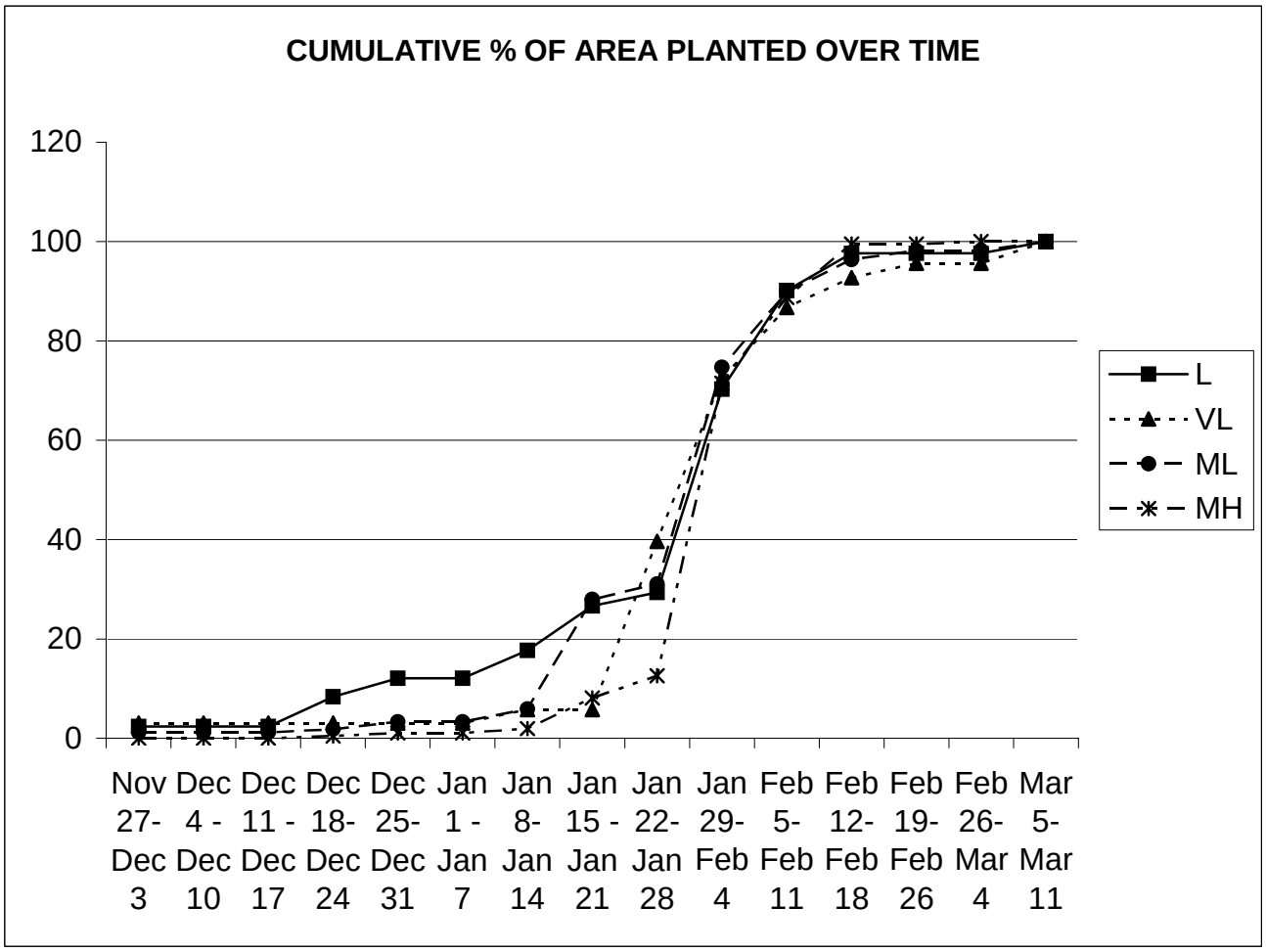
Cropping Pattern	**VL** (20 plots)	**L** (38 plots)	**ML** (72 plots)	**MH** (107 pl)	**Total** (237 pl)
Fallow/Fallow/Boro	55.00%	42.11%	23.61%	20.56%	27.85%
Fallow/Mustard/Boro	45.00%	39.47%	59.72%	39.25%	45.99%
Fallow/BAman/Boro	0.00%	0.00%	0.00%	4.67%	2.11%
BAman/Fallow/Boro	0.00%	7.89%	4.17%	1.87%	3.37%
BAman/Mustard/Boro	0.00%	10.53%	11.11%	19.63%	13.92%
Mixed/Mustard/Boro	0.00%	0.00%	1.39%	0.93%	0.84%
TAman/Fallow/Boro	0.00%	0.00%	0.00%	11.22%	5.06%
TAman/Mustard/Boro	0.00%	0.00%	0.00%	1.87%	0.84%
					100.00%

* The sequence used here is based on the flood year (starting in June) rather than the calendar year.

As cropping intensity increases, flexibility in timing the planting of the Boro crop is inevitably reduced. Early transplanting of the Boro crop, in December or early January, would enable a harvest in late April or early May. Where a mustard crop is grown after drawdown and prior to the Boro, however, the transplanting of Boro may be pushed into February, resulting in a later harvest and greater exposure to early flood risk. Currently this is a trade-off that farmers need to factor into their decision making: Option 1 is a mustard crop, followed by a *Boro* crop**.** The mustard is grown as a cash crop, the seeds can be sold to millers for mustard oil production; the cash thus obtained is immediately invested into the inputs for the proceeding *Boro* crop. As the proceeding analysis shows, depending on land elevation, there is risk of losing some of the crop due to flood damage. Option 2 is a *Boro* crop alone. The more flexible timings permitted by a single *Boro* crop mean that there should be negligible flood damage risk, however the crop is also more expensive (less profitable) as greater levels of credit will be needed to supply the necessary inputs.

Figure 1 below summarises the planting dates for our sample plots by land elevation categories.

Figure 1: Timing of Boro transplanting, by elevation classes at Charan beel



As seen from the figure, higher proportions of area are transplanted later in the *Rabi* calendar as land elevation increases. About 10% of the low land is planted by end-December, while there is very little planting in December in the other land types. The planted proportion for Medium High lands is only a little over 10% until late January. In the last week of January and the first week of February, there is a rapid surge in planting across land types. Planting continues through February, and is more or less complete by the end of the month, except for a few plots that are planted in early March.

Very low lands appear somewhat anomalous to this pattern, with little planting occurring until the third week of January. Two possible explanations exist for this: first, being immediately adjacent to the receding *beel*, VL lands drain slower than average and are the last to be exposed if they are even ever completely exposed. Planting may be delayed due to this factor, even if the land was previously fallow. Second, VL lands are more likely than other land types to grow local varieties of Boro. Local varieties are usually of short enough duration to be harvested well before flood arrival, even if planted late, or have some ability to elongate to cope with some early onset flooding. They are however low yielding.

Table IV below shows the temporal distribution of harvest according to land type.

Corresponding to earlier planting of L lands compared to other land types, a greater proportion of L lands are also harvested earlier. Boro crops on ML and MH lands, being least susceptible to flood damage, are

more likely to be harvested late in the summer, with about 66% of the crop on these land types still standing on 20 May.

Across land-types, the bulk of harvest occurs in May, especially in the last week. By the first week of June, all plots have been harvested.

Table IV: Harvest times by land elevation at Charan

Harvest Dates	VL	L	ML	MH	Grand Total
25-27Apr-98	10%	17.53%	5.5%	1.38%	5.9%
04-06 May-98	0.00%	0.00%	5.5%	1.13%	2.18%
06-08 May-98	40%	9.15%	4.16%	1.26%	6.65%
11-13 May-98	0.00%	0.00%	0.00%	0.82%	0.37%
16-18 May-98	0.05%	33.89%	20.83%	28.61%	24.68%
22-24-May-98	45%	34.40%	56.9%	59.62%	53.5%
31 May - 02-Jun-98	0.00%	5.03%	6.94%	7.17%	6.15%
Grand Total	100.00%	100.00%	100.00%	100.00%	100.00%

6. Flood Spread at Charan Beel

Over the dry-season, the Charan beel area steadily dries up until only the small area of the perennial beel remains inundated. Thus there is a temporal decline in flooded areas as well as depths from drawdown onwards until the start of May, with much of the area drying up early in the winter. The first panel of Figure 2 shows the flood extent on 11 May, when the water spread is at its lowest[5]. The second panel, for 23 May[6], shows that the water levels have already started gradually increasing in the 3rd week of May, and the lowest plots close to the perennial part of the beel have been inundated.

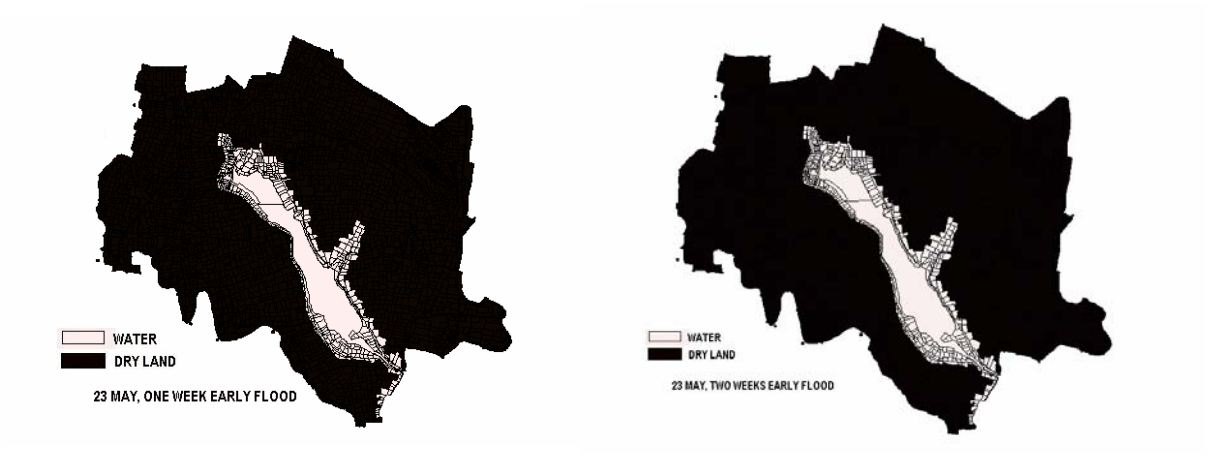
Figure 2: Water levels at Charan Beel on 11 May and 23 May, 1998

[5] The water cover/depth stays at this minimum level for well over a month.

[6] 23 May is chosen for the illustration of our early flood arrival simulation here because a good proportion of the Boro crop in the area is harvested in 22-24 May, as seen before.

The water spread results from the GIS-based counterfactual simulations are illustrated (as on one particular day, 23 May) in Figures 2 and 3, the first where the flood arrives one week early and the second where it arrives two weeks early. As can be seen, the *areal extent* of the flood spread seems to remain more or less constant at Charan at this critical period even when the flood arrives a week or two early.

Figure 3: Water cover at Charan on 23 May, one and two week early floods.



It would be misleading, however, to conclude from this that early flood arrival does not pose a threat to the Boro crop. Table V below presents the average water depth on the sample plots for the baseline of 23 May, compared to when the flood arrives 1 and 2 weeks early. Medium high plots are seen to stay flood-free even with a two-week early arrival of floods. VL plots on the other extreme, are seen to be very vulnerable to even a short advance in flood timing. The average flooding on VL plots on 23 May when the flood arrives just a week early, is 1.36 metres, a depth that is enough to almost completely destroy any standing crop.

Table V: Average water heights (metres) for sample plots by land elevation

	VL	L	ML	MH	All Plots
Average of 23May98 water height	0.026	0.009	0	0	0.0021
Average of 23May98, 1 wk early	1.36	0.271	0	0	0.15
Average of 23May98, 2 wks early	2.33	1.13	0.18	0	0.43

7. Estimates of crop damage due to early flooding

As the estimates presented in Table VI show, 55% of the VL plots suffer some form of damage even from a one week early flood. Significantly, when the damage occurs, it is likely to be substantial. 40% of the VL plots are almost completely damaged by a one week early flood. Evidently, the low plots flood rapidly and deeply, as was previously indicated in Table V. The L plots on the other hand, are largely unaffected by a 1 week early flood. A two week early flood would however cause significant damage to about a quarter of the low land Boro crop. The ML and MH plots remain largely unaffected even by a two week early flood.

Table VI: Crop damage estimates by land elevation

Very Low Land Crop Damage: % of Plots in Damage Categories					
	No damage	**20% to 40%**	**40% to 60%**	**60% to 80%**	**80% or higher**
Baseline Flooding	100%	0%	0%	0%	0%
1 Week Early	55%	0%	5%	0%	40%
2 Weeks Early	50%	0%	0%	0%	50%

Low Land Crop Damage: % of Plots in Damage Categories					
	No damage	**20% to 40%**	**40% to 60%**	**60% to 80%**	**80% or higher**
Baseline Flooding	100%	0%	0%	0%	0%
1 Week Early	92%	3%	0%	0%	5%
2 Weeks Early	61%	3%	11%	0%	26%

Medium Low Land Crop Damage: % of Plots in Damage Categories					
	No damage	**20% to 40%**	**40% to 60%**	**60% to 80%**	**80% or higher**
Baseline Flooding	100%	0%	0%	0%	0%
1 Week Early	100%	0%	0%	0%	0%
2 Weeks Early	90%	3%	1%	1%	5%

Medium High Land Crop Damage: % of Plots in Damage Categories					
	No damage	**20% to 40%**	**40% to 60%**	**60% to 80%**	**80% or higher**
Baseline Flooding	100%	0%	0%	0%	0%
1 Week Early	100%	0%	0%	0%	0%
2 Weeks Early	100%	0%	0%	0%	0%

With a one-week early flood being a high-probability event, the VL lands, and to a lesser extent, L lands, are seen to be very exposed to early flood damage at Charan beel. The aggregate estimates, however, do not provide a clear idea of whether there is any specific pattern to the damage. A profile of damaged vs undamaged plots could provide a better idea. Since the sample numbers of VL plots are small, it is instructive to look at information at the plot level. We present such information in Table VII below[7].

[7] Note that varietal information was not available for all boro-cropped plots in the database.

Table VII: Plot-level damage information for VL plots

			VL: Undamaged Plots					
Plot ID	**Area (m^2)**	**Variety**	**Planting Date**	**Harvest Date**	**Pattern***	**Baseline Damage**	**1 wk early**	**2 wks early**
10937	1123	BR 11	03-Dec-97	06-08-May-98	F/F/B	0	0	0
10938	1305		24-Jan-98	06-08-May-98	F/F/B	0	0	0
22173	1409		24-Jan-98	06-08-May-98	F/F/B	0	0	0
22174	1334		24-Jan-98	06-08-May-98	F/F/B	0	0	0
22175	1681		24-Jan-98	06-08-May-98	F/F/B	0	0	0
22176	2389		24-Jan-98	06-08-May-98	F/F/B	0	0	0
10345	532.6		07-Feb-98	06-08-May-98	F/F/B	0	0	0
22110	507.5	Local	18-Feb-98	25-27-Apr-97	F/F/B	0	0	0
22177	1696	Local	18-Feb-98	25-27-Apr-97	F/F/B	0	0	0
22121	1616	Kuinal (Local)	05-Mar-98	06-08-May-98	F/F/B	0	0	0

			VL: Damaged Plots					
Plot ID	**Area (m^2)**	**Variety**	**Planting Date**	**Harvest Date**	**Pattern***	**Baseline Damage**	**1 wk early**	**2 wks early**
20537	1016	IR 8	14-Jan-98	22-24-May-98	F/F/B	0	80-100%	80-100%
21659	1970		24-Jan-98	22-24-May-98	F/M/B	0	80-100%	80-100%
21661	2341		24-Jan-98	22-24-May-98	F/M/B	0	80-100%	80-100%
22027	3614	IR 8	01-Feb-98	22-24-May-98	F/M/B	0	80-100%	80-100%
21948	1921	IR 8	03-Feb-98	22-24-May-98	F/M/B	0	42%	80-100%
22045	2781	Sharkari/BR 16	03-Feb-98	22-24-May-98	F/M/B	0	80-100%	80-100%
22046	3700	Kaora	04-Feb-98	22-24-May-98	F/M/B	0	80-100%	80-100%
22004	3009	Sharkari/BR 16	05-Feb-98	16-18-May-98	F/M/B	0	0	80-100%
22050	1728	Sharkari/BR 16	05-Feb-98	22-24-May-98	F/M/B	0	80-100%	80-100%
22002	1051		19-Feb-98	22-24-May-98	F/M/B	0	80-100%	80-100%

F=Fallow, M=Mustard, B=Boro

The plot-level information for VL lands is quite revealing. The plots undamaged by one and two week early floods are exclusively single-cropped with Boro. The majority of these are planted before January 25, and are harvested around the 7th of May, well before even an early flood arrival. The exceptions that are planted in February are local varieties with short durations, which are still able to come off the land ahead of the early flood danger time zone. This is in marked contrast to the damaged plots, where almost all plots are double-cropped with mustard preceding boro. This often pushes planting time into early February, and

inevitably delays harvest until the last week of May. At the baseline, in a normal flood year, harvest at this time is in advance of flooding. But when the flood arrives even a week early, damage to these crops is in excess of 80%. Note also that the damaged VL plots are mostly planted to the older generation of long-duration HYV Boro such as IR8.[8]

8. Vulnerability to early flooding by socio-economic category

Given the overall orientation of this study, it is particularly important to determine whether there is any empirical evidence that the poorer classes are more exposed to early flood risk than more well-to-do classes. One way of approaching this would be to take the *particular* set of 'damaged' vs 'undamaged' VL and L plots above, and determine empirically if the damaged ones are more likely to belong to poorer households or not. This did not prove to be possible, however, because of the lack of a complete link between cropping and household information in the dataset, as discussed above. For some of the plots in the above set, ownership data were not available. Hence, a more general question is posed: given that VL and L lands are by-and-large found to be the only types exposed to early flood risk, is there evidence that these lands types (in *general*) are more likely to be owned by poorer households? Additionally, typically what proportion of the land portfolio of poorer households is made up of VL and L lands? The dataset from Charan contains complete plot ownership records of a household sub-sample stratified by land-ownership classes that enables this analysis. In order to avoid any potential distortions arising from small samples, the 7 socioeconomic classes in Table II were collapsed into 4 for this analysis: (almost) landless (<0.5 acres), marginal and small (0.5 to 2.5 acres), medium (2.5 to 7.5 acres), and large (>7.5 acres).

The distribution of land ownership by social class across land elevations is shown in Table VIII. High land comprises over 50% of the total land area held in the sample. This sample value is generally reflective of elevations around Charan beel, where lower lands are concentrated around the beel, with elevations generally increasing as distance from beel increases, and households operating lands in a large surrounding area. The actual area of VL and L land is relatively small (about 22% of total), and this skewness in the distribution of elevations implies that there is a natural hedge available against early flood risk at Charan. However, if particular classes are found to hold significantly disproportionate amounts of L & VL land, the hedge available to them would be correspondingly low.

[8] Similar plot-by-plot analysis for L lands is not presented due to space constraints. Although the pattern for L plots does not turn out to be as clear cut as for VL plots, as a general rule, all plots planted by the last week of January appear to be flood risk-free, and as for VL plots where mustard precedes boro, there is an increased chance of damage.

Table VIII: Aggregate land ownership by socio-economic class (acres)

SECLASS	VL	L	ML	MH	H	Grand Total	L&VL as % Of total
Landless	1861	358	287	989	3713	7208	30
Marginal & Small	3895	443	1391	4361	8096	18186	23
Medium	1073	481	760	1649	4949	8912	17
Large	0	0	70	149	1493	1712	0
Total	6829 (19%)*	1282 (3.5%)*	2508 (7%)*	7148 (20%)*	18251 (51%)*	36018	

* % of grand total (36018 acres)

The last column in Table VIII shows the % of VL and L land area in total land owned by each category. There does appear to be a connection between socio-economic class and the distribution of land-ownership by elevation classes. The nearly landless own disproportionate amounts of land potentially vulnerable to early flooding (30%) compared to the average (22.5%). The proportion of L & VL land in the portfolio of marginal & small and medium classes is roughly similar to the average. The large farmers, however, own practically no VL and L lands, their portfolios almost exclusively comprised the flood-free MH and H land. This empirical connection points to elevation makeup being a further inequalising factor in the floodplains of Bangladesh. The gulf in the wealth status of the landless and the large farmers is already substantial, with a large farmer owning over fifteen times the land owned by a nearly landless floodplain dweller. But with the largest farmers owning practically no low land in Charan, and the poorest owning disproportionate amounts, the riskiness of low land production adds to the vulnerability gulf between large and smallholders.

9. Short-duration varieties

The early floods experienced in Charan beel and other such sites in the North-Central area are predominantly due to early local precipitation events, which cannot be controlled by the construction of submersible embankments. An alternative way to manage this risk is by adjusting the cropping calendar during the year so that the Boro crop can be harvested from a week to two weeks early. It can be seen from the simulation results for VL plots in Table VII that the bulk of the early flood damage happens when plots harvested during the period 22-24 May period are visited by early floods. At the baseline itself, *i.e.*, in the period 22-24 May, water levels are not high enough to cause damage to any of the plots. Thus if these plots were harvested even a week earlier, *i.e.*, in the 15-17 May period, a one-week early flood would cause no damage whatsoever to these plots. In the case of the L plots, the risk of damage is principally from *two*-week early floods, again predominantly on plots harvested around 22-24 May. As before, a one-week earlier harvest would eliminate damage from even the relatively low-probability two-week early flood.

Opportunities to adjust the cropping calendar in order to achieve an earlier Boro harvest potentially exist throughout the crop year. However, as seen from the simulation tables, damage is largely restricted to VL and L plots that are at most double-cropped, involving no *Aman* production. Thus the *Kharif* season does not seem to offer an opportunity to advance the calendar. Mustard is almost exclusively the pre-Boro crop in double-cropped plots. As seen before in the case of VL plots, it is the set of plots double-cropped with mustard and Boro that stand most exposed to early flood damage. Therefore it is worth investigating whether opportunities exist to squeeze the crop calendar in the early *Rabi* period. However, an investigation of the mustard varietal information in the database revealed that a local mustard variety, Tori-7 was predominant in the Charan area. Tori-7 is a low-yielding variety, but can be grown in 70-80 days, while all the higher-yielding varieties take upwards of 90 days. Thus, far from providing opportunities to shorten the cropping calendar, the available alternatives in fact would tend to elongate it.

The opportunities for contraction of the cropping calendar then seem restricted to the Boro crop itself. A look at the varietal composition in Table VII for VL land reveals that there does indeed appear to be scope for mitigating early flood risk by using shorter-duration Boro varieties. Boro grown on VL and L plots at Charan is primarily of three varieties:IR8, or ‘IRRI rice’, BR16, and BR11. Table IX below presents basic information on the growth duration (including seedbed period) and experimental grain yields for these varieties and some potential replacement varieties. The widespread prevalence of IR8 in lowland plots in Charan is somewhat surprising, since it is a variety dating back to the late 1960’s which has played a significant role in the green revolution, but has since been widely supplanted by improved varieties developed later. Quite possibly, its strong presence at Charan points to inadequate extension services in the area. With a growth duration of 170 days, IR8 is of longer duration than most available alternatives. The other two prominent higher-yielding varieties observed at Charan, BR11 and BR16, also have relatively long durations (165 days). At least two attractive alternatives exist that can provide comparable yields and reduced durations in the field. BR 26 and BR28 reduce the field duration by over two weeks compared to the existing varieties, and do not suffer a significant disadvantage in terms of yields. BR29 enables a slightly earlier harvest compared to IR8, BR11 and BR16, and significantly higher yields.

Table IX: Growth duration and yield potential of some important Boro varieties in Bangladesh

Variety	Growth duration (days)	Grain yield (t/ha)
BR 11*	165	6
BR 14	160	6
BR16	165	6
BR 26**	145	5.8
BRRIdhan 28	140	5.8
BRRIdhan 29	160	5
BRRIdhan 36	140	5.5
IR8	170	5.5

*Originally released as *Aman* variety, but also grown as boro.

**Originally released as *Aus* variety, but also grown as boro.

Sources: Jashim and Chowdhury (2001); Salam (1992), FAP20 (2000), BRRI (1997)

It is important to note that the experimental results reported in Table IX can differ significantly from what is achieved on farmer's fields. However, the available evidence points towards significant advantages in moving away from the traditional higher yielding varieties such as IR8, as well as the older generation of BRRI-developed higher-yielding varieties such as BR11, towards the new generation of shorter-duration, higher-yielding varieties. Thus our evidence from Charan shows that early flooding is not a problem that will require any new investments in technology. Requisite technology in the form of a new generation of shorter duration *Boro* varieties has been available for some time now, but is apparently failing to reach this group. A programme of farmer-based research on using existing shorter duration Boro varieties could go some way in ameliorating this situation.

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Farm diversification opportunities in Bulgaria – the perceptions of farmers in the Plovdiv region – a preliminary analysis

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Abstract

Agriculture faces significant challenges in responding to the rapidly changing global agri-business environment. Due to the decreased incomes in agriculture in the last few decades, farm diversification is frequently recommended as one approach to business survival. The paper outlines the structural changes in Bulgarian agriculture since 1944. This paper also analyses how farm managers with different farm types (size and land ownership patterns) evaluated two strategic options, 'related' diversification (introducing new agricultural activities) and 'unrelated' diversification (introducing new non-agricultural activities). The managers identified whether they perceived these strategies as feasible for their future development, what factors encouraged/discouraged diversification and the outcomes they expected from diversification. Farm diversification was perceived as an innovative business approach, irrespective of farm size and landownership patterns, which was viewed as feasible in the medium term (5 years) by only one third of the respondents.

Keywords: **farm diversification, farm development, related diversification, unrelated diversification, Bulgaria, Plovdiv region**

1. Introduction

Over the last few decades, significant changes in the global agri-business environment have decreased the profitability of agricultural primary production for many small and medium sized farms in many countries. This has led to farm diversification becoming widely advocated and implemented in the EU countries, USA, Australia and New Zealand (Ilbery *et al.*, 1998; Bowler, 1999; EC, 2000; Prag, 2000; Williams, 2000; McNally, 2001; Windle and Rolfe, 2005).

The objectives of this paper are to review and evaluate two strategic options 'developing new agricultural activities' and 'developing new non-agricultural activities' and to identify whether Bulgarian farmers with different sized farms and patterns of land ownership evaluated these alternatives in different ways. The paper is based on a farm survey and focuses on five aspects: the feasibility of the two options, the most likely new alternative activities, identifying the factors encouraging and discouraging diversification and finally, the outcomes expected from the two diversification options.

The paper is divided into five sections. The next section discusses a range of issues regarding farm diversification, followed by a brief description of agriculture and diversification activities in Bulgaria. The methodology is described in section three, while the analysis of the data is reported in section four. The final section draws some conclusions about the future direction and development of farm diversification in Bulgaria.

2. Farm diversification and decreasing the dependence on agricultural production

In strategic theory literature, diversification strategy is defined as a plan of development, which takes a business away from its existing markets and products at the same time (Hake, 1971; Johnson and Scholes, 2002). Many authors such as Ansoff (1968), Besanko *et al*. (2000) and Johnson and Scholes (2002) argue that there are two main types of diversification:

- Related diversification – development of new products and markets within the industry in which the business operates.
- Unrelated diversification – when the business moves out of its current industry to exploit its current 'core competence' or to create a new one, or to create a 'genuinely' new market.

Referring to agriculture, farm diversification may be defined as adding a new venture to the existing farming unit (MAFF, 1994). Damianos and Skuras (1996) provide a more detailed definition of farm diversification, which is the development of alternative economic activities using the whole range of the farm's resources (land, capital, labour, buildings, etc.). These alternative activities may be agriculturally based (related diversification), or non-agriculturally based (unrelated diversification) (Slee, 1989; Damianos and Skuras, 1996; Ilbery *et al.*, 1998; Bowler, 1999; Ellis, 2000; Prag, 2000;

McNally, 2001; Sofer, 2001; Daskalopoulou and Petrou, 2002). However, the rationale behind agriculturally based and non-agriculturally based diversification differs.

In general, the aims of farm diversification are to: reduce the dependence of the farm on a single market, product or customer; achieve higher returns on investment; ensure future growth and to avoid strong competition (Hake, 1971).

The most common reasons for developing new agricultural activities (related diversification) are: declining or inadequate farm incomes; creating employment for family and / or non-family members; planning future expansion; exploiting an opportunity or ability and reducing business risk. (Hake, 1971; Haines and Davies, 1987; EC MEANS, 1999; Prag, 2000; McNally, 2001; Sofer, 2001). The rationale for developing non-agricultural activities (unrelated diversification) are: increased efficiency of the agricultural sector resulting in higher productivity and reduced employment; rising costs of inputs combined with falling prices of outputs, reducing agricultural incomes; changes in demographic and occupational levels; development of new policies and priorities relating to agriculture and rural areas; improvement of the rural infrastructure (Prag, 2000; Chaplin *et al*., 2004).

The development of farm diversification faces a range of financial and political barriers such as lack of capital for investment or financial support, difficulty in obtaining planning permission, lack of experienced labour and difficulties in obtaining the right information or advice (MAFF, 1994; Chaplin *et al.*, 2004).

Different aspects of farm diversification have been reported by Damianos and Skuras (1996) in Greece; Ilbery et al. (1998) in England; McNally (2001) in England and Wales; Sofer (2001) in Israel; Chaplin *et al.* (2004) in Central and Eastern Europe and Windle and Rolfe (2005) in Australia. In general, their results show that diversification increased both, farm incomes and the demand for labour in the rural areas. However, it was also reported in Greece, a neighbouring country to Bulgaria, that large numbers of farms still maintain a strong agricultural character (Daskalopoulou and Petrou, 2002) while Chaplin *et al.* (2004) found that diversification is unlikely to solve the problem of unemployment in the rural areas in Central and Eastern Europe. In Australia, sugarcane farmers had relatively low interest in diversification (Windle and Rolfe, 2005).

The views of Bulgarian farmers towards farm diversification have not previously been reported. Before these views are presented it is appropriate to review their context and a review of the current characteristics of the agricultural sector in Bulgaria provides this.

3. Agriculture and farm diversification in Bulgaria

Agriculture has traditionally been an important sector in the economy of Bulgaria (Appendix 1) and agricultural land accounts for about 55% of the total area of Bulgaria (6.2 million ha) (SENTER, 2000).

During the period of Communism (1944-1989), agriculture was characterised by large state-controlled and over-specialised agricultural industrial complexes (AICs), centrally determined prices, no recognition of market forces and guaranteed markets. Over that time, the main goals of agricultural policies in Bulgaria were to provide an adequate

supply of basic food products, at low prices to the domestic market (OECD, 2000; Mergos *et al*., 2001). The collective farms were encouraged to develop non-agricultural activities, diversifying into food processing and light manufacturing (Chaplin *et al.*, 2004).

In 1989, the transition towards a 'free market' economy began in Bulgaria. Agricultural reform was characterised by the liquidation of the AICs, the development of a private sector, land restitution, privatization and price liberalisation. The agricultural industry was in a critical situation due to accumulated problems inherited from the period of Communism, the slow pace of reforms, lack of clear and consistent policies, reduced domestic demand and loss of the main export markets (EC, 1998; MAF, 2000; Georgieva, 2003). These structural changes led to a crisis in the agricultural sector with a significant decrease in the area and production of many crops (FAO, 1999; SENTER, 2000).

The farming structure that emerged after the liquidation of the AICs were a large number of private farms (average size about 1.5 ha producing mainly for self-consumption), and private production co-operatives (average size of about 700 ha) (FAO, 1999; MAF, 2000; Georgieva, 2003). The majority of these agricultural enterprises (individual farms and co-operatives) are still transitional, in need of significant improvements and consolidation. Consequently, they do not have a strategic vision for their future development nor plans for product/market changes (Bankova, 1999; EC, 2002).

After 1997, when land restitution was completed, a radical agricultural reform began in Bulgaria. A land market was established and new, more efficient agricultural and rural development policies were introduced. Agricultural policies became more consistent with long-term goals to develop an efficient, competitive and export-orientated agricultural sector and to improve the incomes of those working in agriculture and to prepare for the EU accession (MAF, 2000). The Special Accession Programme for Agriculture and Rural Development (SAPARD) has been introduced to prepare Bulgaria for the entry into the EU and to solve priority problems in agriculture and rural development before the candidate countries become members of the EU (EC, 2000; MAF, 2000; SENTER, 2000; Georgieva, 2003). One of the aims of this programme has been to transpose the West European model of agricultural diversification to the associated countries from Central and Eastern Europe (Chaplin *et al.*, 2004).

The popularity of farm diversification in Bulgaria increased slowly after the EU accession process started in 1999 not least because the development of alternative economic activities has been strongly promoted by Bulgarian agricultural and rural development policies and by the European Union's pre-accession SAPARD programme which has encouraged farm diversification.

4. Methodology

In this research, opportunities for farm diversification were investigated on a sample of agricultural/horticultural farms (excluding animal farms) in the Plovdiv region of Bulgaria (Appendix 2). Farmers were asked to evaluate two alternative strategies 'related diversification' and 'unrelated diversification'. Data collection was undertaken during January - April 2001. The research method used was structured face-to-face interviews as this took account of both, the farmers' lack of experience with research interviews and

the innovative nature of this topic. The same research method (face-to-face structured interviews) was used in Greece for investigating alternative farm enterprises and their strategies (Damianos and Skuras, 1996) and in New Zealand for assessing farmers' behaviour (Gary and Wilkinson, 1997).

Purposive sampling was employed due to the lack of an accurate and up-to-date list of the agricultural/horticultural farms in the Plovdiv region. Farmers were chosen due to their relevance to the research topic and their ability to produce the most valuable data. A total of 76 respondents were interviewed in their working places.

The data was analysed to determine whether variations in farm size or land ownership patterns influenced the evaluation of the two strategic options of related and unrelated diversification.

Farms in the sample were divided into the following groups: 'small' farms – less than 2 ha; 'medium size' farms – between 2-10 ha; and 'big' farms – more than 10 ha. In terms of land ownership, farms were classified: 'own' farms – cultivating only their owned restituted land; 'mixed / leased' farms – cultivating either a mixture of their own and leased land or only leased land; and co-operatives.

The majority of the data collected was quantitative and was analysed using the Statistical Package for Social Sciences (SPSS) Version 10. Some qualitative data derived from open ended questions was also collected. A range of descriptive analytical techniques were employed to determine patterns and relationships between variables.

Due to the limited number of co-operatives (5) and the small sample size, the validity of some of the statistical test results was restricted. A variety of approaches (e.g. reducing the number of possible answers, filtering out the independent variable categories) were considered and it was decided that these approaches would not significantly add to overall understanding.

5. Main findings

The majority of respondents (81%) were male and more than 40 years old. The average age overall was 49 years. More than half of the respondents (57%) had secondary qualification (11-12 years education) and 32% had a university degree. The interviewees had significant experience of working in agriculture (more than 15 years). SENTER (2000) stated that Bulgaria has a valuable comparative advantage because their farmers are well educated and experienced, however, a disadvantage is their advanced age (over 60 years old).

The survey found that farm diversification was not a common practice. Less than 8% of the interviewees (6 farms) had diversified their activities and all were still in the initial stages of diversification. Three farmers commenced animal breeding (with market orientation), another two had established small wineries and one had developed a plant-nursery alongside his crop-growing activities.

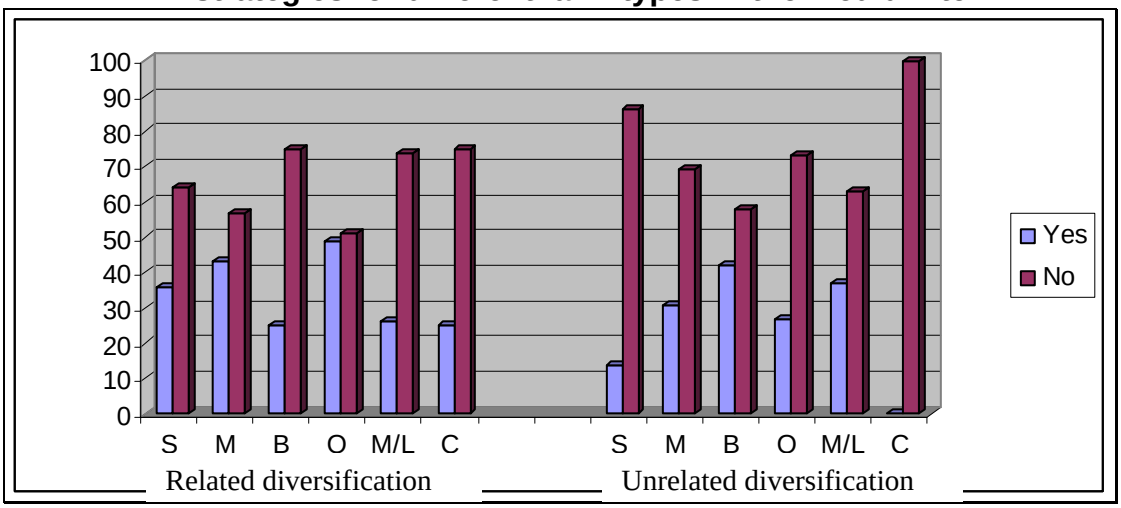
Of the 70 farms who had not diversified, 41of them (58%) expressed interest in diversifying their businesses. For 21 of the respondents (31%), diversification was not

considered appropriate in the medium term (next 5 years) and 8 farms (11%) were undecided.

5.1. Feasibility of diversification

About one third of the respondents considered both strategic options feasible for their businesses in the medium term (5 years). The results revealed a preference for new agricultural activities (related diversification) rather than non-agricultural activities, irrespective of farm size and land ownership pattern (Figure 1). Unrelated diversification was perceived as an option that might be feasible in the long term but not in the short or medium term. None of the cooperatives intended to diversify by introducing non-agricultural income streams. National and international reports (MAF, 2000; OECD, 2000; SENTER, 2000) confirm that the majority of the new co-operatives in Bulgaria are re-structured old collective farms. They have a very poor financial basis and have to adapt quickly to survive in the new competitive environment.

Figure 1: Perceived feasibility of 'related' and 'unrelated' diversification strategies for different farm types in the medium term



Note: S – 'small' farms; M – 'medium size' farm, B – 'big' farms, O – 'own' farms; M/L – 'mixed/leased' farm; C – co-operatives

5.2. Most favoured diversification activities

The alternative activities, considered most feasible by the interviewees who intended to introduce 'related diversification', were cultivating new agricultural crops such as herbs, oil-bearing or arable crops. The SENTER report (2000) emphasised that Bulgaria has a very good climate and a huge variety of herbs, which is a 'unique' advantage for herb production for export. The results revealed that the interviewees with different farm types (in terms of size and land ownership patterns) differed in their preferences for developing new agricultural activities. About one third of the respondents with small farms (39%) intended to combine agricultural activities with livestock farming. Those with 'big' farms and the co-operatives wanted to introduce oil-bearing crops suitable for big plots of land. However, 2-10 ha farms and those respondents, who cultivated only their own land, expressed a preference for planting herbs (Table 1). Herb production is labour intensive and best suited to smaller plots of land (SENTER, 2000).

Table 1: The top four new agricultural activities for farms of different size and ownership pattern

Activities	Related diversification			Related diversification			Total
	S	M	B	O	M/L	C	
	%	**%**	**%**	**%**	**%**	**%**	**%**
Herbs	20	44	0	44	14	0	35
Animal farms	39	28	0	33	14	0	27
Oil-bearing crops	0	17	33	6	29	100	15
Arable crops	20	6	0	6	4	0	8

Note: * This table includes only the most frequent four answers and excludes all the other answers. Percentages are based on all responses and may not sum to 100%
* S – 'small' farms; M – 'medium size' farm, B – 'big' farms, O – 'own' farms; M/L – 'mixed/leased' farm; C – co-operatives

More than one third of the interviewees who accepted the challenge of developing new non-agricultural activities (40%) wanted to establish a small-scale winery. Other desirable activities, stated by less than one third of the farmers (30%), were apple juice processing units or drying fruits and vegetables (10%). Respondents with different farm sizes and ownership patterns had different preferences. Farmers with less than 2 ha and 70% of those with 'own' farm who wished to introduce 'unrelated diversification' intended to develop small-scale wineries. This result was supported by both, SENTER (2000) and OECD (2000), who argued that establishing a winery was potentially an efficient business activity in the transition towards a 'free market' economy in Bulgaria. In comparison, farmers with 'big' production units apparently had more confidence and wished to dry their production (*e.g.* fruits) for export markets. SENTER (2000) stated that there is a market niche in the EU countries for dried fruits and vegetables and the Bulgarian farmers have the potential to address this market niche. The respondents with 'mixed/leased' farms (40%) wanted to establish fruit-processing units (*e.g.* apple juice) (Table 2). Other alternative non-agricultural activities although not very common amongst the interviewees, were establishing a farm shop or producing frozen fruits.

Table 2: The top four new non-agricultural activities for farms of different size and ownership pattern

Activities	Unrelated diversification			Unrelated diversification			Total
	S	M	B	O	M/L	C	
	%	**%**	**%**	**%**	**%**	**%**	**%**
Small winery	100	46	20	70	20	0	40
Small fruits processing unit	0	39	20	20	40	0	30
Drying room	0	0	40	0	20	0	10

Note: * This table includes only the most frequent four answers and excludes all the other answers. Percentages are based on all responses and may not sum to 100%
* S – 'small' farms; M – 'medium size' farm, B – 'big' farms, O – 'own' farms; M/L – 'mixed/leased' farm; C – co-operatives

SENTER (2000) suggested that organic farming could be a successful direction for Bulgarian agriculture. However, although respondents were aware of organic production it was identified as feasible by only one respondent. Another diversification activity, not very popular, was agri-tourism as respondents found it difficult to understand.

5.3. Factors encouraging diversification

The main factors encouraging farm diversification were a combination of business, economic and personal factors such as expected good financial results (profit and cash

flow), available market demand and possession of knowledge and experience. However, those considering new non-agricultural activities were characterised by their youth (Table 3). The SENTER report (2000) demonstrated that 60% of Bulgarian farmers are over 60 years old.

Table 3: Factors encouraging farm diversification for different farm types

Encouraging factors*	Related diversification			Unrelated diversification			Related diversification			Unrelated diversification		
	S	M	B	S	M	B	O	M/L	C	O	M/L	C
PERSONAL FACTORS												
Possession of knowledge and experience	40	33	39	80	54	40	28	43	100		50	
No age limitations					31					50	50	
Improved personal and financial security	40	39					50					
BUSINESS FACTORS												
Increased farm profit	40	42	42	60	85	60	67	43		90	60	
Increased cash flow				40	31	60				50	40	
Reduced business risk	40		33									
Available machinery									100			
ECONOMIC FACTORS												
Available market demand	60	56	46		39		56	57	100		30	
Sufficient distribution system		33	33	40				57		30		

Note: * This table includes only the most frequent four answers and excludes all the other answers. Percentages are based on all responses and may not sum to 100%
* S – 'small' farms; M – 'medium size' farm, B – 'big' farms, O – 'own' farms; M/L – 'mixed/leased' farm; C – co-operatives

The results demonstrated that the factors encouraging the development of new agricultural or non-agricultural activities were not influenced by farm size (Table 3).

Farm diversification was not a popular option for the managers of the co-operatives and only one of them intended to introduce new agricultural activities. None wanted to develop non-agricultural activities (Figure 1). This result could reflect an OECD (2000) report that stated that the newly established co-operatives have major financial problems, effectively preventing investments in new markets and products. However, the individual farms ('own' and 'mixed/leased') were mainly encouraged to support product and market changes due to perceived financial benefits (profit and cash flow), their accumulated knowledge and experience, and their youth (Table 3).

5.4. Factors discouraging diversification

About two thirds of respondents thought that developing new activities related to, or not related to agriculture, was not feasible in the medium term (Figure 1).

A review of the literature found that, in general, the economic performance of the newly established private farms in Bulgaria was poor (OECD, 2000; Georgieva, 2003). Their financial resources (own and borrowed) for investing were limited. Falling profits and cash flow problems together with the lack of subsidies and grants for investments were the key factors discouraging product/market transformations according to the respondents, irrespective of their farm size and land ownership patterns (Table 4). Lack of markets and the increased production costs were identified as primary discouraging factors when respondents considered developing new agricultural activities, whereas those who wished to develop non-agricultural activities pointed out the lack of governmental financial and organisational support (subsidies and available advisory

services) as the key negative factors. Additionally, farmers cultivating less than 10 ha were also discouraged by lack of modern machinery.

Borrowing money was a very complicated task in the 1990s as loans for agricultural activities were perceived as high risk by the banks and agricultural land was not accepted as a security (MAF, 2000). Acquiring specialised advice was almost impossible due to the belated establishment of extension and advisory services (OECD, 2000).

Table 4: Factors discouraging farm diversification for different farm types

Discouraging factors*	Related diversification			Unrelated diversification			Related diversification			Unrelated diversification		
	S	M	B	S	M	B	O	M/L	C	O	M/L	C
PERSONAL FACTORS												
Age limitations				33								
Lack of knowledge and experience												
BUSINESS FACTORS												
Decreased farm profit	33	38	33				32	40				
Decreased cash flow				25	35	29				28	35	25
High production costs	33	33	33				35	35	33			
Lack of or obsolete machinery	33	33										
Lack of capital for investments				67	79	57	30		67	78	77	50
ECONOMIC FACTORS												
Lack of market demand	33	58	44				42	60	33			
Lack of subsidies			44	25	35	71	32		67	41		100
Lack of advisory services			33	33	41	29				48	29	50
High level of bureaucracy										28		

Note: * This table includes only the most frequent four answers and excludes all the other answers. Percentages are based on all responses and may not sum to 100%
* S – 'small' farms; M – 'medium size' farm, B – 'big' farms, O – 'own' farms; M/L – 'mixed/leased' farm; C – co-operatives

5.5. Outcomes of farm diversification

The expected outcomes from diversification depended on farm size and ownership pattern. Farmers with less than 2 ha and 'own' farm prioritised livelihood security and quality of life and could be classified as 'lifestylers'. However, in a Bulgarian context, this would refer to security of their livelihood but in a West European context this would be interpreted as rejecting higher income opportunities for a better life style. Respondents with farms of more than 2 ha and those who leased land could be classified as 'flexible strategists', aiming for increased business viability and trying to respond to the rapidly changing external environment in Bulgaria by exploring potential new market opportunities (Table 5). The MAF report (2000) indicates that the number of these farms is increasing slowly and hopefully, they will represent the future of farming in Bulgaria.

Table 5: Expected outcomes of the two diversification strategies for different types of farm

Expected outcomes	Related diversification			Unrelated diversification			Related diversification			Unrelated diversification		
	S	M	B	S	M	B	O	M/L	C	O	M/L	C
	%	%	%	%	%	%	%	%	%	%	%	%
Increased business viability	60	89	100	100	92	80	72	86	0	80	100	0
Better quality of life	80	78	67	100	69	60	78	71	100	80	60	0
Better quality of products	40	39	67	50	46	60	39	57	100	50	50	0
Diversity of products	60	17	0	0	31	20	33	0	0	40	10	0
Diversity of markets	60	78	33	50	62	60	78	71	0	50	80	0

Note: * This table includes only the most frequent four answers and excludes all the other answers. Percentages are based on all responses and may not sum to 100%
* S – 'small' farms; M – 'medium size' farm, B – 'big' farms, O – 'own' farms; M/L – 'mixed/leased' farm; C – co-operatives

6. Conclusions

Farm diversification is an emerging field of research in Bulgaria and this study is one of the first to investigate the perceptions and opinions of farmers towards farm diversification.

Farmers in the Plovdiv region of Bulgaria, irrespective of farm size and land ownership patterns, did not favour farm diversification, preferring to retain their traditional agricultural orientation. Several factors contributed to their negative perceptions. The external economic environment had not encouraged farm owners/managers to introduce product/market transformations due to poor agricultural and rural development policies, lack of Governmental financial or organizational support, unstable markets and limited export markets. The number of advisory offices in Bulgaria who could provide helpful information and practical guidelines was also very restricted.

On the other hand, some business factors were also perceived as barriers to farm diversification, including limited financial resources from existing agricultural enterprises.

However, a limited number of farms had diversified their businesses and more intended to introduce new agricultural or non-agricultural activities. They were encouraged to undertake product/market transformations due to their optimistic financial results and significant knowledge and experience.

Farming plays an important role in the rural economy in Bulgaria. It is the main user of the land and a significant employer (MAF, 2000). Farm diversification is a common business approach for increasing the farm incomes in the West European countries (EC, 2000, Chaplin *et al*., 2004). During the pre-accession process, the EU has provided guidelines and established the requirements for agricultural restructuring in Bulgaria (EC, 2000). Hence, the Special Accession Program for Agriculture and Rural Development (SAPARD) that was introduced in 2000 prioritises and supports diversification of economic activities (MAF, 2000; EC, 2000, 2002).

Despite the difficult economic environment in Bulgaria, farm diversification has a lot of potential in Bulgaria due to favorable natural and weather conditions and cultural traditions that have existed for centuries. Equally, the completion of the process of joining the EU will present new challenges and opportunities for the successful implementation of farm diversification in Bulgaria. Although the majority of farmers rejected the adoption of new business approaches, such as farm diversification, over the next 5 years, they were aware of these opportunities but were waiting for improved political/legal stability and economic growth to provide a favorable business environment for product and / or market transformation. The FAO (1999) predicts that the numbers of entrepreneurial farms will increase and they would play an important role in the revitalisation of the agricultural sector in Bulgaria.

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APPENDIX 1: Geographical location of Bulgaria

APPENDIX 2: Geographical location of the Plovdiv region of Bulgaria

POTENTIAL IN AGRIBUSINESS – FRUIT AND VEGETABLE PROCESSING INDUSTRY IN INDIA

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POTENTIAL IN AGRIBUSINESS – FRUIT AND VEGETABLE PROCESSING INDUSTRY IN INDIA

ABSTRACT

India is the second largest producer of fruit and vegetables in the world. But, around only 2 percent of fruit and vegetable production is processed. This paper reports the consumption of fruit and vegetables in India and the status, growth and potential for fruit and vegetable processing. Production of fruit and vegetables grew at an annual rate of 4.35 and 5.74 percent, respectively during 1992-2002. Consumers' expenditure on fruit and vegetables has been rising over the years in India. Consumers' demand for fruit was more responsive than was the demand for vegetables to increased income. The study found that the number of processing units has grown by about 3.68 percent per annum during 1992-2003. Capacity utilization was about 37 percent in 1992, which has now increased to about 47 percent. Because of low capacity and poor capacity utilization, processing is at very low level. With regards to exports, there is a lack of processable varieties of fruit and vegetables. However, there has been tremendous growth (20.32 percent compound) in exports of processed fruit and vegetables particularly during the nineties following new economic policies, but India's share of world exports is very low. Among the various processed fruit and vegetable products exported, dried & preserved vegetables constituted the largest share (47 percent). Following economic liberalization, foreign direct investment in the processing sector has been increasing. India has the potential to become a leading exporter of processed fruit and vegetable products. To achieve this, there is a need to remove the constraints facing the industry. Globalization and liberalization have brought unprecedented challenges and severe competition to the processing industry. Firms must be innovative and need to anticipate and respond to the requirements of consumers for their survival and sustained growth. Only then one can hope to see the fruit and vegetable processing industry as a 'sunrise' industry.

Key words: Fruit and vegetables, processing, income elasticity of demand, compound growth rate, installed capacity, exports

ISSN 1816-2495
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INTRODUCTION

Under traditional agriculture, farmers grow crops for their own use, depend upon their own resources and purchase few inputs. Now, with technological advancement, farmers buy a sizable portion of their inputs and produce crops/farm products for the market/ non-farming population. This is called commercial agriculture, which has resulted in increasing productivity, economies of scale, increasing returns to investment, higher income for labour, etc. But at the same time, commercial agriculture has led to problems related to income distribution, industrial peace, social justice, etc.

Marketing, processing, production, farm supplies, research, extension, government policies and programs are important areas for agri-business. The focus in this paper is on processing of agricultural commodities. Processing refers to deliberate activity, which changes a commodity into a more useable form with value addition. Among the agro-processing industries, food processing is the dominant one. Processed food products can be classified into major product groups such as cereal products, fruit and vegetables, dairy, meat, and marine products. Due to diverse agro-climatic conditions, India is rich in raw material for agro-processing industries. As far as fruit and vegetable production is concerned, India with 45.50 million tons of fruit and 90.83 million tons of vegetables occupies first and second place, respectively in the world's total production. Due to lack of post-harvest handling and processing facilities about 30 percent of fruit and vegetables are lost/ damaged. Fruit and vegetables are highly perishable in nature, and processing assumes paramount importance for exploiting the economic potential by creating time, form and space utilities. The demand for processed fruit and vegetable products is bound to rise with increased real income and improvement in the standard of living, modern life style, urbanization, contribution of women to household income, etc. *Roti and Dal* (chapati and pulses) used to be the typical Indian diet since time immemorial. Due to the

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substantial reduction in output of pulse crops in India, prices have increased manifold and pulses have become out of reach of the majority of people. Vegetables have become a relatively cheaper substitute for costly pulses. Keeping in view the above facts, this paper reports the consumption pattern of fruit and vegetables in India and the status, growth and potential for the fruit and vegetable processing industry.

METHODOLOGY

Data on the number of processing units, production, installed capacity, capacity utilization and related parameters were collected from published sources i.e. Annual Reports of the Ministry of Food Processing Industry, Government of India; FAO, Production Year Book; FAO, Trade Year Book; Fertilizer Statistics; Economic Survey of India, etc. To study the consumption pattern of fruit and vegetables, data on Monthly Per Capita Expenditure was collected from National Sample Survey (NSS) Rounds for the years 1983-84 (38^{th} round), 1987-88 (43^{rd} round), 1993-94 (50^{th} round) and 1999-2000 (55^{th} round). To determine changes in demand for fruit and vegetable products, the income elasticity of demand was calculated. To calculate this, total consumption expenditure of households has been taken as a proxy of income and the double log function below used for determining the income elasticity of demand:

$$Y = a\, x^{b}$$

$$\text{Log}Y = \text{Log}\, a + b\, \text{Log}\, x$$

Where:

Y = consumption expenditure on item concerned (in rupees)
x = total consumption expenditure or income (in rupees)
b = regression coefficient (income elasticity)

To determine trends, a linear regression equation was estimated. The annual growth rates were calculated by using an exponential function as given below:

$$Y = abt$$

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Log Y = Log a + t Log b

r (Compound Growth rate) = (Antilog b – 1) x 100

Where,

Y = Dependent variable,

a = Constant,

b = Regression coefficient,

t = Time

r = Compound growth rate

RESULTS AND DISCUSSION

Production of fruit and vegetables: Production of fruit and vegetables in India has gradually increased over time. The average annual production of fruit was 16.18 million tons during 1973-75 and 45.82 million tons during 2000-02, an increase of 183.19 percent (Table 1).

Table: 1 Total production of fruit and vegetables in India over time

(Million tons)

Year	Fruit	Vegetables
1973-75	16.18	33.78
1976-78	17.48	38.51
1979-81	18.70	40.99
1982-84	22.38	44.66
1985-87	25.31	48.38
1988-90	27.04	52.32
1991-93	31.00	60.85
1994-96	40.19	71.31
1997-99	44.27	83.68
2000-2002	45.82	93.76
Compound Growth Rate (percent) – 1973-2002	4.34	3.80
1992-2002	4.35	5.74

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Similarly, the average annual production of vegetables rose to 93.76 million tons during 2000-02 from 33.78 million tons in 1973-75, an increase of 177.56 percent.

A large variety of fruit is grown in India and with a total of over 46 million tons, accounts for about 10 percent of world production. India ranks first in the production of mango, banana, sapata and acid lime. In 2001-02, bananas occupied the top position at 16.45 million tons accounting for about 35.74 percent of total fruit production, followed by mangoes (23.12 percent), citrus (9.95 percent), papaya (3.95 percent), apple (3.08 percent), pineapple (2.73 percent), guava (2.39 percent) and grapes (2.39 percent) (Table 2).

Table: 2 Production of important fruit and vegetables in India: 2001-02

(Millions tons)

Fruit	Production	Vegetables	Production
Banana	16.45	Potato	24.00
Mango	10.64	Brinjal	7.80
Citrus	4.58	Tomato	7.42
Papaya	1.82	Cabbage	5.70
Apple	1.42	Onion	4.85
Pineapple	1.26	Cauliflower	4.70
Guava	1.10	Okra	3.42
Grapes	1.10	Peas	3.11
Sapata	0.70	Others	35.54
Litchi	0.42	Total	96.54
Others	6.53		
Total	46.02		

Vegetables constitute the most important food next only to cereals and milk. India is the leading world producer of cauliflower, second in onion and third in cabbage. Among vegetables, potato occupies the top position with 24 million tons accounting for about 24.86 percent of total vegetable production followed by brinjal (8 percent), tomato (7.69 percent), cabbage (5.90 percent), onion (5 percent), cauliflower (4.87percent), okra (3.54 percent), and peas (3.22 percent).

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Production of fruit and vegetables increased at an annual rate of 1.66 million tons and 4.32 million tons, respectively during 1992-2002. Production of fruit grew at an annual compound rate of 4.35 percent and vegetables at 5.74 percent between 1992 and 2002.

Consumption of fruit and vegetables: The per capita monthly expenditure on fruit, vegetables, food and total consumption expenditure in 1983, 1987-88, 1993-94 and 1999-2000 is presented in Table 3.

Table 3: Monthly per capita expenditure on fruit and vegetables over different NSS Rounds

(Rs)

Year	Vegetables	Fruit & nuts	Total food	Non-food	Total consumption expenditure
Rural					
1983-84	5.3	1.6	73.8	38.8	112.6
1987-88	8.2	2.6	100.8	57.3	158.1
1993-94	19.1	5.9	177.8	103.6	281.4
1999-2000	30.0	8.4	289.0	197.0	486.0
Urban					
1983-84	8.2	3.5	97.0	67.1	164.1
1987-88	13.1	6.3	139.8	110.2	249.9
1993-94	25.0	12.2	250.3	207.7	458.0
1999-2000	43.9	20.7	411.0	444.0	855.0

The monthly per capita total expenditure (MPCE) has been increasing over the years in India. However, the increase in MPCE was more pronounced in 1999-2000 (55^{th} round) over 1993-94 (50^{th} round) than in 1993-94 (50^{th} round) over 1983-84 (38^{th} round). The average monthly per capita total expenditure (food and non-food expenditure) was Rs. 112.6 in 1983-84 (38^{th} round), which increased to Rs. 486 in 1999-2000 (55^{th} round) in rural India whereas in urban India, it increased from Rs. 164.10 to Rs. 855 during the same period. With the passage of time, the percentage of expenditure on food items has declined in both areas, indicating that with increased income, consumers spend relatively more on non-food items. The MPCE on fruit and vegetables has also shown a rising trend in both areas. In the case of vegetables, the MPCE in rural areas was Rs. 5.30 in 1983-84,

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which increased to Rs. 30.0 in 1999-2000 in rural areas and in urban areas, it rose to Rs. 43.90 in 1999-2000 from Rs.8.20 in 1983-84. The MPCE was higher in urban than in rural areas in all four rounds. Rising consumption on fruit and vegetables must be due to increased consumer incomes and changes in consumption. It is a good sign, indicating increasing awareness about the importance of fruit and vegetables in diets.

Income elasticity: The income elasticity of demand for fruit and vegetables has been computed for the rural and urban areas for 1993-94 (50^{th} round) and 1999-2000 (55^{th} round) based on the data collected from NSS rounds. In rural and urban regions in 1993-94, the income elasticity of demand for fruit was 1.50 and 1.36 percent respectively, indicating elastic demand in both regions. It shows that fruit consumption increases by 1.50 percent for each one per cent increase in income in rural regions and by 1.36 percent in urban regions. In the case of vegetables, the income elasticity of demand was 0.62 in rural areas and 0.67 in urban areas indicating relatively inelastic demand in both areas. The income elasticity of demand for fruit has increased over the years and reached 2.03 in rural and 1.68 in urban areas in 1999-2000 (55^{th} round). In relation to vegetables, there has not been much increase in income elasticities (0.72 in rural and 0.73 in urban regions) during this period. From the above, it is inferred that consumer demand for fruit is more responsive to income than is the demand for vegetables.

Fruit and vegetable processing industry – status and growth:

India is the second largest producer of fruit and vegetables in the world. But only about 2 percent is processed compared to about 80 percent in Malaysia, 30 percent in Thailand, and 60 – 70 percent in the UK and USA. Fifteen percent of milk is processed. Although India has an abundant supply of food, the food processing industry is still nascent. Despite low volumes, the processed food industry ranks fifth in size in the country, representing 6.3 percent of GDP. It accounts for 13 percent of the country's

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exports and 6 percent of total industrial investment. The performance of the fruit and vegetable processing sector and other sectors is depicted in Table 4.

Table 4: Trends and growth in the fruit and vegetables sector and other sectors: 1992-2003

Year	Production of fruit and vegetable products (lakh tons)	Installed capacity of fruit and vegetables processing (lakh tons)	Capacity utilization of fruit and vegetables processing (percent)	Number of licensed units under FPO	Number of modern rice mills	Number of roller flour mills	Production of milk (million tons)	Production of processed milk products (lakh tons)	Production of marine products (lakh tons)
1992	3.5	9.5	36.84	4057	32969	696	58.5	2.2	43
1993	4.69	11.08	42.33	4132	32969	702	61.2	2.29	46
1994	5.59	12.6	44.37	4270	33557	750	63.5	2.49	47
1995	6.76	14.02	48.22	4368	34113	800	65	2.61	49
1996	8.5	17.5	48.57	4674	34685	812	68	2.76	53
1997	9.6	19.1	50.26	4932	34688	812	71	2.85	53
1998	9.1	20.4	44.61	5112	34688	820	74.5	3.01	56
1999	9.4	20.8	45.19	5198	35088	820	74.5	3.07	56
2000	9.8	21	46.67	5293	35088	820	78	3.16	56
2001	9.9	21.1	46.92	5569	35000	820	84.6	3.2	60
2002	10.3	21.98	46.86	5569	NA	NA	NA	NA	NA
2003	10.72	23.28	46.05	6097	NA	NA	NA	NA	NA
Linear Trend value	0.62	1.24	0.48	177.77	257.55	14.25	2.66	0.12	1.75
CGR (%)	9.33	8.09	1.15	3.68	0.76	1.89	3.87	4.42	3.48

Source: Annual Reports, Ministry of Food Processing Industry, Govt. of India (various issues).
CGR - Compound Growth Rate

Production of processed fruit and vegetables has gone from 3.5 lakh tons in 1992 to 10.72 lakh tons in 2003, an increase of 0.62 lakh tons per annum. However, production of processed fruit and vegetables is much less than the installed capacity of fruit and vegetable processing units reflecting low capacity utilization. Fruit and vegetable processing industry capacity has increased from 9.5 lakh tons in 1992 to 23.28 lakh tons in 2003. As a result of withdrawal of an excise duty on fruit and vegetable products in the Union Budget of 2001, the installed capacity and growth of this sector has been increasing steadily. Production in 2003 was approximately 4 percent above 2002. As regards capacity

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utilization this was only 37 percent in 1992, i.e. against installed capacity of 9.5 lakh tons, only 3.5 lakh tons of fruit and vegetables were processed. Capacity utilization slowly increased and reached 50 percent in 1997. In the next year it declined to 44.61 percent, which may be due to the imposition of an 8 percent excise duty on fruit and vegetables products in 1997. After that it again increased and now is around 46 - 47 percent. In 1992, there were 4057 FPO licensed units and 6097 units in 2003, an increase of about 178 units annually.

The number of modern rice mills rose from 32969 in 1992 to 35000 in 2001, an increase of about 258 mills per annum. Roller flour mills went from 696 in 1992 to 820 in 2001 or about 14 new mills per annum. The production of processed milk products, milk and marine products increased at the rate of 0.12 lakh tons, 2.66 million tons and 1.75 lakh tons per annum, respectively. In India, a significant portion of the processing of fruit and vegetables is carried out as a small scale cottage industry. However, both modern and traditional methods of processing are also used on large scales to process fruit and vegetables, for example, potato chips, banana chips, raisins, pickles, jellies, and squashes.

The production of processed fruit and vegetable products grew at the compound rate of 9.33 percent per annum and installed capacity grew at 1.15 percent per annum between 1992-2003. The number of modern rice mills, roller flour mills, production of milk, processed milk products and marine products have grown at 0.76, 1.89, 3.87, 4.42 and 3.48 percent, respectively. Licensed units under FPO have grown at 3.68 percent per annum.

Export of fruit and vegetable products: The fruit and vegetable processing sector in India has a tremendous potential for export due to the diversity in horticultural production and seasons. The domestic consumption of processed foods is still low because of

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traditional eating habits and low purchasing power of the masses and hence initially the success of the fruit and vegetable processing sector is primarily linked to exports. Fruit and vegetables have a strong export potential in India provided the domestic market becomes more stable in production of standard and quality products. Exports have fluctuated over the years but increased from Rs. 206 crore in 1992-93 to Rs. 1207 crore in 2002-03 (Table 5).

Table: 5 Export of processed fruit and vegetable products: 1992-93 to 2002-03

(Rs. Crore)

Years	Dried & processed vegetables	Mango pulp	Pickles & chutneys	Others	Total
1992-93	85.73 (41.63)	58.34 (28.33)	28.65 (13.91)	33.21 (16.13)	205.93 (100.00)
1993-94	107.08 (39.88)	57.98 (21.59)	36.13 (13.46)	67.31 (25.07)	268.5 (100.00)
1994-95	146.52 (42.08)	80.71 (23.18)	49.75 (14.290	71.23 (20.46)	348.21 (100.00)
1995-96	247.66 (50.38)	84.61 (17.21)	52.53 (10.69)	106.77 (21.72)	491.59 (100.00)
1996-97	231.07 (48.77)	105.01 (22.16)	56.43 (11.92)	81.26 (17.15)	473.77 (100.00)
1997-98	479.89 (63.02)	125.31 (16.46)	76.71 (10.07)	79.59 (10.45)	761.5 (100.00)
1998-99	383.08 (54.29)	138.56 (19.63)	75.96 (10.77)	108.11 (15.31)	705.68 (100.00)
1999-2000	589.9 (59.37)	196.53 (19.78)	89.99 (9.06)	117.23 (11.79)	993.64 (100.00)
2000-01	738.29 (54.87)	263.85 (19.60)	136.46 (10.14)	206.94 (15.38)	1345.54 (100.00)
2001-02	537.15 (48.80)	241.34 (21.93)	120.34 (10.93)	201.74 (18.33)	1100.57 (100.00)
2002-03	561.03 (46.48)	297.01 (24.61)	154.16 (12.77)	194.73 (16.13)	1206.93 (100.00)
Linear Trend value	60.99	24.85	11.99	16.37	114.19
CGR (%)	23.18	19.24	17.38	16.61	20.32

Note: Figures in parentheses indicate percentages.

Dried and preserved vegetables constituted the largest share of processed fruit and vegetable exports. Processed exports were 41.63 percent in 1992-93 declining to 39.88 percent in 1993-94, then increasing and reaching 63.08 percent in 1997-98, before falling to 46.48 percent in 2002-03. Mango pulp is in 2nd place and its share of total exports ranged from 16.46 percent in 1997-98 to 28.33 percent in 1992-93. The contribution of

ISSN 1816-2495
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pickles and chutneys to total exports of fruit and vegetable products ranged between 9.06 percent in 1999-2000 and 14.29 percent in 1994-95. The main countries importing Indian processed fruit and vegetable are the Gulf countries, USA, UK, Germany and Russia.

Exports of processed fruit and vegetables have increased significantly during the 1990s particularly after economic liberalization. During the 1980s exports of processed fruit and vegetables grew at a compound rate of 5.3 percent (Singh and Vasisht, 1995), but in the 1990s were 20.32 percent. Export of dried and preserved vegetables, Mango pulp, pickles and chutneys growth rates were 23.18, 19.24 and 17.38 percent per annum, respectively.

Constraints faced by the Fruit and Vegetable processing industry: It is estimated that in India about 30-40 percent of the total harvest goes to waste and only about 2 percent of total production is processed. Constraints inhibiting the growth of the fruit and vegetable processing industry include:

1. Limited availability of varieties suitable for processing, which affects processing in two ways. Firstly, it causes low processing volumes. For instance, in India only about 2.0 percent of total fruit and vegetables grown are processed, in contrast to Malaysia (83 percent), Philippines (78 percent), Brazil (70 percent) and Thailand (30 percent). Secondly, it results in high processing costs. For instance, to produce one ton of orange juice in India, 14 tons of raw material is needed, whereas only about 10 tons is needed in other countries.

2. Fruit and vegetables are highly perishable and require a reasonable storage and transportation system, which does not always exist in India. The lack of these facilities causes huge annual wastage. Government plans to upgrade cold storage facilities continue to be on the back burner. The existing facilities are highly inadequate to keep pace with rising production of fruit and vegetables in the country.

3. In India, legislation regulates the processed food industry like the Prevention of Food Adulteration Act, 1954 and the Fruit Products Order, 1955. No doubt, these laws are meant to provide uniform and high quality food products to consumers but due to certain practical problems they have hampered the growth of the processing industry.

4. Production is concentrated mainly in unorganized and tiny sectors where economies of scale are not possible. Attainment of international acceptable quality products in these small units is difficult.

ISSN 1816-2495
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5. Modern technology is available to a handful of large companies. Obsolete technology in production, processing, packaging and distribution coupled with high costs and government duties and taxes make Indian products less competitive in world markets.

6. Absence of effective backward linkages in the fruit and vegetable processing industry with small farmers also cause mismatches between industry production schedules and the supply of raw materials.

7. The high cost of raw material, machinery and packaging material; poor technology in processing, packaging and distribution; inadequate and expensive air- cargo and shipping and port facilities, etc. also inhibit the growth of this industry.

Potential for Fruit and Vegetable processing: Despite various constraints, there exists great potential for further fruit and vegetable processing in India. Important factors in achieving this potential are:

1. There is an opportunity to tap under exploited minor fruit. Many products, though nutritious, are not suitable for consumption in their fresh state, but can be processed into excellent products. Processing could make better use of existing capacity in the processing industry.

2. With the improvement in living standards and more women supplementing the family income, there is a shift in food requirements and the demand for processed fruit and vegetables is bound to increase. Convenience foods, ready-to-eat and fast foods have become a social necessity. The availability of convenient fruit and vegetable products providing nutritious products at reasonable prices during the off season should greatly help working women to save their valuable and creative time. Also, today with the impact of the electronic media, rural people have also become users of processed fruit and vegetables.

3. Fruit and vegetable processing causes huge solid wastes. Processing of wastes/by-products may increase total returns or lower unit processing costs. It is estimated that every year fruit and vegetables worth about Rs.3000 crore are wasted due to lack of post harvest processing. If this loss is avoided /controlled, it would not only increase the income of the growers but also add to the food basket of the country.

4. India is the largest producer of fruit and vegetables in the world, accounting for about 10 and 13 percent of world total fruit and vegetable production, respectively. But India's share of world trade is small suggesting the country has potential for more exports (Table 5).

5. Fruit and vegetable processing has close and direct rural linkages throughout the country. This helps to create employment both in skilled and unskilled segments in growing, harvesting, transportation, storage, processing and distribution.

6. The Ministry of Food Processing Industry in India is extending financial assistance in the form of grants in-aid for setting up new processing units, modernization and

ISSN 1816-2495
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upgrading of existing units. This will go a long way in boosting the fruit and vegetable processing sector.

Policies needed for sector development: Some suggestions for achieving growth and development in the fruit and vegetable processing industry in India are given below:

1. Varieties of fruit and vegetables fit for processing should be developed. The processors should enter into contracts with farmers and procure the products at specified prices. Currently, contract obligations are not always met. If the demand for processed products is not adequate, companies do not procure the product claiming inferior quality. If the free market prices are higher than contract prices, farmers will not sell produce to the processors. It is necessary to develop a contract binding both parties to their obligations. The Ministry of Food Processing Industry is operating a scheme to strengthen backward linkages through promotion of contract farming.

2. Farmers need to be encouraged to form cooperatives to grow raw materials for industry. They could supply semi-finished material, thus cutting transport cost of peel, pomace, etc.

3. There is a long distance from factory to ports/sea ports and products may not be dispatched for export immediately after reaching the ports/sea ports. Refrigerated vans for taking products from factories to ports/sea ports and storage facilities need upgrading.

4. The possibility needs to be explored for collaboration with multinationals, to better compete in the world market.

5. Efforts should be made to improve capacity utilization, using multi purpose processing plants. Installing flexible machinery that can process a range of products is vital.

6. Research and development and technology transfer should be encouraged by giving special incentives by providing better quality material and improving productivity.

CONCLUSIONS

Demand as well as production of fruit and vegetables has increased considerably over time in India. Production of fruit has grown at an annual compound growth rate of 4.35 percent and vegetables at 5.74 percent during 1992-2002. Now, further processing has assumed paramount importance for commercial exploitation by creating time, form and space utilities. The installed capacity utilization is low (below 50 percent). The growth in output of processed fruit and vegetables was greater during the 1990's than the 1980's, mainly due to new Government economic policies. India witnessed a substantial increase

ISSN 1816-2495
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in exports of processed fruit and vegetables during the 1990's but total exports still remain a very small fraction of total output. Exports could be increased by developing appropriate research and development policies and relaxing the constraints faced by the processing industry.

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ISSN 1816-2495
www.ifmaonline.org

Journal of International Farm Management Vol.3. No.2 - January 2006

FINANCE FOR SMALL AND MEDIUM ENTERPRISES:

NIGERIA'S

AGRICULTURAL CREDIT GUARANTEE SCHEME FUND

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ISSN 1816-2495
www.ifmaonline.org

Finance for the SMEs – Nigeria's Agricultural Credit Guarantee Scheme Fund

Abstract

A major challenge facing many developing countries, especially in Africa, is devising appropriate development strategies that will capture the financial services requirements of farmers and small and medium entrepreneurs who constitute about 70 percent of the population. The Federal Government of Nigeria considers this segment critical for its development efforts to be fully realised. The Government has instituted various policies to achieve its aims, including a commercial bill financing scheme; regional commodity boards (later called national commodity boards); an export financing and rediscount facility (1987); the Nigerian Agricultural Cooperative and Rural Development Bank Ltd; community banks, People's Bank; the Agricultural Credit Guarantee Scheme Fund (ACGSF); and the Small and Medium Enterprises Equity Investment Scheme among others. These policies have contributed to improving the livelihoods of farmers and entrepreneurs.

Keywords: finance, farmer, bank, guarantee, small & micro enterprises

1.0 Introduction

In Nigeria, credit has been recognised as an essential tool for promoting Small and Micro Enterprises (SMEs). About 70 percent of the population is engaged in the informal sector or in agricultural production. The Federal and State governments in Nigeria have recognized that for sustainable growth and development the financial empowerment of the rural areas is vital, being the repository of the predominantly poor in society and in particular the SMEs. If this growth strategy is adopted and the latent entrepreneurial capabilities of this large segment of the people is sufficiently stimulated and sustained, then positive multipliers will be felt throughout the economy. **To give effect to these aspirations various policies have been instituted over time by the Federal Government to improve agricultural production capabilities, positively channel the potential of SMEs to enhance their standard of living and to put the sector in the front burner of Government's development strategy.**

This paper focuses on policies taken by Nigeria to either institutionalize or enhance the availability of credit to SMEs. It also examines the operations of the Agricultural Credit Guarantee Scheme Fund and the strategies adopted to sustain micro financing and development of entrepreneurship in Nigeria.

In addressing this issue, the paper is divided into six parts. Following the Introduction in Part I, Part II examines Government policies aimed at channeling finance to the agricultural sector. Part III highlights the operations and achievements of the Agricultural Credit Guarantee Scheme Fund. Part IV discusses innovations and initiatives by the Central Bank of Nigeria (CBN) to sustain its operations in the face of changing economic conditions. Part V discusses constraints, new products for financing SMEs introduced by the CBN and prospects for the Scheme, while Part VI concludes the paper.

2.0 Government Policies for providing Micro Finance for the Development of Agriculture

Micro finance policies to bring credit to the under banked sector of the economy were generally biased towards developing agriculture. Policies implemented by the Federal Government included a commercial bill financing scheme (1962), regional commodity boards (later called national commodity boards, 1977), and an export financing and rediscount facility (1987). Others were:

(i) Nigeria Agricultural Co-operative & Rural Development Bank (NACRDB)

The Nigeria Agricultural and Co-operative Bank Ltd was established in 1972. The Nigeria Agricultural Co-operative & Rural Development Bank evolved recently from the merger of the Nigeria Agricultural and Co- operative Bank with the People's Bank.

(ii) Community Banks

The community banking concept was also introduced into the financial landscape. They provide banking and financial services for the rural economies and micro-enterprises in the urban centres and are structured on communal ownership. The first community bank started operations in 1990. There were five hundred and four community banks by May 2004.

(iii) Sectoral Allocation of Credit & Concessional Interest

Until 1996, the Central Bank of Nigeria issued guidelines on sectoral allocation of credit with concessional interest rates for agriculture.

(iv) Specified Percentage of Total Deposits Mobilised in the Rural Areas

A specified percentage of total deposits mobilised in the rural areas were to be lent to borrowers in such areas.

(v) Rural Banking Programme (1977)

A rural banking policy, which compelled commercial banks to open a specified number of branches in rural areas was implemented in the 1980s and early 1990s. Over 700 rural branches were opened before the programme was discontinued.

3.0 The Agricultural Credit Guarantee Scheme

In a study conducted in 1976 by the CBN, shortage of primary production credit was identified as one of the major causes for declining agricultural production. This shortage was attributed to reluctance by the banks to provide credit for real sector activities, especially agricultural production. The reasons were obvious:

- inherent risks associated with agricultural production;
- urban/semi urban based nature and mode of operations of the banks;
- high cost of administration of agricultural loans and;
- inability of farmers to provide the necessary collateral.

As a probable solution to the above problems the Agricultural Credit Guarantee Scheme Fund was established by the Federal Government (60 percent) and Central Bank of Nigeria (40 percent) in 1977 with an initial Fund of Naira (₦)100 million subscribed and paid up capital of ₦ 85million.

The Scheme provides guarantee cover for loans advanced to the agricultural sector by banks. The cover pledges to pay to the banks, 75% of any outstanding default balance by borrowers provided that collateral pledged has been realised and applied to the account. The Central Bank of Nigeria manages the Fund, and is responsible to a Board. To operate the Scheme, the CBN opened Agricultural Finance Offices (now Development Finance Offices) in its branch offices in 22 states of the federation. Through the branch offices, the Central Bank of Nigeria handles the day-to-day operations of the Scheme. The CBN issues a Guarantee Certificate to the lending bank to pay 75% of any outstanding balance in the event of default less the amount realised from the security pledged by the borrower. The lending bank can file a claim on the Fund if the above has been fulfilled.

(a) Scope of the Scheme

Agricultural activities the Fund can guarantee are:

- establishment or management of rubber, oil palm, cocoa, coffee, tea and similar crops;
- cultivation or production of cereal crops, tubers, fruit of all kinds, cotton, beans, groundnuts, sheanuts, benniseed, vegetables, pineapples, banana and plantains;
- animal husbandry, that is, poultry, pigs, cattle rearing and the like, fish farming and fish capture; and
- processing in general where it is integrated with at least 50 per cent of farm output e.g. cassava to garri, oil palm to palm oil and kernel, groundnut to groundnut oil etc.

(b) Loan Limits Under The Scheme

The Scheme now has a capital base of ₦3.0 billion and loan limits of ₦20,000 for loans without tangible securities, ₦1.0 million for individual borrowers, and ₦10.00 million for cooperatives and corporate borrowers.

(c) Types of Security Accepted for Loans:

Acceptable securities for loans under the Scheme can be any of the following:

(i) a charge on land on which the borrower holds a legal interest, or a charge on fixed assets, crops or livestock;

(ii) a charge on any moveable property of the borrower;

(iii) a life assurance policy, a promissory note or other negotiable security;

(iv) stocks and shares;

(v) a personal guarantee and

(vi) Any other security acceptable to the bank.

(d) Performance of the ACGSF to date:

Loans guaranteed:

Despite the fact that micro finance services are not readily available in Nigeria, the ACGS has achieved giant strides. From its inception in 1978 to 2004 it guaranteed a total of 397,422 loans valued at ₦ 7.603 billion. Micro lending under the ACGS (that is loans under ₦ 50,000) were 365,423 or 91.9 percent, valued at ₦ 3.856 billion or 50.6 percent of total loan value.

The volume of guaranteed lending by banks peaked in 1989 when 34,518 loans were guaranteed. Thereafter the total number of loans dwindled being only 12, 859 in 1999, before increasing to 35,035 in 2004. The major factor responsible for the increase was that banks now see lending under the Scheme as being very profitable. Six banks currently participate in the Scheme out of 89 operating in the country. The introduction of the Structural Adjustment Programme in 1986, market liberalization in the 1990s, closure of unprofitable rural branches, and banking sector distress greatly reduced and affected banks' participation under the ACGS.

Loan Repayments:

Between 1978 and 2004, 252,608 loans valued at ₦ 4.538 billion were fully repaid out of the 397,422 loans guaranteed with a value of ₦7.603b. This represents 64 and 60 percent rate respectively.

Claims Filed and Claim Settled:

One of the major mandates of the Scheme is to process and settle genuine claims filed by the banks. A total of 6994 claims for ₦289,721,500 have been filed by the banks since Scheme inception, with 2961 claims valued at ₦26,410,700 settled. Furthermore, 1596 claims valued ₦44,218,500 were recovered from defaulters in the States before they could be settled.

4.0 Constraints Militating Against the Scheme:

One of the major factors militating against the success of the ACGS is scarcity of loanable funds due to lack of bank support for the Scheme. The number of participating banks rose gradually from 10 in 1978 to 28 in 1986 and peaked at 34 in 1989. Thereafter, the number declined with only six participating now.

It has always been argued that banks are in business to make a profit. They cannot be borrowing short and lending long to micro and small enterprises that are characterized by high risk. Furthermore, in a free-market economy, which is private-sector driven, government's intervention is expected to be minimal.

Other constraints are (i) inadequate capital base, (ii) unwillingness of farmers sometimes to repay loans; (iii) non-settlement of claims; (iv) poor project appraisal by banks; (v) lack of adequate collateral; (vi) high cost of administering small loans; (vii) reduction in the number of participating banks.

5.0 Efforts by the CBN Management to enhance the Scheme:

(i) There was an increase in share and paid-up capital from ₦100million to ₦3billion in March 2001;

(ii) Loan limits were increased from:
₦5000 to ₦20, 000 with out collateral:
₦100, 000 to ₦500, 000 to individuals with collateral:
₦1million to ₦5million for cooperatives and corporate bodies;

(iii) Other measures included a Self Help Groups Linkage Banking Programme; a Trust Fund Model, an interest drawback program and a campaign to encourage more banks to participate.

5.1 Innovations and Initiatives by the CBN to Improve Lending Under the Scheme

To ensure that micro and small enterprises had the financial resources to widen their economic activities, the CBN initiated various models, products and strategies to improve lending under the Scheme. Prominent among these are the following:

5.1.1 Self-Help Groups Linkage Banking Programme

The Self-Help Groups Banking Linkage Programme (SHGBLP) for savings mobilisation was launched under the ACGS in 1991 and became operational in 1992. Under the programme, farmers with a common purpose are encouraged to form groups of between 5 and 15 people. They can then undertake regular savings, which are deposited in a partner bank of their choice. After saving for six months, they may then apply to the partner bank for a loan. The groups can be informal or registered (formal).

Bank loans to a group are normally in multiples of the balance in their savings account at the time of loan application. So far, banks have advanced loans nationwide four times the total balance in the savings accounts. Under this program, a lending bank holds the group savings as security, which can not be drawn on until loans are repaid. The aim of the Self-Help Groups Linkage Banking is to inculcate a culture of savings and banking in group members and for them to build up resources for financing their farm projects without recourse to bank borrowing in the long run.

5.1. 2 Trust Fund Model (TFM):

The Bank has widened the scope of Self-Help Groups Linkage Banking to include State Governments and blue chip companies willing to provide funds for farmers within their catchment areas or in the host communities where they operate. The intermediation is in the form of Trust Funds, which they deposit with partner lending banks to secure part of the banks' exposures to farmers. Companies participating in the TFM include the following:

(a) Micro Credit Scheme for Agricultural Development operated through the Shell Petroleum Development Company Ltd

(b) Green Card in association with Nigerian Agip Oil Company Ltd

(c) Total Oil Plc

State Governments participating in the TFM are Nassarawa, Ebonyi, Kogi, Benue, Lagos, Jigawa, Kwara and Katsina States. Katsina State Government raised a rural development loan from the International Fund for Agricultural Development and placed part of it with a partner lending bank to enable it to extend credit to farmers. In all the programmes, savings of the farmer groups were used to secure 25 per cent of the loans, the Trust Fund secures 25 per cent while the ACGSF guarantees 75 per cent of the balance.

5.1.3 Interest Drawback Programme (IDP)

The IDP is a scheme to rebate interest to borrowers who repay agricultural loans according to contractual terms. The IDP is designed to benefit farmers/entrepreneurs who borrow under the Agricultural Credit Guarantee Scheme. The current rebate is 40% of accrued interest. Farmers who fully repay their loans on time under the ACGS are refunded 40% of the interest on their agricultural loans. As at 31st January,

2005, 5,583 farmers had received ₦17.633million as rebated interest, being 40 percent of the interest paid.

5.1.4 Participation of Community Banks (CBs) under the ACGS

To further enhance the availability of credit to farmers and other micro entrepreneurs, the Central Bank of Nigeria approved CBs participation under the ACGS from 2004. This was done to improve outreach under the ACGS and to facilitate access by the disadvantaged to credit. The CBs are located in the rural areas, and have a deep knowledge of the financial needs of smallholder producers and micro entrepreneurs. They will be eligible for the guarantee cover.

5.1.5 The Nigerian Agricultural Insurance Company (NAIC)

The Nigerian Agricultural Insurance Company was established in December 1987 to provide insurance cover for farmers against natural disasters and other risks associated with agriculture. The CBN stipulates guidelines to assist NAIC's operations, one of which is mandatory insurance cover on loans granted by banks to the agricultural sector under the Agricultural Credit Guarantee Scheme. Insurance cover is also compulsory for farmers who benefit from any agro-allied credit by approved lending institutions or agencies.

6.0 Constraints and Limitations to Successful Micro Financing in Nigeria:

Despite the progress outlined above, there are a number of constraints militating against successful financing of micro enterprises particular and agricultural production in general. Prominent among these are:

(a) Unwillingness of banks to lend to micro entrepreneurs despite the fact that generally they repay their loans.

(b) Inadequate or non-monitoring of micro and small enterprises by banks, leading to defaults.

(c) Delays by banks in processing and disbursement of loans.

(d) Diversion of funds.

(e) Over-concentration of decision making, where all loans are required by some banks to be sanctioned by Area/Head Offices.

(f) Inadequate staff training to handle lending to SMEs.

(g) Policy conflicts resulting from numerous alternative sources of credit with different interest rates e.g. NACRDB, community banks, State and Local Governments Agricultural Credit Agencies, etc.

(h) Inability of borrowers to offer acceptable collateral for large loans which places a limit on their probable scale of operation.

(i) Inadequate coverage of cash and tree crops owing to the long gestation nature of loans for such projects.

(j) Problems of illiteracy, which affects record keeping and decision-making ability of borrowers.

7.0 The Small and Medium Enterprises Equity Investment Scheme (SMEEIS)

The Small and Medium Enterprises Equity Investment Scheme facilitated by the CBN, was initiated by the Bankers' Committee (all the banks in Nigeria) as another means to funding small and medium scale enterprises in Nigeria. The scheme requires all banks to set aside 10 percent of their profit before tax annually for equity investment in small and medium enterprises. The scheme is to promote indigenous entrepreneurship, develop local technology, generate employment, facilitate the flow of funds from banks for the establishment of new, viable SMEs, ensure output expansion, re-distribute incomes and promote industrial linkages. The Scheme involves equity participation of banks in enterprises that they have appraised to be viable. The banks partner with the entrepreneurs.

(i) Activities Covered by SMEEIS:

SMEEIS funds can be used for the following business activities (with the exception of trading):

- Agro-allied,
- Information technology and telecommunication,
- Manufacturing,
- Educational establishments,
- Services,
- Tourism and leisure,
- Solid minerals; and,
- Construction.

(ii) Funds Set Aside and Investments made by Banks under SMEEIS

The total funds set aside were ₦41.433billion by 83 banks as at December 31st 2005. At this time ₦12.049billion had been invested by 58 banks in 2002 projects.

(iii) Ensuring Micro and Small Enterprises have unhindered access to SMEEIS Funds

Recently, the Bankers' Committee decided that ten percent of the SMEEIS funds be set aside for financing micro-entrepreneurs such as fashion designers, mechanics, vulcanizers, black smiths, carpenters, etc.

8.0 Microfinance Policy

The CBN recognised micro finance as an important tool for poverty alleviation through empowering the micro and small entrepreneurs. The CBN wanted to see sustainable financial services available to those who don't have access to formal financial resources. Microfinance institutions are important in achieving this objective and are being promoted to be commercially viable through an appropriate policy and regulatory framework. From this guidelines have been developed for microfinance institutions and other micro finance service providers. It is also important for the microfinance sector to gain both public and donor confidence.

9.0 Future Prospects

Measures are being put in place to restore the confidence of the banks and borrowers in the Scheme and to address the constraints outlined above. For instance, the Agricultural Credit Office in each CBN branch is given targets on loans to be guaranteed and repaid on an annual basis. The Development Finance Department of the CBN is also collaborating with the Federal and States Ministries of Agriculture

on a campaign to increase participation in the Scheme's activities at the grass roots level down to agricultural families. Equally, an outreach strategy targeted at the Managing Directors of the banks to get them committed to lending under the Scheme has been put in place. In addition, the CBN organised free training programmes for desk officers of lending banks to improve their skill and capacity in agricultural credit administration. Advertising consultants were engaged to design and implement publicity programmes to capture the interest of banks and borrowers. The steps taken so far have been yielding fruitful results with 35,055 loans guaranteed last year valued at ₦2.08 billion.

10.0 Conclusion

Lack of access to economic resources, especially finance, by the numerous sparsely located SMEs and farmers across Nigeria, continues to inhibit economic growth and development. This calls for critical examination and the adoption of an approach to avoid declaring SMEs and farmers as "endangered species". It is important to double our efforts to transform the economy and continuously explore pragmatic methodologies to address the problems of our farmers and SMEs.

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Proceedings of the 20 Years Anniversary of the Agricultural Credit Guarantee Scheme in Nigeria (1978-1998).

Activation of Organizational Management in Agricultural Reform: A Case Study of Iijima Town, Japan

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Abstract

Recently, reform of regional agriculture has been one of the main concerns of Japanese agriculture. An essential condition for agricultural reform is to obtain farmer support for reform. This paper describes participation by farmers in a regional agricultural reform from the perspective of change management theory. The reform involved four stages. In the first stage, a sense of urgency was created among the farmers arising from the uncertain farming outlook and the discovery of ongoing problems related to succession in the long term. In the second stage, mutual trust was developed between the farming centre, which drove the reform and the farmers, since the latter could perceive that the centre was heeding their concerns regarding the reform process. In the third stage, the farming centre showed the proposed reform plan to the farmers, and explained the radical farming system adjustment it proposed and asked for the farmers' participation in the reform process. In this case, communication was achieved through the sharing of a sense of urgency and mutual trust. In the fourth stage, the farmers' ideas and brainstorming were combined with the planning team's proposal to create a practicable plan.

1. Introduction

The Japanese agricultural sector has been depressed for several decades because farm management efficiency has not improved despite the fact that agricultural product prices have fallen or remained constant at best. This has discouraged entry into the agricultural sector and led to a dearth of young, full-time farmers. The main reason for this is the immature and inefficient farming resource market, particularly the malfunctioning farmland market at the regional level. Since farmland prices are very high, farmers tend to keep their farmland as family property rather than as a production resource. Part-time farmers have little interest in selling or renting their farmland, and continue farming even if they incur losses since these can be recovered through off-farming income. On the other hand, full-time farmers face difficulties in expanding their farming operations through purchasing or renting farmland. Therefore, neither large-scale farming nor higher agricultural productivity

ISSN 1816-2495
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have eventuated, thereby weakening the competitive position of Japanese agriculture in world markets.

In the light of the above circumstances, and to enhance agricultural production, the Japanese government launched a farming programme to achieve improved resource use, particularly farmland at the regional level. The focus is on consensus building among farmers to ensure their participation in any programme to improve resource use. An important feature of any reforms are new organisational arrangements. Farm management researchers are determining how the traditional group farming units can be modified to provide a sustainable regional agriculture[9]. A group farming unit has its own management and accounting for yearly income and expenditure. This paper describes the participation process in regional agricultural reform using a case study of Iijima town in Japan.

2. Change management and regional agricultural reform

Since a number of farmers are involved in regional agricultural reform, change management theory contains abundant interesting suggestions for analysing this issue. Change management is the process followed in implementing change in an organization.

The following eight steps constitute a typical model of change management: (1) establishing a sense of urgency, (2) creating a guiding coalition, (3) developing a vision and strategy, (4) communicating the change vision, (5) empowering broad-based action, (6) generating short-term wins, (7) consolidating gains and producing additional change, and (8) anchoring new approaches in the culture[2].

Change management theory focuses on the role of a guiding team and its importance in developing a vision, communicating it to the members and involving as many of them as possible in achieving change. In regional agricultural reform, the guiding team is extremely important, particularly with regard to establishing a sense of urgency, creating a coalition, developing a vision and strategy, and communicating the change vision when inaugurating reform. Moreover, the guiding team is vital in motivating farmers to participate in planning reform since more feasible plans can be drawn up by using information provided by farmers. Furthermore, farmers who participate in planning could be expected to join the guiding team and strengthen it substantially.

In this paper, we explain how farmers can be inspired to be involved in regional agricultural reform from the viewpoint of change management.

3. Case study of regional agricultural reform

Iijima town is located in the southern region of Nagano prefecture in Japan, and practices systematic agriculture under the guidance of the farming centre (*Eino Senta*). The farming centre was founded in 1986 and was assigned the responsibility for formulating a practicable plan for stimulating regional agriculture. The farming centre received the 31st

'Japan Agriculture Prize' (*Nihon Nogyo Sho*) in 2002 for regional agricultural reform.

The following initiatives were undertaken to achieve agricultural reform in Iijima:

a) Area Farming Unions (AFUs) were established between 1988 and 1989; approximately 95% of the farmers joined a union.

b) Between 1990 and 1992, four new agricultural producers' co-operatives (*Nojikumiai Hojin*) were established in every AFU. These co-operatives were legal entities.

c) A pool system was introduced under the farming centre's initiative. In this system, the total incentives provided to farmers accumulate to create a fund for undertaking development and reform activities. The Japanese government provides incentives in the form of subsidies for switching from rice cultivation to cultivating other crops. Farmers who undertake this conversion are eligible for a subsidy payment, although this incentive is insufficient to launch any farming improvements. For this reason, the farming centre initiated the pool system for carrying out regional agricultural reform in Iijima.

d) Zone-based cultivation was introduced throughout the town to eliminate farming input waste and increase earnings. Since the town is situated in a hilly area, the first step was to cultivate a single rice variety in a particular zone. The land was divided into zones, based on elevation. To ensure maximum returns, the rice variety planted is based on the elevation of the land. Farmers are encouraged to cultivate the *koshihikari* (non-glutinous), *mochihikari* (glutinous), and *miyamanishiki* (brewing) varieties of rice. These varieties are used as food grain, and to make rice-cake and wine respectively. The income from the sale of rice is pooled and subsequently distributed among the farmers according to the farming acreage.

e) An agricultural land-holding rationalization (*Nochi Hoyu Gorika*) programme was initiated in 1989. The Kamiina Agricultural Cooperative (JA Kamiina) was authorized to conduct this programme.

f) Farming activities and farmland-use adjustment were supported by the geographic information system (GIS) introduced in 1994.

4. Fact-findings of regional agriculture

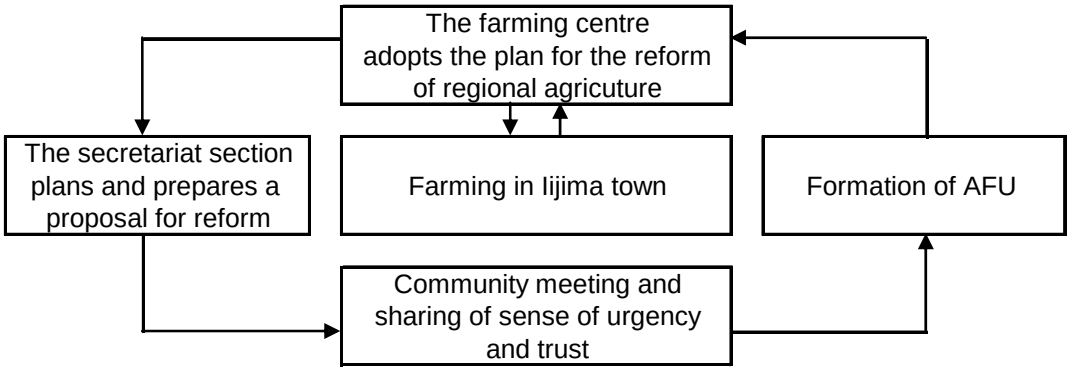
The transformation and modification of regional agriculture was carried out in the following steps. First, a farming centre was established to initiate and formulate the strategy for the reorganization of regional agriculture in Iijima. The town government and JA Kamiina, which were assigned the responsibility for agricultural planning, had not always shared the same vision and plan for regional agriculture; this sometimes caused confusion among farmers and resulted in them losing trust in both institutions. For this reason, the most important objective of the farming centre was to integrate the planning functions for regional agriculture. Thus, the farming centre emerged as a strategy-planning organization for regional agriculture which enabled the town government and JA Kamiina to

harmoniously carry out their regional agricultural activities. The second stage was to create a new framework for regional agricultural reform based on the early experience of JA Kamiina. The third stage was to create a practicable reform plan and the fourth stage was to implement the plan.

The creation of the Area Farming Unions and the agricultural producers co-operatives were the first steps undertaken, followed successively by plans for a pool system, zone based cultivation and land-holding rationalization. Iijima town expected that drawing up an overall plan as a package would consume a considerable amount of time; further, after its completion, the surrounding environment taken into account when formulating the plan would have changed significantly, thereby possibly ruining the effectiveness of the plan. For this reason, to ensure the effectiveness of the plan and to save time, Iijima town created the Area Farming Unions and the co-operatives only in the first stage.

Figure 1 shows the path followed in undertaking reform. The steps in this figure are elucidated in section five of this paper.

Figure 1. Working process for regional agricultural reform



5. Reform of regional agriculture in Iijima town

Iijima town comprises 35 natural villages (rural communities: *Nogyo Shuraku*) in four wards (*Kus*). Table I, lists the farming information for this town:

Table I. Basic farming information for Iijima town:

Name of the ward	Number of communities	Number of working group farming (GF) units	Number of communities with no GF units	Total number of farmers	Area of paddy fields (ha)	Percentage of farmers participating in AFU (%)
Iijima	14	6	2	162	223.5	96.9
Tagiri	6	3	2	281	103.3	94.3
Hongo	6	1		191	118.4	99
Nanakubo	9	3		448	171.3	93.8
Total	35	13	4	1398	616.5	95.6

Source: Report on the Long-Term Programme for Promotion of Agriculture in Iijima town [Iijima-machi Nogyo Sinko Choki Keikaku Chosa Hokokusho], Community Development Centre, Japan,1987.

Prior to the introduction of organized regional agriculture, all communities apart from four were involved in group farming co-operatives[4]. A total of 13 group farming units were working in the four wards. One remarkable point of difference was the imbalance between the number of members in the groups; the smallest group included only six farmers, while the largest consisted of 151 farmers. Another problem was the inefficient use of machines and equipment. Initially, one set of farming equipment, which included a tractor, a rice planting machine, and a rice harvesting machine, was allotted to a group farming unit under the joint-use system. However, the development of the farming equipment's capabilities prompted a request for a broader scope for the use of the equipment, beyond the current (on-going) range of group farming. Contemporaneously, other group farming units did not have sufficient farmers who could manage the equipment since some had retired due to old age. This resulted in inefficient use of farming machines and equipment. A major contrast was observed in the use of tilling and harvesting machines. In the smallest group, the farming tractor was used to till only five hectares of land and the harvesting machine harvested only four ha of crop. On the other hand, in the largest group farming unit the working performances of the tractor and the harvester were 30 ha and 18 ha respectively. Therefore, the working performance of the community-based group farming units was considered inadequate. In other words, these big differences between group farming units were attributed to their actual work performance especially to their managerial capabilities. Consequently, in 1988, Iijima town decided to initiate regional agricultural reform. This reform involved the following processes.

i) Establishment of a farming centre

The farming centre comprised the following:

a) General meeting committee: This is a decision-making body, responsible for strategy planning and for the execution and undertaking of the agenda for regional agriculture. The members of this committee comprise the representatives of the town council, the agricultural committee, farmers' organizations, the town branch office of the Kamiina Agricultural Cooperative, the prefectural office of the centre for agricultural

improvement and extension, consumers, the prefectural agricultural development corporation, and the town office. This committee has 60 members.

b) Board of executives: Board members are elected from the general meeting committee. They are responsible for managerial activities in all the sections in the organization. They prepare and scrutinize the agenda for the general meeting. They are responsible for arranging regular general meetings.

c) Special committees: Members of the general meeting committee are assigned to five special committees - the facilities and machine-use committee, the local life promotion committee, the farming activities planning committee, the farmland use committee, and the labour committee. They possess expertise in their respective fields.

d) Secretariat: The secretariat office and the planning office are both in this division. The responsibility of the secretariat office is for the farming centre's general affairs and that of the planning office is to design a plan for regional agricultural reform. The members comprise representatives of the farming instructors of the Iijima branch office of the Kamiina Agricultural Cooperative, the town agricultural officers, and the prefectural agricultural extension officers.

The chief farming instructor of the Iijima branch office of JA Kamiina was appointed as the convenor and person in charge of the secretariat division. After assuming this position, he played the leading role in implementing reform. He evaluated Iijima town's future farming scenario based on the prior experience of JA Kamiina, which provided the framework for the regional agricultural plan. The framework was first presented to the planning team of the secretariat division. The convener's ideas were shared with team members during the ensuing discussion. As shown in Figure 1, the reform proposal was generated in this section, after which it was examined and modified by each special committee and finally explained at a farming scenario for Iijima town at the farming centre's general meeting. The proposal was then introduced to the farmers in each community and ward and their active participation in the project was sought.

ii) Concepts in the proposal

At the community and ward meetings, the reform proposal was presented to the farmers as a new concept for farming cooperation. Its aim was to form a new farmers' organization – the area farming union (*Chiku Einou Kumiai*) – in each of the four wards to replace community-based group farming. At the time, however, the proposal was seen merely as providing information from the farming centre for the farmers. The essential features of the AFU are as follows:

a) It is regarded as a subsystem of the farming centre and a practicable organization to carry out regional agricultural reform.

1. Every AFU has an advisory committee which provides support and advice to the management. The committee acts for the secretariat section of the farming centre.

2. It is not mandatory for farmers to participate in the newly constituted AFUs. However, all farmers were requested to join an AFU, because improvements in land-use efficiency could not be achieved if a considerable number of farmers refrained from participation.

   The AFUs were designed to carry out the following two principal activities:

a) To inaugurate a new type of corporate farm in every ward to support regional agriculture and to recommend the setting up of three mushroom farms and a flower-growing greenhouse therein and to motivate the villagers to participate in these corporate farms and to work in the management and operation sections.

b) To execute a land-holding rationalization programme to improve the efficiency of farmland use. In this programme, the AFUs were given responsibility for renting abandoned, convertible, and rentable farmlands from part-time and retired farmers and re-allocating such land to farmers to produce greater profit. Table II lists the total area of abandoned cultivated farmland and the number of farmers who had such farmland.

Table II. Abandoned farmland in Iijima town

Year	Abandoned cultivated land	
	Area (ha)	Number of concerned farmers
1985	6	53
1990	27	161
1995	22	103
2000	44	252

Source: Agricultural Censuses in Japan.

iii) Sharing an impending agricultural problem

At the first community meeting, the planning team explained the inefficiencies[8] in current farming activities and the necessity for agricultural reform; it then showed the new development proposals to the farmers. However, many farmers did not see any necessity for agricultural reform and raised several questions regarding the plan. The farmers did not acknowledge the impending farming problems and discussed mainly the disadvantages of the proposed plan: to them, the plan appeared to be a socialistic adaptation, too drastic to achieve, etc. Some farmers went so far as to use harsh words to emphasize their dissent.

Table III shows the proportion of farmers who supported each of the two AFU proposals. The percentage of farmers interested in both the corporate farms establishment programme and the efficient farmland use programme were 18.6% and 32.9% respectively. Thus the majority of the farmers did not regard the proposals in a positive light.

Table III. Farmer interest in the two ventures associated with the proposed plan

Ward (*Ku*)	Percentage of the farmers who gave priority to	
	Corporate farms (%)	Efficient farmland use (%)
Iijima	16.2	30
Tagiri	20.1	32.5
Hongo	21.6	47.4
Nanakubo	19.1	30.6
Total	18.6	32.9

Source: Report on the Long Term-Programme for the Promotion of Agriculture in Iijima town [Iijima-machi Nogyo Sinko Choki Keikaku Chosa Hokokusho], Community Development Center, 1987.

At the time, 89.5% of the respondents were part-time farmers engaged in non-farming occupations, which provided the bulk of their income. The full-time farmers (approximately 10.5%) were more concerned with managing their own farms (in 1990). As a result farmers showed limited interest in the plan.

In response to this difficult situation, the planning team took two major actions to break this impasse. One was to establish a sense of urgency and the other was to foster the farmers' trust in the farming centre and its planning team. As the team's first step, instead of explaining the reform plan further, it requested each farmer to create his or her own vision for farming in the following ten years and to identify the family member who would lead the farming activities after his or her retirement. In this approach, the team members attempted to share a mental model with the farmers. The team concluded that the reform plan had not been understood by the farmers since their forecasts for regional agriculture were considerably different from that of the team members. At the time, few farmers did not have a positive forecast about their farming activities. However, through this process, the farmers realised that without reform in the near future, their farming situations might deteriorate. In creating their visions, some farmers could not identify a family member qualified to succeed. In reality, a number of farmers were on the verge of retirement; some had sons who were not interested in farming. In fact, since Japan became an industrial production-based economy the agricultural sector has increasingly failed to attract mass attention; only a small number of people become farmers after the retirement of the family head. In this case, the sharing of a concrete, ten-year vision made the farmers realise that without reform, regional agriculture would be poorly maintained. The exercise emphasized the sharing of a mental model and also led to the establishment of a sense of urgency.

After this, the team members endeavoured to explain the benefits and advantages of the farming centre's proposal, especially the efficiency of systematized regional agriculture. However, even then, the farmers did not support the reform plan proposed at the team meeting. The convener and his team were again required to respond to the farmers' queries. Therefore, after the meeting, the planning team held a discussion to prepare lucid replies to

the farmers' questions. It summarized and enumerated all of the farmers' questions and opinions in a few pages called the answer sheet; they used the farmers' exact words from the previous meeting, such as big wrapper (*furoshiki*), socialistic or too drastic. They then distributed these answer sheets to the farmers and discussed them again at subsequent meetings held at short intervals.

The distribution of the answer sheets induced two major changes in the farmers' mindsets. First, each farmer's reliance on the farming centre increased. After perusing the summarized answer sheets, the farmers realised that the farming centre had paid attention to their concerns and had responded to the issues discussed at the previous meeting. Second, it offered the farmers an opportunity to learn of the circumstances in Hongo ward, where farmers had been challenged to systematize their farming, and to recognize the inefficiencies in their farming techniques. In other words, the farmers began to understand the necessity for undertaking agricultural reform to avoid the worst-case scenario. Thus, in this stage, the proposed reform plan was transformed from simple information into knowledge; as a result, the farmers' feelings changed and they showed interest in the farming centre's strategic reform plan.

The concept of regional agriculture, born in the community and the ward, implies farming activities that focus on the conditions necessary for essential changes that can be achieved through systematic reform. It will ensure the elimination of all farming waste and simultaneously ensure optimal land cultivation and the efficient use of farmland and farming equipment. Such regional agriculture will require considerable change in management by farm households.

iv) Combining ideas for management

Thus, a change could be observed in the farmers' attitude toward regional agriculture - from negative to positive - signifying that the trust building initiative had inspired confidence in the proposal. Subsequently, to develop alternatives to their current farming practices, the farmers joined the discussion to formulate a practicable plan to systematize regional agriculture. A community leader's meeting was held, where they put forward ideas for a practicable regional agricultural plan. The plan was formulated by combining the proposals of the planning team with the farmers' on-site brainstorming. The combined[7] plan was based mainly on the following:

a) Recommendations of the managerial staff, such as the AFU directors

b) Preparation of the AFU models

First, the recommendations to union directors by the farmers came up for discussion; this encouraged farmers to exchange their know-how based on their own convictions and experiences. Second, group farming units in each community were advised to merge with the AFU and carry out their usual activities. In addition, it was perceived that there was an over-investment in agricultural machinery and equipment allotted to each community-based

group farming unit. For this reason, some equipment was purchased by the AFUs and used for organized regional agriculture, and the rest sold in the second-hand market. Third, the term of the union directors was extended to two years from one year, as the latter was considered to be inadequate to obtain sufficient managerial experience of organizational development.

As a consequence of the first community meeting, held in September 1988, organizational reform was inaugurated in December of the same year. Subsequently, the various reforms outlined above were implemented through the AFUs under the leadership of the farming centre.

6. Change management in Iijima town

The process of change management in regional agriculture is depicted in a flow chart (Figure 2). In the first stage, discussions were held on the likely deterioration in farming if regional agricultural reform were not achieved soon. The farmers shared a common farming predicament; this was presented as a mental model to the farmers. At the same time, the farmers understood the necessity for solving the problems. This sharing of a sense of urgency among the farmers led to their growing interest in participating in reform. In the second stage, mutual trust was developed between the farming centre and the farmers, since the latter could perceive that the farming centre had listened to their concerns regarding reform. In the third stage, the farming centre showed the reform plan to the farmers, explained the radical farming system adjustment it proposed and asked for the farmers' participation in the reform activity. In this case, communication was achieved through the sharing of a sense of urgency among the farmers. In the fourth stage, the farmers' ideas and brainstorming were combined with the planning team's proposal to create a practicable plan that enhanced the functioning of the planning team.

Figure 2. Stages of the process of change-management in regional agricultural reform

Phase 1		Phase 2	
Stage 1	Stage 2	Stage 3	Stage 4
Sharing a sense of urgency	Trust building	Sharing of vision	Combination of ideas
Sharing of mental model	Building a mutual trust relationship	Sharing of visions for regional agriculture	Combination of the proposed plan with the farmers' opinions
1. Identification of farming uncertainties. 2.Problem-finding in Iijima town.	1. Fostering of the farmers' trust. 3. Transformation of the farmers' attitude from negative to positive. 2. Fostering of their concern.	1. Drastic alteration of the farming activities. 2. Encouragement of farmers to participate in reform.	1. Formulation of a practicable plan. 2. Promoting communication. 3. Inauguration of AFUs and corporate farms in the four wards.

7. Conclusion

In agricultural reform, the participants are farmers who have no initial obligation to reform; thus, motivating them to participate actively is vital. However, it is difficult to do this by using only explanation or persuasion; from this case study, it is concluded that change management is more effective. In our case study, the effective methods for change management were as follows:

1. Creating a sense of urgency: Since the management situation of each farm is different, it is important to create a sense of urgency by encouraging farmers to discover their problems for themselves. In Iijima town, a sense of urgency was generated by requesting farmers to create their own farming visions.

2. Attracting concern: Iijima town set a rather high target for reform, which the farmers considered to be quite drastic believing that it would considerably influence their farming. The reform plan raised many concerns with farmers in Iijima town; however, many regions chose reform plans that could be resolved with little opposition from farmers.

3. Establishing a simple vision and strategy: In many regions an overall reform plan was drawn up as a package and subsequently implemented. However, this method was not adopted in Iijima town since the town expected that the plan's implementation would consume a considerable amount of time; further, after its completion, the surrounding environment taken into account when formulating the plan would have changed significantly, thereby possibly limiting the effectiveness of the plan. For this reason, Iijima town prepared and proposed plans to farmers, and presented these plans in succession.

4. Building trust: Farmers do not participate in reform if they do not strongly believe in it; this is because it is the farmers themselves who bear the risk in any reform. Iijima town succeeded in building trust among farmers by paying careful attention to all opinions, even to minority opinions and responding to every comment and question put forth by the farmers.

5. Strengthening the leading team: Initially, the planning team was established as the team leading the reform. However, after some ideas proposed by farmers were incorporated into the reform plan, those farmers or others who agreed with them joined the leading team and helped in communicating the plan to other farmers.

Based on change management, the farmers' active participation in the systematization of the regional agriculture was achieved. In conclusion, the above discussion has clarified the process for realising unique and committed regional agricultural reform.

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The Japanese agricultural sector has been depressed for several decades because farm management efficiency has not improved despite the fact that agricultural product prices have fallen or remained constant at best. This has discouraged entry into the agricultural sector and led to a dearth of young, full-time farmers. The main reason for this is the immature and inefficient farming resource market, particularly the malfunctioning farmland market at the regional level. Since farmland prices are very high, farmers tend to keep their farmland as family property rather than as a production resource. Part-time farmers have little interest in selling or renting their farmland, and continue farming even if they incur losses since these can be recovered through off-farming income. On the other hand, full-time farmers face difficulties in expanding their farming operations through purchasing or renting farmland. Therefore, neither large-scale farming nor higher agricultural productivity

ISSN 1816-2495
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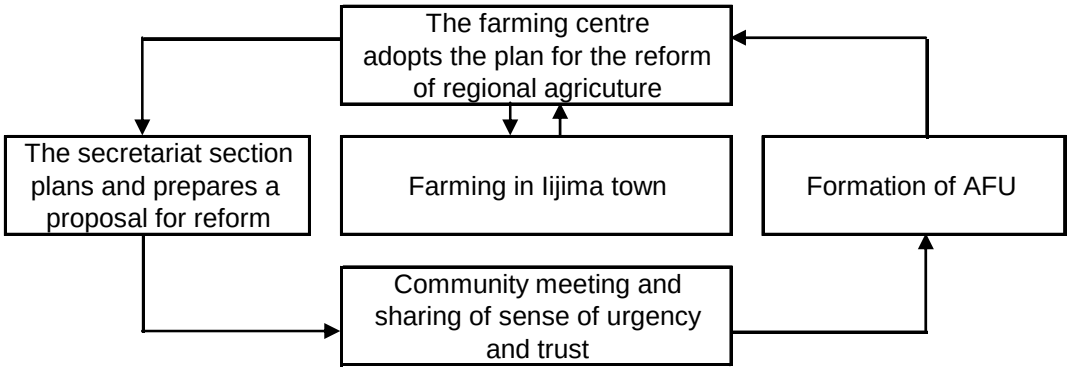
The transformation and modification of regional agriculture was carried out in the following steps. First, a farming centre was established to initiate and formulate the strategy for the reorganization of regional agriculture in Iijima. The town government and JA Kamiina, which were assigned the responsibility for agricultural planning, had not always shared the same vision and plan for regional agriculture; this sometimes caused confusion among farmers and resulted in them losing trust in both institutions. For this reason, the most important objective of the farming centre was to integrate the planning functions for regional agriculture. Thus, the farming centre emerged as a strategy-planning organization for regional agriculture which enabled the town government and JA Kamiina to

harmoniously carry out their regional agricultural activities. The second stage was to create a new framework for regional agricultural reform based on the early experience of JA Kamiina. The third stage was to create a practicable reform plan and the fourth stage was to implement the plan.

The creation of the Area Farming Unions and the agricultural producers co-operatives were the first steps undertaken, followed successively by plans for a pool system, zone based cultivation and land-holding rationalization. Iijima town expected that drawing up an overall plan as a package would consume a considerable amount of time; further, after its completion, the surrounding environment taken into account when formulating the plan would have changed significantly, thereby possibly ruining the effectiveness of the plan. For this reason, to ensure the effectiveness of the plan and to save time, Iijima town created the Area Farming Unions and the co-operatives only in the first stage.

Figure 1 shows the path followed in undertaking reform. The steps in this figure are elucidated in section five of this paper.

Figure 1. Working process for regional agricultural reform



5. Reform of regional agriculture in Iijima town

Iijima town comprises 35 natural villages (rural communities: *Nogyo Shuraku*) in four wards (*Kus*). Table I, lists the farming information for this town:

Table I. Basic farming information for Iijima town:

Name of the ward	Number of communities	Number of working group farming (GF) units	Number of communities with no GF units	Total number of farmers	Area of paddy fields (ha)	Percentage of farmers participating in AFU (%)
Iijima	14	6	2	162	223.5	96.9
Tagiri	6	3	2	281	103.3	94.3
Hongo	6	1		191	118.4	99
Nanakubo	9	3		448	171.3	93.8
Total	35	13	4	1398	616.5	95.6

Source: Report on the Long-Term Programme for Promotion of Agriculture in Iijima town [Iijima-machi Nogyo Sinko Choki Keikaku Chosa Hokokusho], Community Development Centre, Japan,1987.

Prior to the introduction of organized regional agriculture, all communities apart from four were involved in group farming co-operatives[4]. A total of 13 group farming units were working in the four wards. One remarkable point of difference was the imbalance between the number of members in the groups; the smallest group included only six farmers, while the largest consisted of 151 farmers. Another problem was the inefficient use of machines and equipment. Initially, one set of farming equipment, which included a tractor, a rice planting machine, and a rice harvesting machine, was allotted to a group farming unit under the joint-use system. However, the development of the farming equipment's capabilities prompted a request for a broader scope for the use of the equipment, beyond the current (on-going) range of group farming. Contemporaneously, other group farming units did not have sufficient farmers who could manage the equipment since some had retired due to old age. This resulted in inefficient use of farming machines and equipment. A major contrast was observed in the use of tilling and harvesting machines. In the smallest group, the farming tractor was used to till only five hectares of land and the harvesting machine harvested only four ha of crop. On the other hand, in the largest group farming unit the working performances of the tractor and the harvester were 30 ha and 18 ha respectively. Therefore, the working performance of the community-based group farming units was considered inadequate. In other words, these big differences between group farming units were attributed to their actual work performance especially to their managerial capabilities. Consequently, in 1988, Iijima town decided to initiate regional agricultural reform. This reform involved the following processes.

i) Establishment of a farming centre

The farming centre comprised the following:

a) General meeting committee: This is a decision-making body, responsible for strategy planning and for the execution and undertaking of the agenda for regional agriculture. The members of this committee comprise the representatives of the town council, the agricultural committee, farmers' organizations, the town branch office of the Kamiina Agricultural Cooperative, the prefectural office of the centre for agricultural

improvement and extension, consumers, the prefectural agricultural development corporation, and the town office. This committee has 60 members.

b) Board of executives: Board members are elected from the general meeting committee. They are responsible for managerial activities in all the sections in the organization. They prepare and scrutinize the agenda for the general meeting. They are responsible for arranging regular general meetings.

c) Special committees: Members of the general meeting committee are assigned to five special committees - the facilities and machine-use committee, the local life promotion committee, the farming activities planning committee, the farmland use committee, and the labour committee. They possess expertise in their respective fields.

d) Secretariat: The secretariat office and the planning office are both in this division. The responsibility of the secretariat office is for the farming centre's general affairs and that of the planning office is to design a plan for regional agricultural reform. The members comprise representatives of the farming instructors of the Iijima branch office of the Kamiina Agricultural Cooperative, the town agricultural officers, and the prefectural agricultural extension officers.

The chief farming instructor of the Iijima branch office of JA Kamiina was appointed as the convenor and person in charge of the secretariat division. After assuming this position, he played the leading role in implementing reform. He evaluated Iijima town's future farming scenario based on the prior experience of JA Kamiina, which provided the framework for the regional agricultural plan. The framework was first presented to the planning team of the secretariat division. The convener's ideas were shared with team members during the ensuing discussion. As shown in Figure 1, the reform proposal was generated in this section, after which it was examined and modified by each special committee and finally explained at a farming scenario for Iijima town at the farming centre's general meeting. The proposal was then introduced to the farmers in each community and ward and their active participation in the project was sought.

ii) Concepts in the proposal

At the community and ward meetings, the reform proposal was presented to the farmers as a new concept for farming cooperation. Its aim was to form a new farmers' organization – the area farming union (*Chiku Einou Kumiai*) – in each of the four wards to replace community-based group farming. At the time, however, the proposal was seen merely as providing information from the farming centre for the farmers. The essential features of the AFU are as follows:

a) It is regarded as a subsystem of the farming centre and a practicable organization to carry out regional agricultural reform.

1. Every AFU has an advisory committee which provides support and advice to the management. The committee acts for the secretariat section of the farming centre.

2. It is not mandatory for farmers to participate in the newly constituted AFUs. However, all farmers were requested to join an AFU, because improvements in land-use efficiency could not be achieved if a considerable number of farmers refrained from participation.

   The AFUs were designed to carry out the following two principal activities:

a) To inaugurate a new type of corporate farm in every ward to support regional agriculture and to recommend the setting up of three mushroom farms and a flower-growing greenhouse therein and to motivate the villagers to participate in these corporate farms and to work in the management and operation sections.

b) To execute a land-holding rationalization programme to improve the efficiency of farmland use. In this programme, the AFUs were given responsibility for renting abandoned, convertible, and rentable farmlands from part-time and retired farmers and re-allocating such land to farmers to produce greater profit. Table II lists the total area of abandoned cultivated farmland and the number of farmers who had such farmland.

Table II. Abandoned farmland in Iijima town

Year	Abandoned cultivated land	
	Area (ha)	Number of concerned farmers
1985	6	53
1990	27	161
1995	22	103
2000	44	252

Source: Agricultural Censuses in Japan.

iii) Sharing an impending agricultural problem

At the first community meeting, the planning team explained the inefficiencies[8] in current farming activities and the necessity for agricultural reform; it then showed the new development proposals to the farmers. However, many farmers did not see any necessity for agricultural reform and raised several questions regarding the plan. The farmers did not acknowledge the impending farming problems and discussed mainly the disadvantages of the proposed plan: to them, the plan appeared to be a socialistic adaptation, too drastic to achieve, etc. Some farmers went so far as to use harsh words to emphasize their dissent.

Table III shows the proportion of farmers who supported each of the two AFU proposals. The percentage of farmers interested in both the corporate farms establishment programme and the efficient farmland use programme were 18.6% and 32.9% respectively. Thus the majority of the farmers did not regard the proposals in a positive light.

Table III. Farmer interest in the two ventures associated with the proposed plan

Ward (*Ku*)	Percentage of the farmers who gave priority to	
	Corporate farms (%)	Efficient farmland use (%)
Iijima	16.2	30
Tagiri	20.1	32.5
Hongo	21.6	47.4
Nanakubo	19.1	30.6
Total	18.6	32.9

Source: Report on the Long Term-Programme for the Promotion of Agriculture in Iijima town [Iijima-machi Nogyo Sinko Choki Keikaku Chosa Hokokusho], Community Development Center, 1987.

At the time, 89.5% of the respondents were part-time farmers engaged in non-farming occupations, which provided the bulk of their income. The full-time farmers (approximately 10.5%) were more concerned with managing their own farms (in 1990). As a result farmers showed limited interest in the plan.

In response to this difficult situation, the planning team took two major actions to break this impasse. One was to establish a sense of urgency and the other was to foster the farmers' trust in the farming centre and its planning team. As the team's first step, instead of explaining the reform plan further, it requested each farmer to create his or her own vision for farming in the following ten years and to identify the family member who would lead the farming activities after his or her retirement. In this approach, the team members attempted to share a mental model with the farmers. The team concluded that the reform plan had not been understood by the farmers since their forecasts for regional agriculture were considerably different from that of the team members. At the time, few farmers did not have a positive forecast about their farming activities. However, through this process, the farmers realised that without reform in the near future, their farming situations might deteriorate. In creating their visions, some farmers could not identify a family member qualified to succeed. In reality, a number of farmers were on the verge of retirement; some had sons who were not interested in farming. In fact, since Japan became an industrial production-based economy the agricultural sector has increasingly failed to attract mass attention; only a small number of people become farmers after the retirement of the family head. In this case, the sharing of a concrete, ten-year vision made the farmers realise that without reform, regional agriculture would be poorly maintained. The exercise emphasized the sharing of a mental model and also led to the establishment of a sense of urgency.

After this, the team members endeavoured to explain the benefits and advantages of the farming centre's proposal, especially the efficiency of systematized regional agriculture. However, even then, the farmers did not support the reform plan proposed at the team meeting. The convener and his team were again required to respond to the farmers' queries. Therefore, after the meeting, the planning team held a discussion to prepare lucid replies to

the farmers' questions. It summarized and enumerated all of the farmers' questions and opinions in a few pages called the answer sheet; they used the farmers' exact words from the previous meeting, such as big wrapper (*furoshiki*), socialistic or too drastic. They then distributed these answer sheets to the farmers and discussed them again at subsequent meetings held at short intervals.

The distribution of the answer sheets induced two major changes in the farmers' mindsets. First, each farmer's reliance on the farming centre increased. After perusing the summarized answer sheets, the farmers realised that the farming centre had paid attention to their concerns and had responded to the issues discussed at the previous meeting. Second, it offered the farmers an opportunity to learn of the circumstances in Hongo ward, where farmers had been challenged to systematize their farming, and to recognize the inefficiencies in their farming techniques. In other words, the farmers began to understand the necessity for undertaking agricultural reform to avoid the worst-case scenario. Thus, in this stage, the proposed reform plan was transformed from simple information into knowledge; as a result, the farmers' feelings changed and they showed interest in the farming centre's strategic reform plan.

The concept of regional agriculture, born in the community and the ward, implies farming activities that focus on the conditions necessary for essential changes that can be achieved through systematic reform. It will ensure the elimination of all farming waste and simultaneously ensure optimal land cultivation and the efficient use of farmland and farming equipment. Such regional agriculture will require considerable change in management by farm households.

iv) Combining ideas for management

Thus, a change could be observed in the farmers' attitude toward regional agriculture - from negative to positive - signifying that the trust building initiative had inspired confidence in the proposal. Subsequently, to develop alternatives to their current farming practices, the farmers joined the discussion to formulate a practicable plan to systematize regional agriculture. A community leader's meeting was held, where they put forward ideas for a practicable regional agricultural plan. The plan was formulated by combining the proposals of the planning team with the farmers' on-site brainstorming. The combined[7] plan was based mainly on the following:

a) Recommendations of the managerial staff, such as the AFU directors

b) Preparation of the AFU models

First, the recommendations to union directors by the farmers came up for discussion; this encouraged farmers to exchange their know-how based on their own convictions and experiences. Second, group farming units in each community were advised to merge with the AFU and carry out their usual activities. In addition, it was perceived that there was an over-investment in agricultural machinery and equipment allotted to each community-based

group farming unit. For this reason, some equipment was purchased by the AFUs and used for organized regional agriculture, and the rest sold in the second-hand market. Third, the term of the union directors was extended to two years from one year, as the latter was considered to be inadequate to obtain sufficient managerial experience of organizational development.

As a consequence of the first community meeting, held in September 1988, organizational reform was inaugurated in December of the same year. Subsequently, the various reforms outlined above were implemented through the AFUs under the leadership of the farming centre.

6. Change management in Iijima town

The process of change management in regional agriculture is depicted in a flow chart (Figure 2). In the first stage, discussions were held on the likely deterioration in farming if regional agricultural reform were not achieved soon. The farmers shared a common farming predicament; this was presented as a mental model to the farmers. At the same time, the farmers understood the necessity for solving the problems. This sharing of a sense of urgency among the farmers led to their growing interest in participating in reform. In the second stage, mutual trust was developed between the farming centre and the farmers, since the latter could perceive that the farming centre had listened to their concerns regarding reform. In the third stage, the farming centre showed the reform plan to the farmers, explained the radical farming system adjustment it proposed and asked for the farmers' participation in the reform activity. In this case, communication was achieved through the sharing of a sense of urgency among the farmers. In the fourth stage, the farmers' ideas and brainstorming were combined with the planning team's proposal to create a practicable plan that enhanced the functioning of the planning team.

Figure 2. Stages of the process of change-management in regional agricultural reform

Phase 1		Phase 2	
Stage 1	Stage 2	Stage 3	Stage 4
Sharing a sense of urgency	Trust building	Sharing of vision	Combination of ideas
Sharing of mental model	Building a mutual trust relationship	Sharing of visions for regional agriculture	Combination of the proposed plan with the farmers' opinions
1. Identification of farming uncertainties. 2.Problem-finding in Iijima town.	1. Fostering of the farmers' trust. 3. Transformation of the farmers' attitude from negative to positive. 2. Fostering of their concern.	1. Drastic alteration of the farming activities. 2. Encouragement of farmers to participate in reform.	1. Formulation of a practicable plan. 2. Promoting communication. 3. Inauguration of AFUs and corporate farms in the four wards.

7. Conclusion

In agricultural reform, the participants are farmers who have no initial obligation to reform; thus, motivating them to participate actively is vital. However, it is difficult to do this by using only explanation or persuasion; from this case study, it is concluded that change management is more effective. In our case study, the effective methods for change management were as follows:

1. Creating a sense of urgency: Since the management situation of each farm is different, it is important to create a sense of urgency by encouraging farmers to discover their problems for themselves. In Iijima town, a sense of urgency was generated by requesting farmers to create their own farming visions.

2. Attracting concern: Iijima town set a rather high target for reform, which the farmers considered to be quite drastic believing that it would considerably influence their farming. The reform plan raised many concerns with farmers in Iijima town; however, many regions chose reform plans that could be resolved with little opposition from farmers.

3. Establishing a simple vision and strategy: In many regions an overall reform plan was drawn up as a package and subsequently implemented. However, this method was not adopted in Iijima town since the town expected that the plan's implementation would consume a considerable amount of time; further, after its completion, the surrounding environment taken into account when formulating the plan would have changed significantly, thereby possibly limiting the effectiveness of the plan. For this reason, Iijima town prepared and proposed plans to farmers, and presented these plans in succession.

4. Building trust: Farmers do not participate in reform if they do not strongly believe in it; this is because it is the farmers themselves who bear the risk in any reform. Iijima town succeeded in building trust among farmers by paying careful attention to all opinions, even to minority opinions and responding to every comment and question put forth by the farmers.

5. Strengthening the leading team: Initially, the planning team was established as the team leading the reform. However, after some ideas proposed by farmers were incorporated into the reform plan, those farmers or others who agreed with them joined the leading team and helped in communicating the plan to other farmers.

Based on change management, the farmers' active participation in the systematization of the regional agriculture was achieved. In conclusion, the above discussion has clarified the process for realising unique and committed regional agricultural reform.

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HYBRID VIGOUR OF BEHAVIOURAL THEORIES IN THE AGRIBUSINESS RESEARCH DOMAIN. IS IT POSSIBLE?

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ABSTRACT

Motives, values and attitudes are key components of the decision-making process. Behavioural studies in agribusiness focus on using these three components to understand the decision-making processes of farmers (Morris & Potter 1995). Literature on three behavioural theories is reviewed with the aim of concluding if the theories can be combined for agribusiness research. Fishbein and Ajzen's Theory of Reasoned Action (1975), Ajzen's Theory of Planned Behaviour (1991) and Rogers' Diffusion of Innovations Theory (1995) are empirically described and their application to agribusiness research is discussed. Findings suggest that although these behavioural theories lost popularity in applied research in the 1980s, they still have application to current rural sociology research. Research is also reviewed to show that the strengths of each behavioural theory can be "hybridised" to construct new valid and reliable theoretical frameworks.

KEY WORDS

Behavioural theory, agribusiness, adoption, Diffusion of Innovations, Theory of Planned Behaviour, Theory of Reasoned Action.

ISSN 1816-2495
www.ifmaonline.org

INTRODUCTION

Agribusiness related studies based on the Theories of Reasoned Action and Planned Behaviour are sparse but those reviewed principally focus on farmers' conservation behaviours. In contrast, a plethora of literature on the Diffusion of Innovations shows its successful application in rural contexts since the 1940s (Fliegel 1993). The main focus of diffusion research is on the adoption of agricultural innovations such as herbicides, hybrid seed and fertilisers (Rogers 1995) with the most recent studies considering the uptake of genetically modified crops and modern agricultural practices in developing countries.

The aims of this paper are to present three behavioural theories used in agribusiness research and to determine if these can be successfully combined. Each theory is described and followed by a comprehensive, but not exhaustive, discussion of relevant studies. The discussions demonstrate that the theories have been successfully applied to the field of agribusiness and are reliable predictors of farmer behaviour. Conclusions are drawn regarding a combined approach to these theories.

THEORY OF REASONED ACTION (TRA)

Fishbein and Ajzen's (1975) seminal text on the distinction between beliefs, attitudes, intentions and behaviours aimed to develop a "cumulative body of knowledge in the attitude area" (p. 520); and this it did. It was from this work that the authors' Theory of Reasoned Action was borne and, despite criticism (Charng, Piliavin & Callero 1988, Sheppard, Hartwick & Warshaw 1988), has remained a powerful tool for predicting an individual's intention or behaviour (Madden, Ellen & Ajzen 1992) within specified limits (Sheppard, Hartwick & Warshaw 1988).

Fishbein and Ajzen (1975, p. 511) argue that attitude and subjective norm indicate intention, all of which are said to be "the primary determinants of behaviour". The TRA therefore posits that intention is the mediating variable between attitude and subjective norm to predict any given behaviour of an individual (Figure 1).

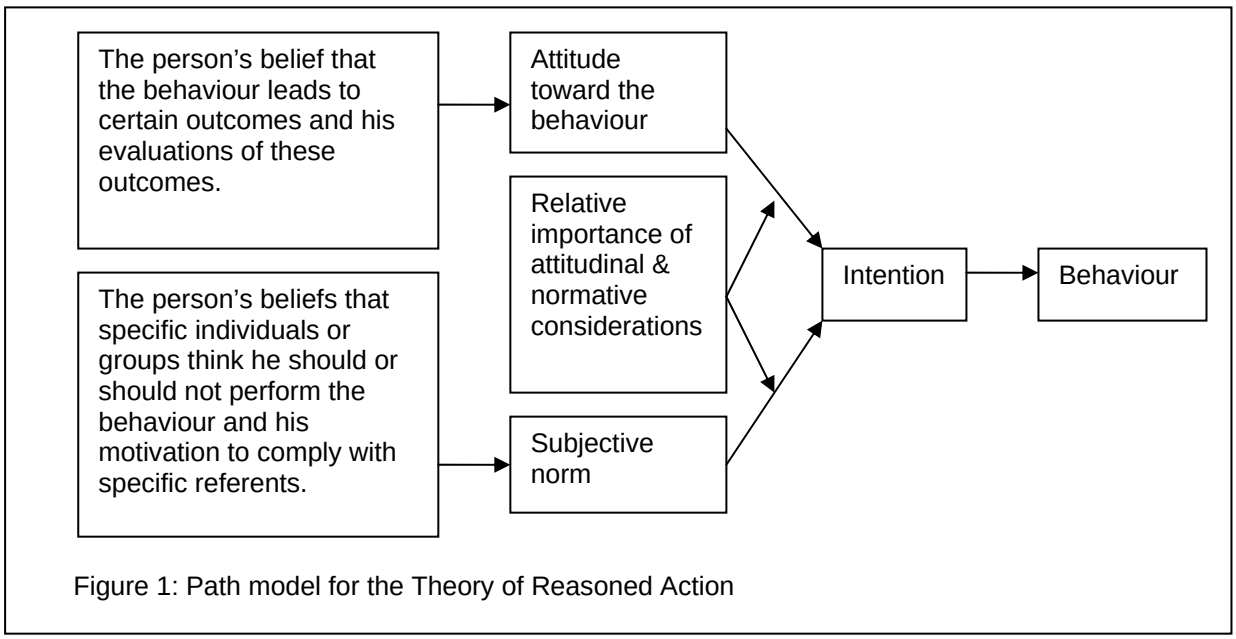

Figure 1: Path model for the Theory of Reasoned Action

ISSN 1816-2495
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The theory takes its name from a critical assumption the authors make, that is, "human beings are usually quite rational and make systematic use of information available to them." (Ajzen & Fishbein 1980, p. 5). It also needs to be explained that this theory is based on determining the influences on an individual, and that a person acts with thoughtfulness and rational motives (Ajzen & Fishbein 1980).

Literature on the Theory of Reasoned Action is sparse in the field of agribusiness with few relevant studies located. Thompson and Panayiotopoulos (1999) tested the TRA in the context of UK dairy farmers and their attitude to buying feed for their herds. It was found that attitude is the key predictor of behavioural intention ($r = 0.96$) while subjective norms did not improve the efficiency of the model ($r = 0.29$). The latter finding was explained by the routine nature of buying cattle feed and also by the animal nutrition expertise held by the farmers in question. It was concluded that farmers buying feed for the first time may be more susceptible to complying with the expectations of salient referents than those who have been performing this behaviour for some time.

The aforementioned study concluded that attitude is a better predictor of behavioural intention than subjective norm. This finding was confirmed in another agribusiness related study on the adoption of olive oil in British kitchens in which Thompson, Haziris and Alekos (1994) found that attitudinal beliefs were the best predictors of intention to adopt ($r = 0.71$ and $p = < 0.001$); a correlation not as strong as Thompson and Panayiotopoulos' results but nonetheless still high. It was also found that including subjective norms as a measure of intention did not add any statistical strength to the model; an extraordinary result considering the 1999 study. Interestingly, the authors note that a preliminary study showed that perceived behavioural control, like subjective norms, did not contribute to the robustness of the model so the TRA was chosen as the research framework, rather than the Theory of Planned Behaviour.

Gorddard (1992) also found that the perceived behavioural control construct of the Theory of Planned Behaviour did not add significance to his research on Western Australian farmer conservation behaviours. His research found significant relationships between all the TRA constructs at the $p \leq 0.10$ level. In this study, Gorddard showed how relationships will change between constructs in the presence or absence of particular variables. It was demonstrated that when attitude and subjective norms were disregarded in the model, behavioural beliefs, such as the influence of various tillage practices on factors such as wheat yield or soil structure, become significant (at $p \leq 0.10$) whereas constraint beliefs, such as ability to access the organic market, remain significant, other constraint beliefs increase in significance, like the need to use conventional methods for crop establishment.

In another agribusiness related study on wine consumption, Thompson and Vourvachis (1995) reported results that contrasted with those above. They found that both subjective norms ($r = 0.54$, $\beta = 0.39$ and $p = < 0.05$) were a better predictor of intention to drink wine and alcohol-free beer than attitude ($r = 0.51$, $\beta = 0.3$ and $p = < 0.05$). This study showed that the opinions of friends, family and guests were unexpectedly the primary determinants of behaviour which, although this study is not considering the opinions of primary producers, agrees with many farmer-orientated behavioural studies (Gasson 1973, Gasson & Errington 1993, Kerridge 1978, Wilkening & Guerrero 1969, Albrecht & Albrecht 1992).

It therefore appears from the findings of Thompson and Vourvachis (1995) that subjective norms, as a construct, are better predictors of behavioural intentions than attitudes. However, since this paper is principally considering research from the agribusiness domain, the findings of Thompson and Panayiotopoulos (1999) are more poignant as they are more directly related to farmer behaviour.

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Charng, Pillavin and Callero (1988) identified a limitation in the TRA in that while past testing might have produced good support for predicting a one-off type of behaviour, such as using a coupon or political voting preferences, there was little evidence to show that the TRA was useful for predicting repeat behaviours, such as continuation of smoking or psychological therapy. This research, conducted on the repeat behaviour of blood donors, found that the TRA provided the best results when supported with variables from identity-theory such as role-person merger, social relations and habit. They also found that as frequency of a behaviour increases, or "career" as it was termed, the importance of attitude and subjective norms eventually decreases.

From observations on the robustness of the TRA, researchers such as Thompson and Thompson (1996), Sarver (1983) and Bagozzi (1992) claimed that vital elements had been omitted from it and conducted research to test their hypotheses. These researchers said that the TRA failed to take into account situations where behaviour was not completely under the individual's control. While many studies had failed to prove the TRA to be inadequate or incomplete in using intentions to predict behaviour, it was this fundamental idea that led to the next major development in attitude and behavioural studies: Ajzen and Fishbein's Theory of Planned Behaviour.

THEORY OF PLANNED BEHAVIOUR (TPB)

An extended model of Fishbein and Ajzen's 1975 Theory of Reasoned Action, the Theory of Planned Behaviour, was first published by Ajzen in 1985 in a book edited by Kuhl and Beckmann and again by its creator in 1991. As can be seen from Figure 2, while 'Intention' is still the central construct of the theory, the construct of 'Perceived behavioural control' has been added. This enables the measurement of the extent to which an individual believes the outcomes of a behaviour can be controlled (Burton 2004). The addition of this new construct was borne from criticism that the TRA failed to account for behaviours associated with incomplete volitional control (Ajzen 1991, Madden, Ellen & Ajzen 1992). In essence, the theory uses knowledge of attitudes, subjective norms and perceived behavioural control to understand beliefs and thus predict behaviour. It is important to note, however, that the TPB uses perceived behavioural control to predict behaviour in two ways: through motivational factors and the intention to perform the behaviour (via the 'Intention' construct) and also through actual control via the direct link between the 'Perceived behavioural control' and 'Behaviour' constructs which is not mediated by intention (Madden, Ellen & Ajzen 1992).

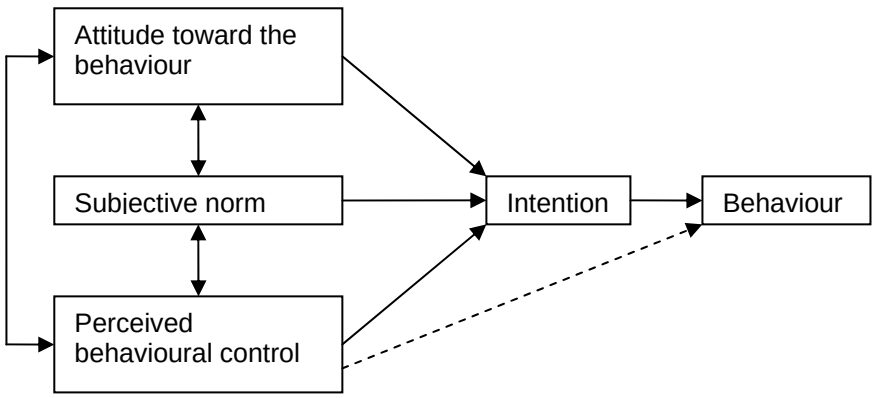

Figure 2: Path model for the Theory of Planned Behaviour

ISSN 1816-2495
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The TPB is an extension of the TRA in that perceived behavioural control over performing the studied behaviour is added to subjective norms and attitude as constructs for predicting intention. Therefore, while there was contention over the primary predictor of intention in the TRA, perceived behavioural control now dominates as the key determinant of intention. While there are studies related to farmer decision making and the TPB, research in this area is sparse.

The TPB has been successfully used to understand farmers' adoption of conservation behaviours. Lynne *et al.* (1995) studied the conservation behaviour of North American strawberry farmers and found perceived behavioural control to be an important factor determining intention as adding it as a construct to the model provided a χ^2 of 9.49 and $p = < 0.05$. The analysis of interviews from this study also found that all four constructs of the TPB (attitude, subjective norms, perceived behavioural control and intention) are necessary for the practical application of the theory if farmer behaviours are to be targeted for change.

Beedell and Rehman (1999 & 2000) also researched farmers' conservation behaviour using the TPB. Their mixed-method study (interviews and survey) compared the hedge-management behaviours of two types of UK farmers (those belonging and not belonging to an advisory group) and found that perceived behavioural control was not a significant determining factor of behavioural intention.

This study found that social pressure and moral obligation determined hedge-management behaviours with members of the "Farming and Wildlife Advisory Group" feeling more social pressure to maintain their hedges than the control group. The motivation to comply with five referent groups provided the measure of social pressure. It was found that the most significant levels of pressure came from within the farmers' own group (the Farming and Wildlife Advisory Group) and the local county council.

Of the measures for each TPB construct, it was found that good/bad attitude, agree/disagree for subjective norm and likely/unlikely for perceived behavioural control were the only measures statistically significant (χ^2 = 6.46, 4.63 and 5.80 respectively where $p = < 0.05$). The measures of most statistical significance were the sums of outcome evaluation and belief strength ($\chi^2 = 11.05$ where $p = < 0.001$) and motivation to comply and normative belief ($\chi^2 = 11.51$ where $p = < 0.001$).

Beedell and Rehman in 2000, using the same data set, however tested different hypotheses. First, to determine the frequency and intensity of conservation behaviours amongst the participants and second, to test the efficiency of the TPB in determining behavioural variation amongst farmers.

The findings were largely the same as those previously described although there was some variation in the outcomes of the social pressure and moral obligation constructs. While there was evidence for these constructs being associated, analysis revealed that farmers did not feel as much social pressure as self-generated internal pressure towards actively pursuing conservation behaviours. Similar to the 1999 study, perceived behavioural control was not a significant factor influencing intention to perform a conservation behaviour as the two groups in question were neutral in their attitudes towards hedge management, in terms of being very easy or very difficult, and both groups held very different perceptions of the behaviours being studied. The conclusion from this study was that the TPB is a good method of understanding variations in farmer behaviour but it was interesting to note the comments regarding the complexity of a TPB questionnaire. It was said that the questionnaire must be very precise and individual questions can often be regarded by participants as contorted; a finding also noted by East (1993).

ISSN 1816-2495
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Other studies on farmer conservation practices, by Gorddard (1991 and 1993), show that the TPB's perceived behavioural control construct added statistical significance to the TRA/TPB model. Gorddard's 1991 study showed that including this construct lifted the model's adjusted R^2 value from 39.3 to 51.3 while significance remained at $p \leq 0.001$.

More recent research by Bergevoet, Ondersteijn, Saatkamp, van Woerkum and Huirne (2004) shows how studies using the TPB have developed in complexity. A survey of Dutch dairy farmers used factor analysis and stepwise regression to understand the relationship between farm size (measured by milk quota size) and individual farmer's goals. The findings from this study largely agree with those of other TRA/TPB studies although, unlike much rural sociology work (Dumas 1987, Lee & Stewart 1983, Makus, Lin, Carlson & Krebill-Prather 1990, Beedell & Rehman 1999 & 2000), farm size as an experimental factor was found to have no relevance to fulfilling farmers' intrinsic, expressive and social goals but was mainly explained by instrumental goals.

Analysis of the data began with testing farm size in association with off-farm income and owning a stud-breeding farm. There was a highly significant relationship between these variables ($p < 0.001$) although $R^2 = 0.25$. The R^2 value showed that the three test factors accounted for 25% of the variation in milk quota size. The R^2 value increased to 0.38, without decreasing statistical significance, when the traditional TPB constructs of attitudes, subjective norms and perceived behavioural control were added to the model. While these R^2 values are quite low, the research showed that variation in the amount of milk Dutch dairy farmers produce is explained by the emphasis these farmers put on attitudes, subjective norms and perceived behavioural control.

Like the research of Lynne *et al.* (1995) and Beedell and Rehman (1999 & 2000) this study concluded that the TPB can explain farmer behaviour and, most importantly, can identify the drivers that influence farmers' decision-making processes. It was found that goals, attitudes, perceived behavioural control and subjective norms greatly influence farmer behaviour and people who target these drivers can influence economic and non-economic-based behaviours. It also showed that barriers imposed by industry and past experiences also influence farmer behaviour.

So far it has been shown that the TPB is suitable for agribusiness related research. However, are there many cautionary tales providing insight into some negative aspects of this theory. The first criticism of the TPB comes from the author himself (Ajzen 1991) in his seminal paper in which he admits that, at the time of publication, the strength of correlation between the constructs was not as strong as desired in terms of "global measures". It was also said that while the relationships between the theory's constructs had been proven, their exact form was unknown. However, shortly after the theory's release empirical studies proved that it was a reliable, standardised tool for predicting and explaining behaviour (Ajzen & Driver 1991).

Since the TPB was first published, research has shown that not only is there significant relationships between the theory's constructs but that it is possible to include other factors in the theory. Ajzen (1991) forecast that this would be the case and, more than ten years later, Burton (2004) cites studies that have successfully integrated additional factors to the TPB on an "as needed" basis. Such factors included habit, moral obligation and self-identity although only the construct of self-identity was nominated as worth using in farming social psychology research. As previously explained, "past behaviour" is another construct that proved to be worth considering.

Despite criticisms, research by Beedell and Rehman (1999 & 2000) proved the TPB to be a suitable tool for measuring farmer behaviour in two ways: to find out if all farmers behave in

ISSN 1816-2495
www.ifmaonline.org

the same way and if not, are differences in their beliefs explained by difference in their behaviours? The TPB was also successfully used by Lynne *et al.* (1995) in predicting the technology adoption behaviour of strawberry farmers. In conclusion, there is agreement that the TPB is useful for understanding behaviour by identifying major influencing factors and that this research framework is not widely used due to its complexity in terms of its questionnaire development and analytical requirements.

DIFFUSION OF INNOVATIONS

Diffusion is defined by Rogers (1995, p. 5) as "the process by which an innovation is communicated through certain channels over time among members of a social system." and has successfully been applied in rural contexts since the 1940s (Fliegel 1993) with the focus being on the uptake of agricultural innovations such as herbicides, hybrid seed and fertilisers (Rogers 1995). Fisher, Norvell, Sonka and Nelson (2000) explain that diffusion differs from adoption in that it is the process by which new technologies are spread among users whereas adoption is said to be an individual, internal decision.

Rogers (1958 & 1995) and Fliegel (1993) refer to the seminal research by Ryan and Gross (1943) who studied the diffusion of sowing hybrid corn by Iowa farmers in the USA. It was this research that provided the fundamental characteristics of the theory: the classic "diffusion of innovations" paradigm. This study promoted the significance of communication as a construct in the diffusion model and provided the generic bell-shaped (Figure 3) and sigmoid (Figure 4) curves of adoption on which a plethora of rural sociology research has been based.

Communication was one of the recurring themes in Rogers' (1995) description of each category of adopter. Among other characteristics, members of each category were described in terms of their communication activities with other members and how far they reached outside the boundaries of their system to access information on a new idea. For example, the term "cosmopolite" (p. 263) was used to describe vast geographic distances between communication networks of innovators whereas those adopters more towards the middle of the bell-shaped curve, were seen as "localites" (p. 264-5). This term describes the information networks of Early Adopters, Early Majority and Late Majority people who tend to seek information from local sources. Laggards were the most fervent localites whose adoption behaviour is at the far right of the bell-shaped curve and were viewed as "near isolates in the social network" (p. 265). Their point of reference for the adoption of a new idea was not associated with social networks, but with how things were done in the past.

Ryan and Gross (1943) identified communication as being extremely important to the diffusion of innovations process. Rogers (1995) provides a definition immediately after that for diffusion: "Communication is a process in which participants create and share information with one another in order to reach a mutual understanding." (p. 5-6).

So far communication has been discussed in terms of social networks, however research findings emphasise the importance of information networks in aiding the diffusion of innovations. Research published as early as 1950 (Wilkening) reports the importance of agricultural agencies and mass media as conduits for information diffusion; research has continued to find support for these methods ever since (see Longo 1990, Saltiel, Bauder & Palakovich 1994). However the most important means of information transfer has been found to be peer relationships (Wilkening 1950, Copp, Sill & Brown 1958, Longo 1990, Saltiel, Bauder & Palakovich 1994), with social class and size of land holding also found to be factors influencing information uptake (Wilkening 1950, Feder & Slade 1984).

ISSN 1816-2495
www.ifmaonline.org

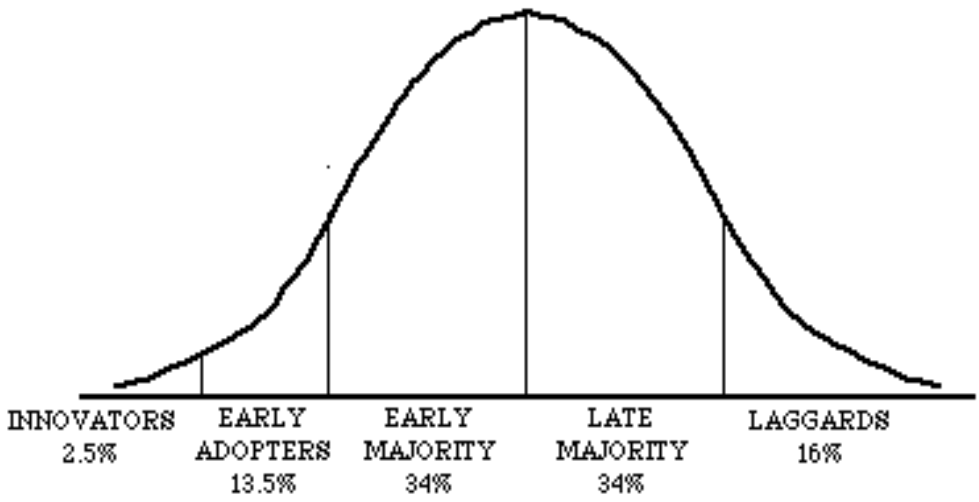

Figure 3: Technology adoption cycle (bell-shaped curve showing categories of individual innovativeness and percentages within each category)

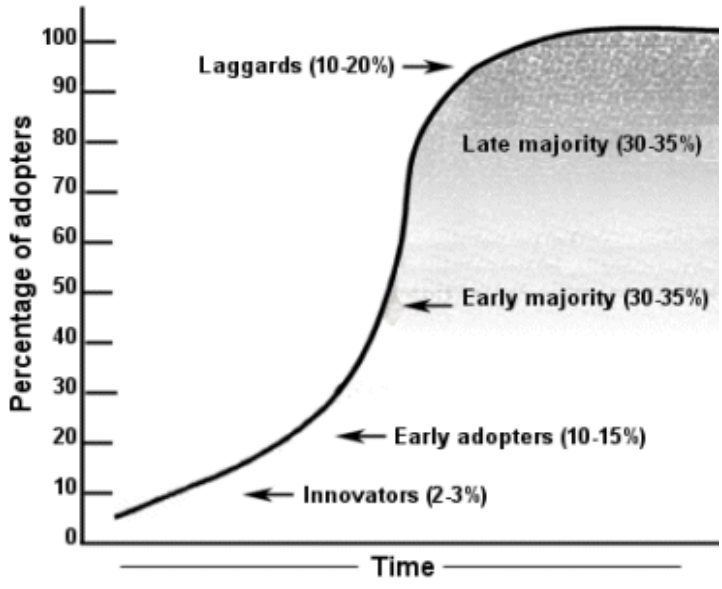

Figure 4: The S-shaped cumulative diffusion curve and adopter categories

ISSN 1816-2495
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Now that the components of the Diffusion phenomenon have been described, the process can be detailed. Many authors who have studied the empirical nature of diffusion (such as Ryan & Gross 1943, Ajzen & Fishbein 1980, Quaddus & Xu 2005) take a classical, linear view of the process with external factors contributing to perceptions which, in turn, give rise to diffusion. Rogers (1995) provides a linear model of the diffusion process within agriculture (Figure 5).

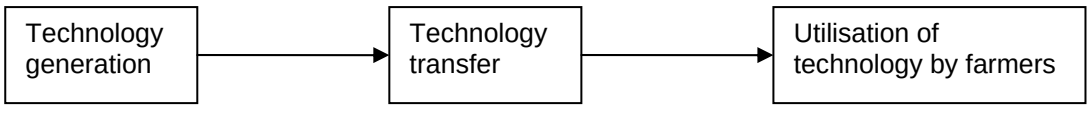

Figure 5: Diffusion as a linear model

However, Fliegel (1993), with support from Feder and Umali (1993), proposes a more widely accepted, non-linear approach to the adoption of agricultural innovations. He argues that the linear approach tends to restrict diffusion to a rational, planned process that relies on institutions such as government departments, rather than viewing the farmer as a passive individual who responds to random forces related to social participation and communication (Figure 6).

Figure 6: A non-linear approach to the adoption of agricultural innovations

In terms of diffusion of innovations in agriculture and rural sociology, Rogers (1995) reviewed 3,890 publications and found rural sociology to have provided the greatest contribution to research in the field of diffusion. Some 845 rural sociology publications were identified with the next greatest contribution coming from marketing and management with 585 publications. It was said that research on diffusion of agricultural technologies provided useful leads to agricultural scientists to have their work used by farmers.

Rogers (1995) and Ruttan (1996) claim that surplus food production and the farm crisis in the USA started the demise of diffusion research in rural sociology in the 1970s. However it appears that there has been a resurgence in the popularity of agricultural diffusion research as shown by studies on the adoption of modern farming systems in developing countries (Masters 2005, Abdulai & Huffman 2005, Weir & Knight 2004, Munshi 2004, Rahman 2003, Neill & Lee 2001, de Sousa & Busch 1998, Mishra & Hossain 2000), the uptake of

ISSN 1816-2495
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conservation practices in farming (Pampel & van Es 1977, Forte-Gardner, Young, Dillman & Carroll 2004, Neill & Lee 2001, Feder & Umali 1993) and the use of biotechnology in farming systems of developed countries (Hategekimana & Trant 2002, Stewart, Harding & Day 2002) or both (Qaim & de Janvry 2005, Pelaez & Schmidt 2002). Research has also re-emerged on the diffusion of grain production technology (Walburger, Klein & Folkins 1999, Forte-Gardner et. Al. 2004, Rajesh & Varadarajan 2000).

Despite the apparent popularity of this concept, diffusion theory and its generic bell-shaped and S-shaped models has been criticised. Major areas of criticism include variation found in the rate of adoption of various technologies (Fliegel & Kivlin 1962, Linder 1986, Fisher *et al.* 2000), its application to agricultural systems in developing nations (Goss 1979 & Ruttan 1996) and its narrow application to individual farmers, as opposed to agribusiness firms (Jensen 1982 & 2001, van Everdinger & Wierenga 2002, Hausman 2005). While these studies present valid criticisms, there appears to be more successes than failures. The few instances in which diffusion of innovations has not been successful suggests that the theory's application is best restricted to research questions related to understanding farmer behaviours in community settings of developed nations.

THE COMBINED APPROACH – AN EXAMPLE

The strengths and weaknesses of three behavioural theories have been discussed. From here, this investigation turns to finding if the strengths of these theories can be combined to provide theoretical frameworks that are equal to, or better, than their "parents". Combining various behavioural theories has been applied successfully on numerous occasions in business and technology research (Intrapairot 2000, Xu 2003 and Hofmeyer 2005) but apparently only once in agribusiness (Tutkun & Lehmann 2006).

Tutkun and Lehmann (2006) combined the Theory of Planned Behaviour and Diffusion of Innovations to explain farmer conversion to particularly animal-friendly stabling systems in Switzerland. Their explanation for this approach was that the weaknesses of TPB can be bypassed and the traditional model enhanced by including diffusion constructs. In their study, the authors obtained data from 176 Swiss farmers and used structural equation modelling to test the reliability and validity of their combined model. Results were extremely encouraging in that seven of the eight relationships tested resulted in a $p < 0.001$ level of significance with the all-important communication construct from the Diffusion of Innovations explaining an astounding 76% of the variation in adoption behaviour. The authors also calculated goodness of fit using four measures (Chi^2:Degrees of Freedom, Root Mean Square Error of Approximation, Goodness of Fit Index and Adjusted Goodness of Fit Index), all of which were reported to be satisfactory thus indicating that the model was consistent with its theoretical basis.

While there has only been one agribusiness related study that has taken a combined approach to behavioural research, the results provide a great deal of inspiration for development of this idea for future research. Tutkun and Lehmann's unique study exhibits theoretical power to suggest that it is possible to combine the strengths of these two influential behavioural theories. A truly exciting prospect.

SUMMARY AND CONCLUSIONS

This review has shown that while there has been growth in complexity of the behavioural theories under consideration, there are themes within each theory that have stayed constant since their inception.

ISSN 1816-2495
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Agricultural studies on the TRA are relatively few since the theory was not fully appreciated until it had the "perceived behavioural control" construct added to make it the TPB. Reviews of the TPB showed that each of its constructs is highly applicable to agricultural research although "past experience" and "self-identity" also have a positive effect on TPB model's strength.

Finally, studies reviewed on Rogers' diffusion of innovation theory showed that the original bell-shaped curve and the categories of adopters are still appropriate for current agricultural research. It was also found that this research paradigm has been successfully applied in agricultural finance and economics. It has yielded sound conclusions about behavioural determinants regarding farmers' choice of marketing options so will thus be highly applicable to agribusiness research.

In conclusion, description and discussion of the aforementioned theories have yielded both pros and cons for each. Research has found both praise and criticism for the theories however, in general, it can be said that there is sufficient empirical evidence to suggest that the TRA, TPB and Diffusions of Innovations theory all have value in agribusiness research. Furthermore, new research provides evidence that these theories can be "hybridised" opening the door to a broader range of research domains previously overlooked.

This paper has posed two questions: 1) Is it possible to combine the virtues of behavioural theories? 2) If so, will the results of such a combined model be valid and reliable? In order to address these questions, a critical analysis was undertaken of three traditional and popular behavioural theories widely used in agribusiness research. This analysis showed strengths and weaknesses of the theories and new research was reviewed to prove that it is possible to combine these theories and that the results will be reliable and valid. It is acknowledged that more research is needed to conclusively verify that a combination of the behavioural theories is possible however, the review undertaken herein provides a starting-point for more research to contribute to this body of knowledge.

ACKNOWLEDGEMENTS

This research is part of the project "Behavioural Determinants of the Adoption of Forward Market by Australian Wool Producers", jointly supported by Agriculture Western Australia and the Australian Research Council. The views expressed in the paper are not necessarily the views of the supporting organisations.

Thanks are extended to Associate Professor Peter Galvin of Curtin University's Graduate School of Business and the anonymous reviewers selected by this journal's editor for their helpful and supportive comments made for the improvement of this paper.

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ISSN 1816-2495
www.ifmaonline.org

FARM INVESTMENTS: ALTERNATIVE OWNERSHIP STRUCTURES THAT ADDRESS THE LIQUIDITY VERSUS PROFITABILITY CONUNDRUM

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Abstract

Investing in farmland is fraught with conflicting signals. Oltmans (2001) concludes that while investing in land may generally be profitable it is seldom, if ever, feasible on a cash flow basis. He argues that the non-depreciable nature of land and long-term capital gains are incompatible with the capital recovery terms sought by investors and lenders. He also notes that literature on farmland investment tends to focus on either the returns (profitability) or the cash flow (feasibility) but not on both simultaneously. To assist in the debate it is helpful to split the farm into two businesses that are often, but not necessarily, linked – the property business, where success is measured by changes in asset values over time and is driven by smart purchase and sale decisions, and the farming business, where success reflects effective and efficient sustainable operation of the resource base. By determining the profitability, liquidity and wealth creation for three ownership structures (land leasing, sharefarming, equity partnerships) from the perspective of both the farming entity and the passive investor (property owner or non-managing equity partner) it is possible to identify for each player the measures most relevant to their expectations from the investment and the factors which most influence them. If the assets of the property business and the farming business are owned by different parties there is no need for an aggregate measure of business performance. The challenge is to determine 'fair' returns to each player; is profit, cash flow or wealth creation criteria the basis for such a comparison? For the property business investors the opportunity cost of capital comes from the farming 'rent' and what they believe the property business will deliver over time (many expect at the very least an inflation proof investment). The opportunity cost of capital for the farming business investors must allow for depreciating assets. Historically the property business has out performed the farming business although its returns have been three times as volatile as farming returns (Nartea and Basanta(1998), Brown (1999)).

Introduction

Investment appraisal is a technique often learned with great difficulty and rapidly forgotten. However it is a very useful tool to evaluate farmland purchase decisions. Considering annual profitability measures only in deciding whether or not to undertake a long-term investment like farmland purchase can be misleading due to the volatility of annual profit and because these measures overlook the nature of farming returns. This paper backgrounds the issue, describes

measures of profitability and financial feasibility for both the property and the farming businesses and proposes solutions to the liquidity versus profitability conundrum.

Farmland Investment

Investing in farmland is fraught with conflicting signals. In an interesting paper Arnold Oltmans (2001) concludes that while investing in land is generally profitable it is seldom, if ever, feasible on a cash flow basis. He argues that the non-depreciable nature of land and long-term capital gains are incompatible with the capital recovery terms sought by investors and lenders.

If these are the facts about investing in land why do people continue to buy land and what makes it worthwhile for them? Or do we agree with those rural professionals who state that farmers are not clear in their investment decisions; are they too influenced by 'lifestyle' factors to make rational decisions? And are non-farmer landowners similarly afflicted with emotional bias in their investment decisions?

Researchers have demonstrated that, historically, farm businesses have achieved attractive returns but is that relevant in today's investment climate? To assist in this debate it is helpful to split the farm into two businesses that are often, but not necessarily, linked – the property business, where success is measured by changes in asset values over time and is driven by smart purchase and sale decisions, and the farming business, where success reflects effective and efficient sustainable operation of the resource base. While property business decisions may determine whether a business still exists or not it is the farming business and its decisions that drive sustainable resource use.

The problem in measuring the aggregate businesses' performance is that success in one business (e.g. capital gain) can cause a measure of apparent failure in the other (e.g. reduced Return on Assets) when, in fact, both businesses could be performing well. This is exacerbated in that returns to land is a principal determinant of farmland price (Cloughley & Journeux (1992). Oltmans (2001) showed that as well as producing current earnings, land is also a vehicle for accumulating wealth so delivers to two common farming goals. With more liquid investments such as shares an increase in their value without an improvement in earnings is often a prompt to sell; similarly an improvement in earnings not reflected in an improved share value is a prompt to buy. While this may seem simple in principle, reported earnings are historical (and not always reliable or comparable) and share values reflect expectations for future earnings; there is still ample opportunity to get it wrong with liquid investments. Land investments are illiquid, not easily reversed nor is it simple to purchase an agricultural land investment. Farming companies listed on the stock exchanges in Australasia have all spectacularly collapsed or redirected their activities away from farming.

Historically the property business has out performed the farming business although returns have been three times more volatile than farming returns (Nartea and Basanta(1998), Brown

(1999)). Nartea and Basanta(1998), and Brown (1999) have shown that farm returns (both property and farming) fluctuate significantly differently to those from stocks and bonds. Both Brown (1999) and Nartea and Basanta(1998) recommend investment in farmland/farming, stocks and bonds in varying proportions as a risk management strategy. Nartea and Pellegrino (1997) showed that 68 per cent of farmland risk could be eliminated through effective diversification; a diverse portfolio of investments (stocks, bonds and farmland) reduced risk to a third of that from farmland alone. Oltmans (2001) referred to recent studies showing total rates of return to farmland comparing favourably with non-farm assets when adjusted for risk. He also observed that literature on investing tends to focus on either the returns (profitability) or the cash flow (feasibility) but not both simultaneously.

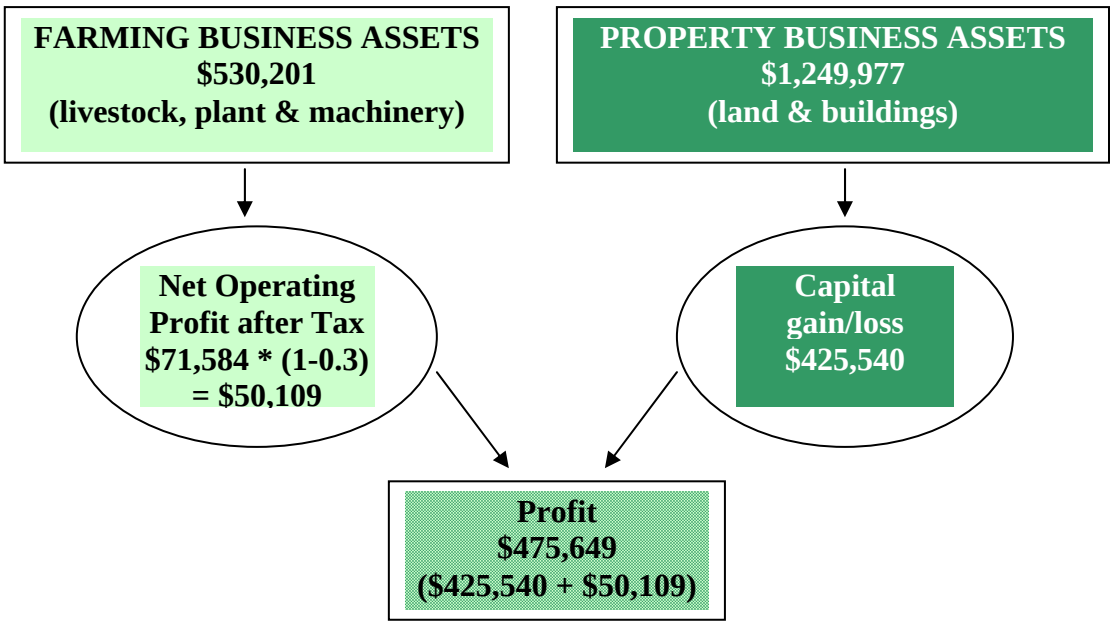
While farmers are often criticized for accepting low farming returns, from their farming business, and relying heavily on property returns they are operating businesses in which few assets depreciate. The opportunity cost of their capital is a combination of the returns from the farming business and the property business (many expect at the very least an inflation proof investment).

Farmland assets in the US over the last 30 years have accounted for 70-80% of total farm assets (Oltmans, 2001) and recent NZ surveys have similar values (The Economic Service, 2001 & 2000, DEXCEL, 2001 & 2000). It is therefore important to determine the impact on farm business profitability and feasibility, of investing in farmland.

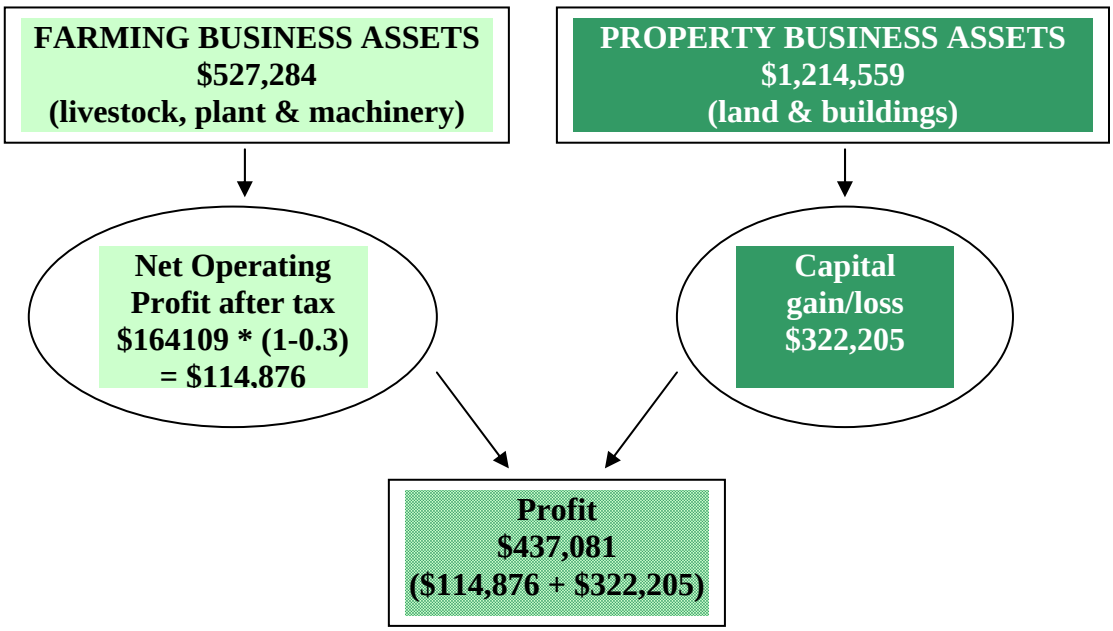
Profitability

Too frequently rural professionals use the terms profit and cash surplus (liquidity) interchangeably. As identified above the overall profitability of a farm investment is the sum of the returns from its farming and property business. The farming business delivers primarily a cash result and the property business does not. ‘Asset rich, cash poor’ is commonly used in farming, suggesting liquidity difficulties identified by Oltmans as the persistent cash flow problems of the farm sector. The problem inherent in a land investment is described by Oltmans (2001) as one of liquidity not profitability.

Profitability is the total of the returns from the farming business, the operating profit after tax, and capital gains or losses from the property business. The returns for 2000/2001 using the weighted average all classes data from the New Zealand Sheep and Beef Farm Survey 2000/01 (The Economic Service, 2001) are shown below. The capital gain increases the return for this business nine-fold from a $50,109 return from the farming business to a total return of $475,649 when the capital gain of $425,540 from the property business is added. The profit of $475,649 provides a return of 26.7% from total opening assets valued at $1,780,178 (land and buildings of $1.25m plus livestock, plant and machinery of $530,201).



The owner-operator data from the Economic Survey of New Zealand Dairy Farmers 2000/01 (Dexcel, 2001) are shown below. The capital gain of $322,205 nearly quadruples the return for this business from $114,876 for the farming business to $437,081 with the additional capital gain from the property business. The profit of $437,081 provides a 25% return from total opening assets of $1,741,843 (land and buildings $1,214,559 and $527,284 for livestock, plant and machinery).



The return on assets after tax (net operating profits after tax / opening assets) for these two farms in 2000/2001 was 2.8% and 6.6% respectively. Using that measure alone as an indication of returns and as a guide to investment decision making who would have decided to buy land and miss out on the 25-26% return?

The above analysis is for one year only and does not take into account the timeframe of the investment. Nor does it recognise that property business returns are highly volatile. In 1996/97 and 1997/98, for example, dairy land values fell (Dexcel, 2001).

To take account of the time value of money Oltmans (2001) used a capital budgeting framework. He calculated the internal rate of return and the net present value to evaluate the profitability of the investments. He then applied a cost of funding to determine the financial feasibility of funding the investment over the time frame given.

Oltmans (2001) method is further explored by Shadbolt and Gardner (2002) who used a sheep and beef cattle farm example to determine that with an average operating profit of $264/ha per year that yielded a 6% return on assets of $4400 ($264 ÷ 0.06 = $4400) a funding cost of 8% ($352) cannot be met; there would be a 2% shortfall ($88/ha/yr) if the farm was totally funded by debt ($88 = $352 - $264). This would quickly lead to a liquidity crisis unless alternative arrangements were found. One common, often short-term, response is not rewarding the family for the true market value of their labour and management. Another arrangement is termed ‘passive’ equity funds. These funds would receive no or little return but at the end of a 15 year term would benefit from any improvement in asset value.

Shadbolt and Gardner (2002) calculated that an increase of just under 4% per annum on asset values from the property business in their example farm would provide a combined return of 8% over the 15 years. If equity holders were confident of at least that 4% growth in asset values, they might find this an attractive investment. Such investors would however need patience and be reconciled to this investment being a growth rather than an income investment. This has been well understood by many successful farming families over the years.

The emphasis placed on operating profit over the years by farmers and consultants has not been misplaced because as this improves so also does liquidity and farm investments become income as well as growth investments. If improvements in operating profits are not achieved the farm might still be a growth investment but it could have liquidity problems that will diminish any growth achieved.

Alternative Ownership Options

One alternative to land ownership is leasing. If the land and buildings were leased at 6% of their market value of $3300 ($198/ha) the $264/ha operating profit would provide a net return of $66/ha. To deliver to an 8% opportunity cost of capital over the 15 years on the investment in stock and plant of $1100, the lease option would need to achieve $88/ha; an improvement in operating profit of 8.3% above that achieved in the land purchase option (from $264/ha to $286/ha). As the assets either depreciate (machinery and plant) or can be particularly volatile (livestock) in a lease option, returns need to be higher to be in line with land inclusive investments.

Other ownership options include share leasing in which both parties to an arrangement share business risks and equity sharing where ownership is spread between off-farm and on-farm members. Equity share arrangements have operated in large family farm ventures for many years.

To explore these ownership structures further consider a 400 cow dairy farm in which the land and buildings are worth $2,276,280, the dairy cooperative shares $546,720, the livestock $400,000 and the plant and machinery $150,000.

Profitability

The operating profit for this farm is forecast to be $215,600 or $1767/ha. Without accounting for capital gains/losses this generates a return of 6.4% on assets of $3.373m. This is the return expected for both an owner operator (who has already fully reimbursed family labour) and an investor in an equity partnership (Table 1). Returns, as calculated by a simple two variable sensitivity analysis, range from 2.6 to 11.9% (Appendix One – Equity share arrangement).

If the investment was split with the land owned by a landowning company (the property business) and a 45% sharemilker contracted to run the farm (the farming business) their returns on assets would be 5.8% and 9.4% respectively (Table 1). In this arrangement both parties share risk and both would gain and lose from variations in milksolids prices and production. The sharemilker, who carries most of the operating costs of the business would have a much greater range in returns (-1.2 to 24.5%) than the landowning company (3.3 to 9.4%) (Appendix One). The emphasis sharemilkers put on productivity is therefore understandable.

Under the cash lease option the returns on assets to the landowner are 6% of the land value while the lessee, who owns the dairy company shares, livestock, plant and machinery achieves 7.2%. While the landowner has no variation in returns under a cash lease arrangement, lessee returns range from -4.6% to 24% (Appendix One).

Some of these investments are in assets that appreciate over time, other are not so it is necessary to extend this analysis to include time value of money. Also allowed for should be the possibility that land and livestock values may not be the same at the end and the beginning of the analysis. The risk analysis at this point must extend beyond the simple two variable sensitivity tables used in the return on assets analysis above. Using @RISK to introduce variability in prices, yields and final market value of assets and the same approach as in the previous example, the Internal Rate of Return and its variability has been calculated for the various ownership structures (Table 1). The results include the calculated range (at the 5% and 95% confidence limits) and assume no appreciation in land values.

For both the equity partnership and the landowning company to achieve a 9.2% sharemilker internal rate of return, land values would have to rise by 5.7% per year. For the lessor to achieve the 7% internal rate of return, land values would have to increase by 1.8% per year.

The internal rate of return for both the sharemilker and lessee have a much greater range than those for the equity partnership and landowning company and although more profitable options on average, they are also more risky. A further risk for the former not calculated here is due to the fixed term of their contracts; they do not have the choice of when to sell their assets. An additional risk to the landowners also not shown here is that the sharemilker or lessee will mismanage land and buildings. This may not affect earning capacity in the short term but could have a negative impact in the long-term.

Profitability	Equity Partnership	Landowning Company	Share-milker	Lessor	Lessee
Return on Assets (RoA)	6.4% (2.6-11.9)	5.8% (3.3-9.4)	9.4% (-1.2-24.5)	6%	7.2% (-4.6-24)
Internal Rate of Return (IRR) with no capital gain	6.2% (3-10%)	5.6% (4-8%)	9.2% (2-18%)	5.8% (5-6%)	7.0% (0-17%)
Capital Gain per year required for equivalence	5.7%	5.7%		1.8%	

Table 1: Profitability criteria (and their variability) for various ownership structures, Return on Assets (minimum and maximum values from the sensitivity tables), IRR (5% and 95% confidence limits from @RISK outcome probabilities) and the capital gain required by the land owning structures to provide the same IRR as their related non-landowning structure.

Liquidity

The higher the returns the greater the level of debt the various ownership options can carry. If interest rates are 8% the sharemilker could support 100% debt, the lessee up to 80% while the amount able to be borrowed by the equity partnership, the landowning company and the landowner who leases land will depend on the cash required from the business. This can often be a point of difference and friction between off-farm and on-farm investors in an equity partnership. Even if they require no cash and view these as purely growth investments as the returns are below the cost of debt they could not borrow all the funds required, but would have to put in some 'passive' funds.

Cash flow or dividend requirements will influence the chosen level of debt as will the requirement to pay off debt over time. If the sharemilker took a 100% debt position there would be little cash available to repay debt. As the return on equity is less than the return on assets if the cost of debt is higher than the return on assets this would also be a disincentive for all but the sharemilking entity to take on debt. Assuming debt is to be repaid over the 15 years of the analysis and basing debt levels on commonly held practice, the cash surplus after tax, principal repayments and capital expenditure is calculated for each ownership structure (Table 2). The interest rate assumed is 8% for the land owning entities and 8.5% for the sharemilker and lessee who have less security and more variable outcomes. It is also assumed that the landowning entities who have less debt require $30,000 per year as drawings/dividends from their 'passive' equity; the sharemilkers and lessees whose labour and management has been fully rewarded draw no additional funds.

Liquidity	Equity Partnership	Landowning Company	Sharemilker	Lessor	Lessee
Debt/Assets %	33%	30%	50%	30%	40%
Farm Cash Surplus	$20,904 (-$33,190 to $84,664)	$10,870 ($-17,608 to $44,434)	$11,009 (-$13,342 to $39,693)	$8,122	$15,625 (-$38,470 to $79,385)
Probability of a cash deficit	31%	31%	27%	0%	33%
Probability of a cash deficit with 20% debt	6%	6%	6%	0%	17%

Table 2: Liquidity (and its variability) for each ownership structure (giving 5% and 95% confidence limits from @RISK outcome probabilities) under assumed debt levels and the probability of a cash deficit occurring for each structure.

Individual attitude to risk will influence how much debt an entity takes on; a sharemilker who is a risk taker might handle 80% debt but one who is more cautious or who has a more cautious

banker will settle at a lower level. For owner operators, sharemilkers and lessees liquidity problems can be partially managed by using family labour as a buffer while in equity partnerships this is seldom the case.

A wide range of outcomes is produced by the risk analysis for the lessee in particular, and sharemilker, who carry all or most of the burden of business risk. The range of outcomes for the landowning company falls between that of the lessee and sharemilker. While the equity partnership also has a wide range of outcomes the probability is 31% that it will have a deficit, assuming a $30,000 dividend; without the dividend the probability of a deficit is only 9%. The lessee on the other hand could be in deficit one year in every three. If the debt levels are 20% of total assets for all ownership options, the probability of deficits is reduced but the lessee could still be in deficit 17% of the time. Only by lowering the lease payment from 6% to 5% of land value or by dropping debt levels to 5% does the probability of deficits fall below 10%. Sharemilkers' and lessees' drawings are often less than the market value of family labour assumed in this analysis. This enables them to borrow more and to pay debt off faster; another example of how family labour is a useful buffer in managing liquidity.

Wealth creation

Net present value (NPV) of the cash flow for each ownership structure is a measure of wealth creation; it is the present value of the future stream of cash generated by an investment. With an internal rate of return (IRR) of 9.2% the sharemilking investment is the only structure with a positive NPV at an 8% discount rate. The equity partnership and landowning company have a similar NPV if land values increase by 4% per year and 4.3% per year respectively. For the lessor to have a similar NPV to the lessee, land values must increase by 3.2% per annum.

If the NPV is calculated on the cashflows after income tax, interest and principal repayments for each ownership structure at a 5.6% post tax discount rate, differences between the options narrows. To generate the same wealth or NPV as the sharemilker the annual increase in land values must be just 3.64% and 3.82% for the equity partnership and the landowning company respectively and lessor land values need only increase by 2.7% for a similar NPV to the lessee. Historically land in New Zealand has increased in value by 11% per annum (Nartea and Basanta 1998).

The value of livestock does not appreciate but is instead linked to product prices and can be highly volatile and as plant and machinery is replaced and has the same value at the end as at the beginning, the sharemilking and leasing options would not appear to generate wealth. The NPV criterion assumes that cash surpluses generated throughout the life of the investment are reinvested and not spent; in practice it takes discipline to achieve this assumption.

Conclusion

Many farmers do not use the techniques available to assess both profitability and feasibility of investing in farm businesses. These techniques help explain the complexities of investing in both depreciating and appreciating assets. As Oltmans (2001) demonstrates the inherent problem in investing in an appreciating asset like land is a cashflow one, not an income or profitability one. He states that land as a growth asset is more suited to equity financing than debt financing; few banks are willing to be either passive or patient in their demands for cashflow! The solution lies in the use of passive equity funds that require no cash return in the short term but rely on longer term growth prospects. If the assets of the property business and the farming business are owned by different parties there is no need for an aggregate measure of business performance. The challenge is to determine 'fair' returns to each player; is profit, cash flow or wealth creation criteria the basis for such a determination? Return on assets based on annual operating profits is not a fair measure for determining rewards as it does not take into account risk, capital gain or time value of money. Unfortunately some sharemilking agreements have been altered in the landowners' favour because of an undue emphasis placed on return on assets.

Returns for the property business investors include farming 'rent' and expected returns from the property business over time (many expect at the very least an inflation proof investment). Their returns are less variable than those for farming business investors. The high variability in returns for farming business investors requires greater emphasis on liquidity as a measure of success and for a range of risk management strategies to be in place to reduce the probability of cash deficits. Bankruptcies are not uncommon among sharemilkers.

Measures of success for the property business and the farming business differ so to ensure 'fairness' it may be more relevant to aim to meet the expectations of each party without attempting to achieve equivalent returns.

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APPENDIX I: SENSITIVITY ANALYSES OF RETURN ON CAPITAL TO MILK PRICE ($/KG MS) AND MILK PRODUCTION (KG MS/COW)

EQUITY SHARE ARRANGEMENT

	Milk Price $/kgMS					
6.4%	**$ 3.00**	**$ 3.40**	**$ 3.80**	**$ 4.20**	**$ 4.60**	**$ 5.00**
300	2.6%	3.7%	4.9%	6.1%	7.3%	8.4%
320	3.1%	4.4%	5.6%	6.9%	8.2%	9.4%
340	3.7%	5.1%	**6.4%**	7.7%	9.1%	10.4%
350	4.0%	5.4%	6.8%	8.1%	9.5%	10.9%
360	4.3%	5.7%	7.1%	8.5%	10.0%	11.4%
370	4.6%	6.1%	7.5%	9.0%	10.4%	11.9%

SHAREMILKER

	Milk Price $/kgMS					
9.4%	**$ 3.00**	**$ 3.40**	**$ 3.80**	**$ 4.20**	**$ 4.60**	**$ 5.00**
300	-1.2%	2.1%	5.3%	8.6%	11.8%	15.0%
320	0.5%	3.9%	7.4%	10.8%	14.3%	17.7%
340	2.1%	5.7%	**9.4%**	13.1%	16.8%	20.4%
350	2.9%	6.7%	10.4%	14.2%	18.0%	21.8%
360	3.7%	7.6%	11.5%	15.4%	19.2%	23.1%
370	4.5%	8.5%	12.5%	16.5%	20.5%	24.5%

LANDOWNING COMPANY

	Milk Price $/kgMS					
5.8%	**$ 3.00**	**$ 3.40**	**$ 3.80**	**$ 4.20**	**$ 4.60**	**$ 5.00**
300	3.3%	4.1%	4.8%	5.6%	6.4%	7.1%
320	3.7%	4.5%	5.3%	6.1%	7.0%	7.8%
340	4.1%	4.9%	**5.8%**	6.7%	7.6%	8.4%
350	4.2%	5.1%	6.0%	6.9%	7.8%	8.7%
360	4.4%	5.4%	6.3%	7.2%	8.1%	9.1%
370	4.6%	5.6%	6.5%	7.5%	8.4%	9.4%

LESSEE

	Milk Price $/kgMS					
7.2%	**$ 3.00**	**$ 3.40**	**$ 3.80**	**$ 4.20**	**$ 4.60**	**$ 5.00**
300	-4.6%	-1.0%	2.6%	6.2%	9.9%	13.5%
320	-2.8%	1.1%	4.9%	8.8%	12.6%	16.5%
340	-1.0%	3.1%	**7.2%**	11.3%	15.4%	19.5%
350	-0.1%	4.1%	8.3%	12.6%	16.8%	21.0%
360	0.8%	5.2%	9.5%	13.8%	18.2%	22.5%
370	1.7%	6.2%	10.6%	15.1%	19.5%	24.0%

Financial Management and Dairy Farmer Satisfaction with Performance

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ISSN 1816-2495
www.ifmaonline.org

Financial Management and Dairy Farmer Satisfaction with Performance

Abstract

This paper reports on a study aimed at identifying financial management practices important in explaining farmer satisfaction with their business performance in the dairy farming industry in the state of New South Wales (NSW), Australia. Principal components analysis was performed on survey data from 204 NSW dairy farming businesses measuring the extent to which a wide variety of financial management practices were undertaken. This analysis identified five financial management dimensions: appraisal practices, environmental accounting, budgeting, aid use and analysis practices. Regression analysis, including control variables, indicated that greater emphasis on financial management was associated with greater satisfaction with business performance. Appraisal practices, including calculating the payback period for investments and assessing the relevant costs and benefits of decision alternatives, were found to be particularly important in explaining satisfaction. The emerging techniques of environmental accounting were also found to have a unique relationship with farmer satisfaction. The findings provide further support for prescriptions in the literature that farmers should invest time and effort into financial management.

Introduction

The farm management literature has been described as ‘long on theory and prescription but short on descriptions of how farmers actually manage their businesses’ (Gasson 1989, p. 127). This comment still applies to the area of financial management. Knowledge about the financial management practices of farmers and the benefits of these practices is limited and heavily reliant on anecdotal evidence. However, it is an important topic for farm business management practitioners. This is illustrated clearly by the results of a recent study of 200 Australian family farm

ISSN 1816-2495

businesses in which farmers ranked financial knowledge as the number one skill they required for changing current practices (Bone et al. 2003). These farmers, and their advisors, would gain from research indicating which financial management practices might be most beneficial. Therefore, the study reported in this paper aimed to identify financial management practices positively associated with farmer satisfaction with their business performance.

The focus of the study is dairy farms in New South Wales (NSW), Australia. Around 91% of Australian dairy farm businesses are classified as small (Australian Bureau of Statistics 2001) and 99% of all Australian broadacre and dairy farms are owned and operated by individuals or families (ABARE 2002). Industry deregulation and a general trend towards fewer, larger farms with increasing production efficiency have put pressure on dairy farm businesses to either grow or exit the industry (Davidson 2001). However, a study by Davey and Nettle (1997), based on 10 dairy farms in Tasmania over a six-year period, suggests that success (in terms of increased profit, net worth and personal satisfaction) from expansion is not assured. What seems to be required is a concomitant focus on business management, with Davey and Nettle (1997) suggesting expansion should be guided by more relevant management accounting and careful budgeting. Given the challenges facing the dairy farming industry in Australia, further investigation of the potential benefits of financial management practices is warranted.

Previous Studies

A limited number of studies have investigated the financial performance benefits of financial management in farm businesses but, as in the broader small business management literature (see, for example, McMahon & Davies 1994; Nayak & Greenfield 1994; McMahon 2001; Zaman & Gadenne 2002), the evidence is somewhat mixed. This is evident, for example, in the results of a series of studies of U.S. farms undertaken by Mishra and colleagues (Mishra, El-Osta & Johnson 1999; Mishra, El-Osta & Steele 1999; Mishra & Morehart 2001). Each study looked at a broad range of factors thought to affect farm financial performance and each included a dichotomous measure of keeping books or records on farm income and expenditure.

Each study expected a positive association between this variable and various measures of financial performance, including returns to operators' labour and management in dollars and net farm income. Mishra, El-Osta & Steele (1999) argue that keeping good financial records helps allocate resources more effectively, increasing efficiency and hence profitability. Support for this was found in Mishra, El-Osta & Johnson's (1999) study of cash grain farms but there was no apparent beneficial impact uncovered in Mishra, El-Osta & Steele's (1999) study of limited resource and other small farms or in Mishra and Morehart's (2001) study of dairy farms. However, record-keeping is only one of a large number of financial management practices and dichotomous measurement of record-keeping is of limited usefulness.

Rather than focusing on the financial management practices undertaken, Jackson-Smith, Trechter and Splett (2004) examined the link between financial management training and knowledge and dairy farm financial performance. Their results found no evidence of a link in the case of simple exposure to such training but a weak positive association was found between financial performance and the application of financial management knowledge in the form of production cost calculation. This provides some support for the benefits of financial management.

The most comprehensive study to date of the farm financial performance impacts of financial management was undertaken by Gloy and LaDue (2003). This study of New York dairy farms found that the adoption of investment analysis techniques was associated with higher return on assets. Investment analysis techniques were measured using two variables, both dichotomous. One considered whether respondents used either the payback period, projected cash flow or discounted cash flow techniques (such as net present value and internal rate of return) to evaluate major expansions. The other considered whether a detailed profitability analysis was undertaken for a major capital investment. Both were associated with higher return on assets. However, Gloy and LaDue (2003) found no evidence to support an association between return on assets and the use of either benchmarking or trend analysis. Thus the evidence from this study is also mixed.

The studies discussed above have focused on financial performance. However, research indicates that farmers do not solely aim to maximise profits, as might be implied from the basic assumption of many economic theories and models. Various

lifestyle, social and environmental objectives, which may be broadly defined as non-economic objectives, are also common amongst farmers (see, for example, Gasson 1973; Kerridge 1978; Schroeder et al. 1985; Coughenour & Swanson 1988; Olsson 1988; Fairweather & Keating 1994; DRDC 1995; McGregor et al. 1995; Bone et al. 2003). Therefore, this study takes a broader view than previous studies by considering farmers' satisfaction with their business's performance on a number of non-economic as well as economic objectives.

Sample and Data Collection

Data was collected from self-administered questionnaires, distributed to all members of the NSW Dairy Farmers' Association via the Association's monthly publication. A reminder was included in the following monthly edition of the publication and local branch secretaries were contacted to seek their support for follow up at branch meetings.

A total of 204 useable responses were received, representing a response rate of 14%. This rate can only be considered crude and a minimum because the distribution method did not allow adjustment for ineligibles and other factors. However, to explore the implications of this response rate, the possibility of non-response bias was assessed by comparing initial and late responders (Armstrong & Overton 1977) and by comparing the demographics of respondents with those of NSW dairy farms reported in secondary sources. The sample was found to over-represent intensive dairy farms in southern NSW where average milk production per farm and herd size is higher than state averages. These farms also made up a large proportion of initial responses. However, analysis indicated that there were no significant differences between regional groups or initial and late responders on other key variables and items reported in this paper.

Table I presents characteristics of the respondents and their farms. The average age of respondents was 46 years and on average they had been operating a dairy farm for 22 years. The mean herd size was 165 cows and the mean farm area used for agricultural production was 189 hectares. Annual milk production per cow averaged 5,455 litres.

Table I Characteristics of Respondents and Their Farms

	Mean	Std. Dev.	*n*
Age (years)	46.3	11.3	204
Years operating a dairy farm	22.3	13.1	202
Herd size (cows)	164.9	91.3	191
Annual milk production per cow (litres)	5,454.8	1,518.8	177
Farm area used for production (hectares)	188.8	120.2	197
Size of farm management team (no. of people)	2.5	0.9	202
Dairy income (% of family income)	92.7	14.6	203

Around half of the farms had a farm management team consisting of two people, reflecting the small, family-oriented nature of most businesses in the industry. Most of the family's income came from dairying, rather than other agricultural activities or off-farm work. Income from dairying represented at least 90% of all family income for around 85% of respondents and 55% of respondents relied entirely on dairying income. Only 15% of respondents received any income from other agricultural enterprises on the farm and only 12% from off-farm, non-agricultural work. The heavy reliance on a single source of income by many dairying families, reflected in these figures, highlights the importance of research investigating ways to sustain or increase this income.

Financial Management Practices

Respondents were asked to indicate the extent to which they undertook each of 24 financial management activities, measured on an 11-point numerical scale where '0' was anchored with 'not done at all' and '10' with 'done very diligently'. The 24 items are presented in the Appendix. Items were chosen after an extensive examination of the literature, expert review by three academics and two dairy industry professionals, and pre-tests with eight farmers.

The item set does not cover every conceivable aspect of financial management. Rather, the focus is on activities that minimise necessary prior assumptions about the structure and resources of businesses in the population of interest. In addition, the item set de-emphasises formal financial management (for example, preparation of formal historical financial statements) because, as Nayak and Greenfield (1994) suggest, formality may not be as necessary in a small business as in larger businesses where other parties must be kept informed. The resulting item set includes activities from most of the major classifications in McMahon and Holmes' (1992) taxonomy of small business financial management practices. Table II includes descriptive statistics for the 24 financial management items.

As can be seen from Table II, written cash budgeting was more commonly undertaken than the other forms of budgeting, particularly balance sheet budgeting, which 40% of respondents reported not engaging in at all. This is to be expected, since proforma balance sheets may not be as important as a cash or income budget. Similarly, relevant cost/benefit analyses of minor and major decisions were also undertaken by a larger proportion of farmers than accounting-based budgeting. Notwithstanding this, a large proportion of farmers (between 60 and 74 per cent) still undertook some form of budgeting to at least some extent.

Nearly all respondents reported keeping summary financial records, comparing current to past financials and tax planning with an accountant. The proportion of farmers comparing current to past financials is in line with previous studies in the UK agricultural sector (Gasson 1989; Sealy & Warren 1994). Ninety per cent of respondents reported seeking financial advice from an accountant or other advisor when considering major farm, investment or borrowing changes and this is in line with other evidence from Australia and New Zealand (Delany & Johnson 1997; Popoff & Perry 1991). However, it is worrying that 10% of respondents claimed that they do not seek any such advice. Unless the specialised skills required to analyse such changes are to be found within the farm management team, it is suggested that seeking outside specialist advice is an important financial management strategy in a small firm (Meredith 1985).

Table II Descriptive Statistics for the Financial Management Items

Items (Question No. – see Appendix)	% undertaking	% not undertaking	Mean
Long-term financial goals (1)	86.8	13.2	6.37
Short-term financial targets (2)	91.6	8.4	7.61
Summary financial records (3)	97.5	2.5	9.39
Compare current to past financials (4)	93.6	6.4	8.18
Cash budget (5)	74.0	26.0	5.92
Compare cash budget to actual (6)	70.6	29.4	5.62
P&L budget (7)	65.3	34.7	4.96
Balance sheet budget (8)	60.1	39.9	4.28
Financial sensitivity analysis (9)	72.9	27.1	5.14
Inter-firm comparisons (10)	78.3	21.7	6.02
Finance analysis (borrow /invest) (11)	75.9	24.1	5.53
Ratio analysis (12)	73.6	26.4	5.51
Contribution margin analysis (13)	74.8	25.2	5.80
Computer use (14)	60.3	39.7	5.68
Taxation planning with accountant (15)	93.6	6.4	8.33
Financial advice for major decisions (16)	89.7	10.3	8.32
Relevant cost/benefit analysis (major) (17a)	92.2	7.8	7.36
Cost/benefit sensitivity analysis (17b)	84.3	15.7	6.45
Payback period calculation (17c)	92.6	7.4	8.18
Relevant cost/benefit analysis (minor) (18)	88.2	11.8	6.58
NRP^ expenditure monitoring (19)	86.6	13.4	6.35
Value of lost production from NRPs^ (20a)	69.0	31.0	4.53
Value vegetation/wildlife benefits (20b)	51.3	48.7	3.20
Land valuations related to NRPs^ (20c)	59.1	40.9	4.01

^ natural resource problem

Scale: 0 = Not done at all; 10 = Done very diligently

'% not undertaking' is based on those scoring 0; '% undertaking' is based on scores of 1 to 10

n ranges from 193 to 204 due to missing values on some items.

Table II also indicates, as expected, that a large percentage of respondents do not undertake the more complex environmental accounting activities. This is likely to be

due to their complexity and also because they are relatively new and developing techniques.

Principal Components Analysis

Principal components analysis was utilised to reduce the number of variables and to discover groups of interrelated financial management items. Five components with eigenvalues greater than one were extracted, accounting for 66% of variance. Examination of the scree plot similarly suggested five components. Rotation using direct oblimin showed that several components had correlations greater than 0.30, indicating that an oblique rotation was appropriate. Table III presents the component loadings from the pattern matrix. Two items, summary financial records (Q3) and comparison of current to past financials (Q4), had factor loadings less than the suggested 0.40 cut-off for significance given a sample size of 200 (Hair et al, 1998). Therefore, these two items were not used in further analysis but it is worth noting that their highest loadings were with other items reflecting similar aspects of financial management. Of the remaining items, highest loadings are shown in bold to clearly indicate each component. Table III also shows the internal consistency reliability for each component, measured using Cronbach's alpha coefficient and based on emboldened items only. Four of the components had very satisfactory alpha coefficients above 0.80. Component 4 had a lower but acceptable alpha.

From examination of the common elements of items loading onto each component, the five components were described as:

Component 1: *Appraisal* – investment and contingency appraisal activities, geared towards the long term.

Component 2: *Environmental Accounting* – activities dealing with the evaluation of the financial impacts of natural resource problems.

Component 3: *Budgeting* – activities dealing with the preparation and use of future-oriented financial statements and target setting.

Component 4: *Aid use* – activities involving the use of financial management aids (support systems).

Component 5: *Analysis* – activities of an ongoing or regular nature oriented towards monitoring the financial situation of the business.

Table III Financial Management Principal Components Analysis: Rotated Loadings[a]

	Components				
Items (Question No. – see Appendix)	**1**	**2**	**3**	**4**	**5**
Payback period calculation (17c)	**0.830**	0.010	0.058	0.112	0.050
Cost/benefit sensitivity analysis (17b)	**0.741**	0.105	-0.040	-0.006	0.160
Relevant cost/benefit analysis (major) (17a)	**0.707**	-0.047	-0.140	0.131	0.092
Relevant cost/benefit analysis (minor) (18)	**0.706**	0.066	0.036	-0.005	0.172
Long-term financial goals (1)	**0.502**	0.038	-0.368	0.018	0.023
Financial sensitivity analysis (9)	**0.475**	0.150	-0.343	-0.122	0.139
Land valuations related to NRPs (20c)	-0.016	**0.893**	-0.092	0.002	-0.081
Value vegetation/wildlife benefits (20b)	-0.128	**0.877**	-0.016	0.004	0.031
Value of lost production from NRPs (20a)	0.082	**0.763**	-0.018	0.028	0.033
NRP expenditure monitoring (19)	0.233	**0.433**	0.131	0.115	0.233
Cash budget (5)	0.016	-0.003	**-0.906**	0.056	-0.034
P&L budget (7)	-0.023	0.022	**-0.905**	0.009	0.028
Compare cash budget to actual (6)	0.098	-0.029	**-0.837**	-0.005	0.087
Balance sheet budget (8)	0.005	0.162	**-0.774**	-0.099	0.079
Short-term financial targets (2)	0.389	0.060	**-0.418**	0.176	-0.094
Financial advice for major decisions (16)	0.155	0.068	0.067	**0.862**	-0.106
Taxation planning with accountant (15)	0.103	0.039	0.072	**0.847**	-0.029
Computer use (14)	-0.288	0.011	-0.202	**0.533**	0.216
Summary financial records (3)	-0.086	-0.157	-0.267	0.334	0.219
Ratio analysis (12)	-0.006	0.006	0.002	-0.048	**0.878**
Inter-firm comparisons (10)	0.125	-0.022	-0.004	-0.018	**0.772**
Contribution margin analysis (13)	0.103	0.055	0.014	-0.059	**0.752**
Finance analysis (borrow /invest) (11)	-0.035	0.088	-0.076	0.078	**0.699**
Compare current to past financials (4)	0.240	-0.081	-0.106	0.271	0.390
Cronbach's alpha coefficient	***0.89***	***0.80***	***0.90***	***0.67***	***0.84***

[a] Kaiser-Meyer-Olkin measure of sampling adequacy = 0.900

The grouping of items into these components fits with conceptual expectations as they are generally in line with major classifications in McMahon and Holmes' (1992) taxonomy of small business financial management practices and expectations relating to the grouping of environmental accounting practices. An exception relates to component 4. This component includes two financial advice items and the computer use item. The former two items were expected to be more closely related to appraisal activities given their longer term planning nature. However, their inclusion with computer use is interpretable as the use of financial management aids or support systems.

In order to represent these dimensions of financial management and to reduce measurement error, averaged scales based on the emboldened items were used in the analysis that follows (Hair et al. 1998). Respondent scores for each component were calculated as the mean of item scores.

Regression Analysis

An index of satisfaction with business performance was developed based on Kotey and Merideth's (1997) instrument. Respondents were first asked to rate the degree of importance they attached to each of eight objectives on a scale of 0 to 10, with anchors being, respectively, 'not at all important' and 'extremely important'. The eight objectives were high volume, high product quality, high profit, low cost of production, conservation of natural resources, business growth, contribution to the community and high quality of lifestyle. Respondents' level of satisfaction with their performance on each of these same eight items was then measured on a 0 to 10 scale with anchors being 'very dissatisfied' and 'very satisfied', respectively. In order to reflect the differing importance attached to the various objectives, the satisfaction score on each item for each respondent was weighted by the importance score. The scales were recoded from 0 – 10 to 1 – 11 prior to undertaking this weighting procedure. Consistent with previous use of this instrument, an index was constructed from these importance-weighted satisfaction scores, computed as the mean of the summed weighted item scores. This index was used as the dependent variable in the regression analysis. Cronbach's alpha for this scale was 0.80.

Previous research has indicated that factors such as farm scale and herd productivity are determinants of farm performance (El-Osta & Johnson 1998; Mishra & Morehart 2001; Jackson-Smith, Trechter & Splett 2004) and so may in turn influence satisfaction with performance. Therefore, two control variables representing these factors were included in the regression: herd size (with logarithmic transformation) and annual milk production per cow (in litres). A third variable, age (in years), was also included in line with Gloy and LaDue (2003) to capture stage of life.

Table IV summarises the results of the ordinary least squares regression analysis. The F-statistic for the regression was significant ($F = 6.608$; $df = 8, 165$; $p < 0.001$). In the table, emboldened variables have significant coefficients at or below the 0.10 level.

Table IV Regression of Satisfaction with Business Performance on the Control and Financial Management Variables

Independent Variable	Unstandardised Coefficient	Standardised Coefficient	*t*-Statistic	Prob. Value
Herd size (log)	-6.627	-0.078	-1.071	0.286
Annual milk per cow	**0.001**	**0.125**	**1.777**	**0.077**
Age	**0.406**	**0.257**	**3.634**	**< 0.001**
Aid use	0.831	0.125	1.569	0.119
Analysis	-0.616	-0.100	-1.050	0.295
Appraisal	**2.419**	**0.345**	**3.560**	**< 0.001**
Budgeting	-0.230	-0.039	-0.429	0.668
Environmental accounting	**1.242**	**0.171**	**2.144**	**0.033**

$R^2 = 0.243$ Adjusted $R^2 = 0.206$
$F(8, 165) = 6.608$, $p < .0001$

The coefficient for herd size was not significant indicating that it had no marginal effect on farmer satisfaction with business performance. This is surprising given the pressures on farmers to increase herd size in order to maintain viability (Davidson 2001). The results here suggest that increasing herd size does not increase farmer satisfaction. The coefficient for annual milk per cow was significant at the 0.10 level

and its sign was positive as expected, indicating that improved herd productivity increases farmer satisfaction with business performance.

The coefficient for age was significant at the 0.05 level and it indicates that, on average, older farmers are more satisfied with their business performance than younger farmers. This could be related to more experience amongst older farmers and also a stage of life with more discretionary income.

Of the five financial management variables, two had significant (at the 0.05 level) coefficients – appraisal and environmental accounting. Both had a positive association with satisfaction, suggesting that the more diligence with which the relevant financial management activities were undertaken, the higher was satisfaction with the dairy farm business's performance. Although the three remaining financial management dimensions – aid use, analysis and budgeting – had significant bivariate correlations with satisfaction (analysis not reported), their coefficients in the regression were not significant, suggesting that there is no marginal influence on satisfaction to be gained from engaging in these activities more diligently. This finding is discussed further in the next section.

It may be noted that all components of financial management were positively correlated with each other, suggesting that those who undertake one set of activities are likely to undertake other sets. Statistics, however, showed no evidence of high collinearity, with the highest variance inflation factor (VIF) being two.

Conclusions and Implications

The results of this study of dairy farms in NSW indicate that greater diligence in some aspects of financial management is associated with greater farmer satisfaction with their business performance. This provides some evidence to support the argument that more comprehensive financial management is beneficial for farmers. The interrelatedness of the dimensions of financial management suggests that those who undertake one set of activities tend to also engage in the others to a similar extent, completing the whole financial management practice package. However, the results

suggest that appraisal and environmental accounting activities may require special emphasis amongst dairy farmers.

The positive association between appraisal and satisfaction is in line with and extends previous findings by Gloy and LaDue (2003, p.173), who found that "the greatest returns to financial management practices appear to be generated in the investment analysis/decision-making area". The reason for the more unique relationship between appraisal and satisfaction may be because actions implemented as a result of appraisal would usually result in major adjustments to current operations (e.g. purchase of new machinery, expanding the dairy) and require substantial financial resources. Inadequate evaluation of the financial implications of these changes may lead to sub-optimal decisions that have substantial negative impacts on business performance and, in turn, satisfaction. Getting these major adjustments right, on the other hand, will result in substantial positive impacts. However, the results should be interpreted with some caution because of the cross-sectional nature of the data. Alternative explanations are possible. For example, it could be argued that better performing businesses (and hence more satisfied farmers) may be in a better position to actually consider major, long-term investments and other changes or additions to operations. Farmers not satisfied with their achievements may not be willing to take a long-term view of their business, perhaps because they are focussed on the short-term, experiencing financial or other stress, or considering leaving the industry altogether. Further research, based on longitudinal data, is needed to investigate these alternative explanations.

Unlike appraisal activities, analysis activities relate to on-going financial performance monitoring through ratio and finance analysis, inter-firm comparisons and the comparison of current results to those in the past. Any actions that are implemented as a result of such monitoring may require only minor adjustments to current operations and so have little marginal impact on performance. A similar argument could be made for budgeting activities.

It is, however, somewhat surprising that aid use was not more clearly related to satisfaction, since it would be expected that professional advisors would also assist in the analysis of major investment decisions. The aid use measure had lower reliability than measures of the other components and therefore measurement error could have

resulted in attenuation in the coefficient. Since the aid use coefficient in the multiple regression was close to significance (being 0.12) further investigation seems warranted. Future research could consider further development and validation of the aid use measure, perhaps extending it by the addition of other potentially relevant items such as employment of internal accounting support staff.

The analysis also suggested that environmental accounting is uniquely related to farmer's satisfaction with performance. Environmental accounting activities involve the evaluation of the financial impacts of natural resource problems (weed infestation, water contamination, erosion, salinity etc) and any actions aimed at alleviating these problems taken as a result of evaluation may provide net economic and environmental benefits over very long time frames. However, there may also be satisfaction in terms of conserving and improving natural resources and contributing to a community that values environmental amenity. Some financial benefits may be also be realised in the shorter term. Evaluation techniques in this area have only begun to gain more widespread consideration in the agricultural sector (Gannon 1996) and their impact on business performance may not yet be fully realised, suggesting research should investigate this class of financial management activities further in the future. The findings of this study for this important emerging area are, however, very encouraging and provide policy makers and farm advisors with some preliminary evidence to help promote farmer uptake of these environmental accounting techniques.

It should be stressed that this study indicates that farmers satisfied with their business performance are engaging more actively in financial management activities but does not directly assert that better financial performance results. This is not a weakness of the study; indeed one of its strengths is that it takes a more holistic view. Other studies outlined earlier have found a direct link between financial performance and certain aspects of financial management. The present study sought to extend those studies by considering a broader range of farmer goals in assessing the potential outcomes of a wider range of financial management practices. Although recognising the essential role of profitability, Fairweather and Keating (1994, p. 197) found in their study of New Zealand farmers' goals that "profitability was a means to an end which was primarily non-economic: being the best, finding a balance, living close to nature". Thus, it is how financial management might help achieve these "softer" ends in the sense of a triple bottom line that this study sought to explore. It did so by using

satisfaction with business performance as an indicator of the quality of that performance. This is similar to the way social scientists measure job satisfaction as an indicator of job quality (Coughenour & Swanson 1988).

With this in mind, it is worth considering what policy makers, farm advisors, financial educators and farmers themselves can do with the results of this study. Firstly, the results suggest that more financial management education for farmers may be beneficial, especially education related to appraising long-term investments and analysing the financial effects of environmental activities. Secondly, some farmers may perceive financial education and practice as more relevant to the vigorous pursuit of financial goals but the results of this study suggest that benefits may also be linked to broader goals such as connection to the land and community. The implications of this are that a wider farmer audience may be encouraged to benefit from financial management education and practice and that financial education programs can be tailored in a way that emphasises broader goals of the farmer. For example, farmers who emphasise environmental goals (Fairweather and Keating's (1994) 'environmentalists') can be encouraged to learn and practice environmental accounting for the satisfaction it will provide in terms of achieving both environmental and financial goals.

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Appendix: Financial Management Items

1. Set specific long-term financial goals that you work towards *(e.g. amount of income in 5 years, level of debt in 10 years, etc)*
2. Work towards specific short-term financial targets
3. Keep up-to-date summary financial records *(e.g. cash book, etc)*
4. Compare current financial results to those in the past and assess the differences?
5. Prepare or update a written cash budget (forecast of cash in and out) for at least 6 months ahead
6. Compare cash budget to *actual* figures and assess differences?
7. Prepare or use a written income statement budget for 6 or more months ahead
8. Prepare or use a written balance sheet budget (forecast of assets, debts, equity) for 6 or more months ahead
9. Forecast your future financial position under a number of "best case" and "worst case" situations of milk prices, climate, interest rates and purchased feed, seed and fertiliser prices.
10. Compare your performance on several key indicators *(e.g. milk per hectare/cow, net cash income, % profit, etc)* with other producers, district averages, etc
11. Review and analyse borrowing and off-farm investment options *(e.g. costs, returns, finance & investment types)*
12. Analyse your results using ratios *(e.g. costs per litre or hectare, profit percentages, etc)*
13. Calculate gross margins (*that is, income from each enterprise less its associated variable costs*)
14. Use a computer for keeping & analysing your records *(e.g. milk production, paddock & financial records, budgets, spreadsheets, etc)*?
15. Get an accountant's advice in advance about the tax implications of your operations or have a plan worked out with an accountant that helps minimise tax
16. Seek financial advice from an accountant or other advisor when considering major farm, investment or borrowing changes

17. When considering long-term major changes *(e.g. buying machinery, expanding dairy, etc)*:
    (a) Estimate all the changes in costs and revenues that may occur on a year-by-year basis
    (b) Estimate these changes in costs and revenues under a number of "worst case/best case" situations
    (c) Work out how long it will take for the investment to pay for itself (*that is, to recoup the money invested*).
18. Estimate & compare all possible changes in costs & income before making decisions about short-term minor changes

(Examples of 'natural resource problems' in the following questions may be weed infested areas, acidity, contaminated water from effluent, erosion from cattle laneways & access to water, salinity, etc.)

19. Monitor total expenditure on controlling or improving each of your natural resource problems *(e.g. total spent on weed control, total on effluent treatment, total on correcting acidity or salinity, etc)*?
20. Calculated or estimated:
    (a) The $ value of reduced production related to your natural resource problems (or the $ value of the increased production that may occur if the problems are corrected)
    (b) The $ benefits of retaining or increasing your native vegetation and wildlife
    (c) The losses in your land value that have occurred or may occur due to natural resource problems (or the future gains in land value from works designed to improve the problems)

Improving labour productivity to facilitate viability on smaller Irish Dairy Farms

Authors

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Keywords: *dairy farm, labour input, multi-functionality*

Abstract

The purpose of this study was to investigate the labour invested on dairy farms and the feasibility of reducing that labour to provide an opportunity to adopt a multi-functional approach, which may assist in maintaining family farm income. Ninety-four dairy farms participated in the study. Farms were categorised according to milk volume produced, as follows: 135 $x10^3$ to 250 $x10^3$ litres (Group 1); >250 $x10^3$ to 320 $x10^3$ litres (Group 2); >320 $x10^3$ to 500 $x10^3$ litres (Group 3) and >500 $x10^3$ to 1,500 $x10^3$ litres (Group 4). Participating farmers recorded the time taken to perform farm tasks, on consecutive 3 or 5-day periods on one occasion per month. The average dairy labour input per day for farms in groups 1, 2, 3 and 4 over the 12-month period was 7.0 h, 7.9 h, 9.6 h and 13.3 h, respectively. A daily time

saving of 3.0 h and 2.2. hours (H) at the milking process and calf care, respectively, was observed on the most efficient compared to the least efficient farms within Group 1. The data indicated the possibility of reducing dairy labour input on these farms to 3.8 h per day or by 65%, which should facilitate multi-functionality.

Introduction

The contribution of agriculture to national wealth and viability of rural areas in Ireland is significant. However, it is clear that the sector is in a state of flux. The sector is undergoing structural change with declining farm numbers and labour resources on farms (Frawley & Phelan, 2002). The recent EU agricultural policy reforms are anticipated to result in a reduction in product prices paid to dairy farmers. This will mean an inevitable increase in scale in order to maintain future competitiveness. Hennessey *et al.* (2000) indicated that an expansion of production, of between 60 and 140% is required if Irish farmers are to maintain their incomes. However, these researchers also showed that labour represented the binding constraint to expansion on 40% of Irish farms. Thus, expansion may not be a feasible or desired option of many dairy producers. Alternatively, the increasing pressure on farm incomes means that the continued existence of many such family farms cannot be maintained from farming alone. Phelan (2005) observed that the contribution of farm income to household income decreased from 70% to 41% between 1973 and 1999/2000 in the Republic of Ireland. Aggregate farm income levels declined in real terms by 14 points between 2000 and 2003 (Department of Agriculture and Food, 2004).

Thus, alternative income sources will be required to retain farm families on an increasing number of potentially non-viable farms. The adoption of off-farm work by farm households

is an important, well-recognised and growing phenomenon in the EU (Kinsella *et al*. 2000). The proportion of farm operators involved in off-farm employment increased from 26% in 1995 to 32% in 2000. However, 69% of these farmers who had off-farm income were engaged in a dry cattle enterprise. But the current inflexibility of dairy systems in terms of labour requirement means that operators within this sector cannot easily engage in off-farm employment. Thus, labour productivity must be addressed for the future, if a substantial number of dairy farm households, especially those on smaller dairy farms, is to be maintained.

Other Irish studies have highlighted the continuing concerns of the dairy industry with the issue of on-farm labour. O'Shea *et al.* (1988), who assessed labour use over a one-year period, on 37 farms in Ireland, found that labour-use varied according to layout, herd size and general organisation of the farm. Gross profit margins did not correlate with labour input per cow. Ruane & Phelan (2001) suggested that dairy and calf facilities required considerable improvement in order to reduce labour input to those tasks on Irish dairy farms. But the issue of labour efficiency at farm level is not unique to the Irish dairy industry. Research studies from other countries have measured labour costs as a proportion of total costs. Carley (1979) indicated that increasing production per cow by 100% reduced labour inputs per 45 kg of milk by 50% for all herd-sizes. Robes and Angaricia (1991) showed that labour costs on Cuban dairy farms accounted for 20% of the total costs of milk production while, Cleary and McKerrow (1996) showed that labour accounted for 21% of total costs on farms in the Western District of Victoria in 1984. Holt (1989) assessed labour use on 61 dairy farms in England (average herd size was 118 cows) and indicated a labour input of 8,253 h/annum, which was equivalent to 1 labour unit to 38 cows. Turner & Fogarty (1995) also completed a

labour study which showed considerable differences in labour required on different sized English dairy farms.

Since increased labour productivity is expected to become a prime factor influencing farm household income by accommodating either expansion or multi-funtionality, there is currently a need to establish the patterns of labour input on-farm and how this is influenced by facilities, layout and work procedures. The purpose of this study was to quantify the labour requirements of dairy farming and to examine strategies for more efficient labour use, particularly on potentially non-viable farms. This should have application in providing a time opportunity for alternative labour-use on such farms.

Methodology and data sources

The study was conducted with dairy farmers mainly in the Munster region of Ireland, since this area accounted for 65% of the total manufacturing milk supply in the country. Individual letters were sent to 360 farmers outlining the purpose of the study and inviting their co-operation. Of these, 143 farmers opted to participate in the study. Proportionally 0.80, 0.18, and 0.02 of these farms had spring (February/March), mixed (spring and autumn) and autumn (October/November) calving herds, respectively. The farms ranged in herd-size from 26 to 300 cows and in milk quota size from 139 $x10^3$ to 1,409 $x10^3$ litres. Farms were classified as one of four categories based on milk volume produced.

The categories were considered representative of different farm groupings in Ireland; group 1 = 135 $x10^3$ to 250 $x10^3$ litres, group 2 = >250 $x10^3$ to 320 $x10^3$ litres, group 3 = >320 $x10^3$ to 500 $x10^3$ litres, and group 4 = >500 $x10^3$ to 1,500 $x10^3$ litres. Proportionally 0.32, 0.28, 0.21 and 0.19 of the farms fell within quota groups 1, 2, 3 and 4, respectively. Farms in milk

groups 1, 2, 3 and 4 had an average milk production of 212 $x10^3$, 281 $x10^3$, 388 $x10^3$ and 764 $x10^3$ litres, respectively. These farms had an average herd size of 47, 55, 74 and 149 cows, respectively, of which almost all were Friesian breed.

The category of milk quota size 135 $x10^3$ to 250 $x10^3$ litres and average herd size 47 cows (Group 1 farms) was selected for detailed analysis of labour input. In both 1992 and 2002 studies of competitiveness in Irish agriculture (Boyle, 2002) found that scale economies existed in herds of 50 to 60 cows. However, 'small farms' below this scale were considered as disadvantaged because they had insufficient scale to adequately remunerate the owned labour input. Thus, Group 1 farms which may require additional income from other enterprises were critically examined for potential time availability for such enterprises.

Data collection

Data was collected over a 12-month period between February, 2000 and January 2001. All farm operators (farmers and/or farm staff) recorded the duration of each task they performed (including contractor time) throughout the day. Two data recording methods were used. The main method involved a timesheet designed to record the total time consumed by 29 different farm tasks for each of 3 consecutive days. The second method involved a Psion organiser, i.e. a hand-held, electronic data logger that incorporated the Observer behavioural package (Noldus Information Technology). On the farms using the Psion, each individual worker recorded data for 5 consecutive days. Sixty-five and twenty-nine farms used data recording methods 1 and 2, respectively. The 29 farm tasks were incorporated within 10 task categories for analytical purposes. This study focused specifically on two task categories, i.e. milking and calf care. 'Milking' included herding cows for milking, milking (clusters on / clusters off), washing up and herding cows after milking. 'Calf care' described the tasks

associated with feeding, cleaning and bedding of calves. 'One-off' questionnaires were also completed for each farm. The questionnaires provided information on facilities and layout and farm practices relating to the milking process, calf care, feeding and cleaning associated with winter housing and waste management on the farm.

Data analysis

Data from ninety-four spring-calving dairy farms for whom a complete dataset was obtained was processed using the Microsoft Access database management system and analysed using the SAS statistical package (SAS, 1999). Analysis of variance across months was carried out using the Mixed procedure, which is a generalisation of the standard linear model used in the GLM procedure. In the analysis carried out, the farm was considered to be the experimental unit from which repeated measures were taken on a monthly basis.

Results

The average dairy labour input per day for farms in milk producing groups 1, 2, 3 and 4 over the 12-month period was 7.0 h, 7.9 h, 9.6 h and 13.3 h, respectively (Table 1). Dairy labour input per day increased with increasing milk producing group ($p<0.001$). This equated to 46, 45, 40 and 28 h/cow/year, assuming 5 full and two half working days (week-end) per week.

Table 1. Dairy labour input per day (h) required by dairy tasks carried out on farms of four milk producing groups

	Milk producing group					
Av. milk produced (litres)	1 212 x10^3	2 281 x10^3	3 388 x10^3	4 764 x10^3	s.e.m.	Significance
Total dairy labour (h) per day	7.0^a	7.9^b	9.6^c	13.3^d	0.50	***

^{abcd} means on the same line without a common superscript are significantly different

*** = P<0.001

Average labour input on milk producing group 1 farms (average 212 x10^3 litres)

It was assumed that volume of milk produced on dairy farms influences the threat to viability on such farms. Labour input on farms within the smallest milk producing group (Group 1 farms) was examined, specifically, to quantify potential available time for involvement in other enterprises, in order to increase total family farm income. The average labour input per day for Group 1 farms over a 12-month period is shown in Figure 1. Total labour input on these farms peaked at 9.6 h in June and gradually declined to 5.4 h in December. (This data represents net labour input per day, excluding mealtimes, etc). When time associated with enterprises other than dairying was excluded, the average labour input per day associated with dairying decreased to 9.0 h in June and to 4.4 h in December.

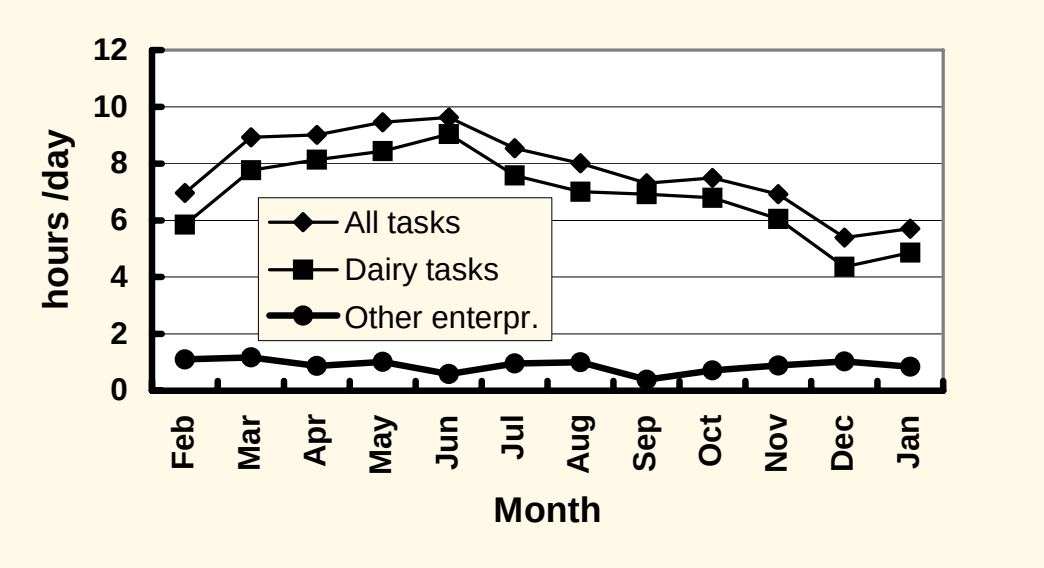

Figure 1: Average daily labour input associated with all tasks, dairy tasks and other enterprises on Group 1 farms (average 212 x10^3 litres)

Dairy labour input associated with specific tasks

Proportionally 0.36, 0.16, 0.12, 0.10, 0.06, 0.11, 0.05, 0.03 and 0.01 of dairy labour time was associated with the task categories of milking process, maintenance (land and buildings), office, grassland management, calving and calf care, feeding and checking dairy animals, cleaning, fertility and miscellaneous over a 12-month period, respectively, on Group 1 farms (average 212 x10^3 litres) (Figure 2).

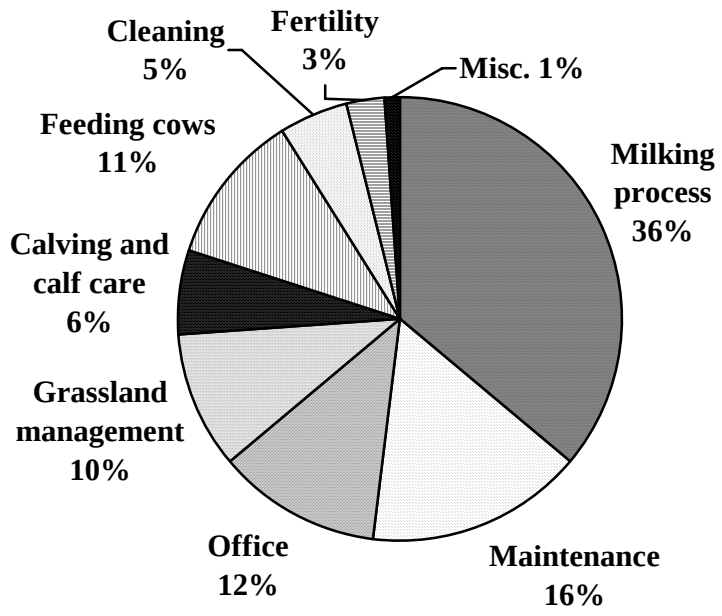

Figure 2: Breakdown of total labour input over the 12-month period on Group 1 farms (average 212 x10^3 litres)

Benchmarking of farms on labour input to different tasks

The dairy task requiring the greatest proportion of labour input was the milking process. The average daily labour input for the milking process over a 12-month period, for the 30 farms was plotted in order to establish the month in which labour input was at a maximum. Labour input was highest for the milking process in May. The task of calving and calf care had a labour demand peak in March. Although calving and calf care accounted for just 6% of dairy labour input over the 12-month period, calf care alone accounted for 13% of dairy labour input in March. The variation in labour input levels in the months of peak labour demand for the tasks of milking and calf care was observed, and potential factors, such as, facilities and practices were compared in order to establish reasons for differences between farms. It was

considered that variation between farms within the same quota category (Group 1 farms) would be best observed by comparing the 20% of farms at both ends of the labour input range. The average daily labour input in the milking process (May) and calf care (March) for the 20% of herds with the least labour input and the 20% with the most labour input, together with quota size and cow/calf number for the respective groups are shown in Table 2. (The least and most efficient herd groupings may consist of different herds for the different tasks.)

Table 2: Average daily labour input of least labour input (20%) and most labour input (20%) herds (within Group 1 farms) (SD) for the milking process (May) and calf care (March), milk quota per year and cow/calf number for the respective groups

	Least labour input 20% of herds	Most labour input 20% of herds
Milking process (May)		
Dairy labour input/day (h)	2.2 (0.35)	5.2 (0.79)
Milk produced ($x10^3$ litres)	207 (43.6)	222 (23.3)
Average cow number	40 (8.9)	56 (6.4)
Calf care (March)		
Dairy labour input/day (h)	0.6 (0.19)	2.8 (0.54)
Milk produced ($x10^3$ litres)	209 (30.7)	209 (38.4)
Average calf number	26 (6.2)	30 (3.6

The milking process

Considerable variation in labour input per day for the milking process during the month of May was observed across Group 1 farms. The 20% of herds with the least labour input (average milk produced = 207 $x10^3$ litres, average cow no. = 40) had an average daily labour input to the milking process of 2.2 h in May. The 20% of herds with the most labour input (average milk produced = 222 $x10^3$ litres, average cow no. = 56) had an average daily labour input to the milking process of 5.2 h during May (Table 2). In terms of labour efficiency, the most and least efficient groups had labour input levels of 0.06 and 0.09 h/cow/d, respectively. In examining the facilities and practices associated with the milking process on the individual farms within the most and least efficient groups, there were a number of factors which could potentially account for the major differences in efficiency. The average number of cows milked per milking unit was 5 and 8 in the most and least efficient herds, respectively. The most efficient herds had pipeline systems with one operator in the pit. Two of the least efficient parlours had recorder plants and had two operators in the pit during milking, thus, doubling the time associated with milking. There was a greater degree of teat preparation carried out in the least efficient herds. A higher proportion of efficient herds had exit gates operated from any point in the pit. The majority of the most efficient farms had the grazing area in one block, i.e. not fragmented, while many farms in the least efficient group had to transfer cows across a public road on a daily basis. The cows in all of the most efficient farms could go to the paddock directly after milking, while in the least efficient group on the majority of farms, cows were retained in the yard until they were subsequently accompanied to the paddock by the drover. There were more instances of mechanized cleaning of yards within the most efficient group, e.g. tractor, pump, slats. The majority of farms in the least

efficient group used some degree of hand cleaning which was generally done on a twice daily basis.

Calving and calf care

Considerable variation in labour input per day for calf care during March was observed on farms in Group 1. The 20% of herds with the least labour input at calf care (average milk produced = 209 $x10^3$ litres, average calf no. = 26) had an average daily labour input for calf care of 0.6 h in March. The 20% of herds with the most labour input (average milk produced = 209 $x10^3$ litres, average calf no. = 30) had an average daily labour input for calf care of 2.8 h in March (Table 2). In terms of labour efficiency, the most and least efficient groups had labour input levels of 0.02 and 0.09 h/calf/d, respectively. In examining the facilities and practices associated with calf care on the individual farms within the most and least efficient groups, there were a number of factors which could potentially account for the major differences in efficiency. The majority of farms in the most efficient group transferred milk to the calf house by a trolley type mechanism, whereas, bucket transfer was used on all of the inefficient farms. A minority and majority of farms fed calves individually by bucket on the most and least efficient farms, respectively. The majority of efficient farms cleaned calving houses mechanically and infrequently, while a majority of inefficient farms cleaned calf houses manually using a fork.

Many other factors influencing labour input to the remaining tasks of cow feeding, grassland management, office etc. were also identified. Further studies investigating practices to improve feasibility of multi-functionality, such as once daily milking and once daily calf feeding are ongoing.

Theoretical dairy labour input

The average for the 20% of farmers having the highest and lowest dairy labour input per day (in group 1), for each month of the year was calculated. (Any one farmer may not have been in the lowest labour input group for all months or for all tasks within a month.) The theoretical profile of dairy labour input over a 12-month period, incorporating the 20% of farmers with the lowest labour input and the 20% with the most labour input (in each month) is shown in Figure 3. The average dairy labour input per day over 12 months for the 20% of farms with lowest dairy labour input per day and for the 20% of farms with highest dairy labour input per day was 3.8 h and 10.8 h, respectively. Taking 6 full working days per week, the average dairy labour input for these two scenarios would be 22.8 h and 64.8 h per week or 1,186 h and 3,370 h per year, respectively. Thus, there is potential to reduce labour input by approximately 65%.

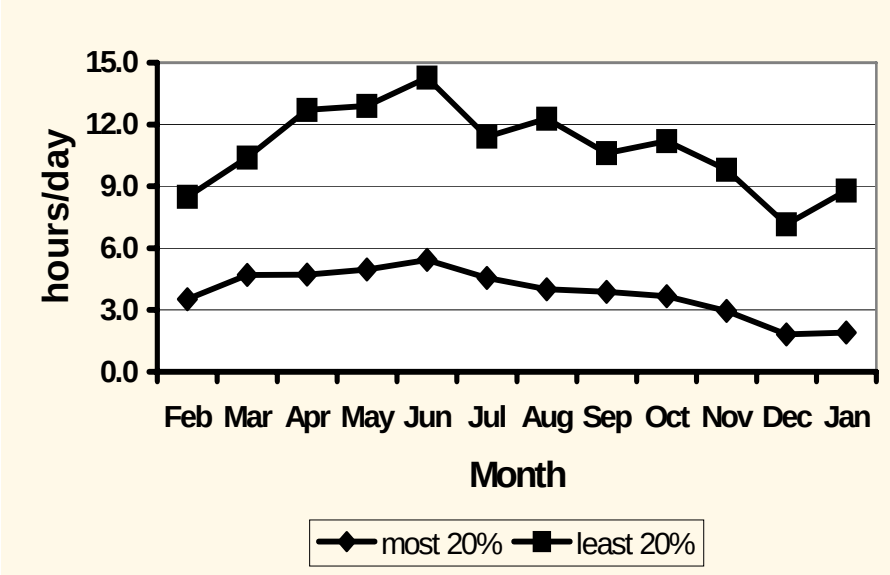

Figure 3: Simulated dairy labour input over 12 months on Group 1 farms – average dairy labour input of 20% highest and 20% lowest dairy labour input farms in each month

Discussion

The increase in labour demand with increasing milk production, found in this study, was consistent with Adamczuk (1978), who also showed greater hours worked with increased farm size. Turner & Fogarty (1995) also found that an increase in the scale of the farm business on English dairy farms resulted in greater labour demand and annual hours worked per individual, and therefore longer working days for the individual worker. Milking emerged as the most time consuming task in this study, accounting for over one-third (0.36) of total dairy labour input. This was somewhat higher than the results of Jagtenberg (1999), who recorded that 0.29 of total labour was required by milking. Ordolff (1986) and Sonck

(1993) both observed a proportion of 0.30 of labour input required by milking on dairy farms in The Netherlands. The higher value in this study may be due to poorer milking facilities. Seasonality of production had a large impact on labour requirements. The springtime labour peak observed in this study has confirmed a previous perception of Irish dairy farmers.

Dairy labour input per day for the Group 1 farms investigated ($135x10^3$ to $250x10^3$ l) was 7.0 h. However, a time saving of 3.0 h and 2.2. h per day at the milking process and calf care, respectively, was observed on the most efficient farms compared to the least efficient farms. The data also indicated the possibility of reducing dairy labour input on these farms to 3.8 h per day, a 65% lowering of current labour inputs on inefficient farms. This is a significant finding for the 'broadened agriculture' concept, as described by Mannion *et al*. (2001), whereby farm households expand the range of goods and services from which they make their living.

The results from this study showing that many farms producing up to 250 $x10^3$ litres require at least one full-time operator are in contrast to New Zealand dairy systems where typically 150 cows can be managed by one labour unit (New Zealand Dairy Board, 1996). This increased labour efficiency on a per cow basis observed in New Zealand, may be due to an economy of scale, where a large number of animals are treated as a group. Reduced labour requirement due to economy of scale is mainly achieved with tasks, such as, milking, grassland, cleaning and cow care (mainly feeding). However, an economy of scale is probably less relevant to tasks such as calf care which require individual animal attention. The reduced labour demand per cow on New Zealand farms may also be due to better facilities and layout, in relation to tasks, such as, milking and grassland. Additionally, the use of overtime, or casual labour, increased mechanization, changing the calving date and use

of reserves of family labour are all key issues in reducing labour requirements on farms. The use of farm contractors for tasks such as maintenance, calf rearing and winter-feeding of dry cows would further reduce the time commitment on dairy farms. Thus, well designed infrastructure and well managed practices employed on farms should facilitate labour efficiency and the possibility of engagement in other farm enterprises or activities, or in off-farm employment. This issue is of increasing importance since farm income has largely been replaced by employment income (Phelan, 2005) resulting in farm and non-farm earning activities competing for time.

Conclusion

It is important that the foregoing knowledge is in the public arena since it indicates that new technologies and good management skill of the operator have the potential to reduce labour input to dairying. In the foreseeable future, low income dairy farmers will need to examine off-farm employment opportunities or to commence new or alternative enterprises or businesses on farms to supplement farm income and maintain or improve farm household incomes. In order to accommodate any available opportunities, the dairy labour input on the farm must be efficiently used or minimized but without adversely impacting on the productivity or profitability of the dairy enterprise. Thus, labour efficiency must be optimized. In this scenario, the number of hours required both for satisfactory farm operation and for any alternative activity must be established. The foregoing data indicates the minimum time required for farm operations, and mechanisms by which this can be achieved on dairy farms.

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Identifying Profitable Urban Markets for Vegetables from Rural Areas: A study in the Northern Part of Bangladesh

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Abstract

This study identifies profitable markets through analyzing net margins/incomes received by farmers in a study in the northern part of Bangladesh. It shows that markets used by farmers depended upon scale of operation. Landless and small farmers were mostly confined to the primary markets and to a limited extent, the secondary markets but medium and large farmers used secondary and also terminal markets and their net margins were higher than those of the landless and small farmers. Net margins/incomes increased for all farmers compared to the past through using profitable markets. The construction of the Jamuna Bridge helped farmers and traders to interlink trading activities up to the capital city and increased the number of buyers in the primary and secondary markets. Marketing flow increased from rural to urban markets, raising farmers' incomes and contributing to farm development in the rural areas.

Keywords: marketing, new channels, net margins, Bangladesh

I Introduction

Identification of profitable markets by farmers is of great importance in realising high product prices. The northern part of Bangladesh has abundant crop resources including rice, maize, fruits, vegetables, etc. but in the past, lack of good marketing networks including transportation from rural to urban markets were major barriers to getting good product prices. Farmers and traders faced difficulties transporting products from this part to the eastern part or terminal market of the capital city Dhaka. The Jamuna River was the principal barrier in transportation to Dhaka or other distant markets. The farmers/traders used to spend 8/9 hours or even one or more days waiting on the eastern bank (Nagarbari) of the Jamuna River with loaded trucks, which caused vegetables to rot and affected prices. Usually, farmers sold their products in the nearest markets at lower prices. But after construction of the 4.8 km braided Jamuna Bridge in 1998, farmers could sell produce in the local and distant markets. There was also a greater number of middlemen and traders from outside areas, resulting in an increasing demand for produce. As a result, the northern agriculture has become a part of a wider market. Changes in the marketing network with increasing product prices altered farmers` economic situations and vegetables now form a major share of their income. Farmers` incomes are as varied as their land resources. For this study farmers were classified as follows: landless (0-0.49 acres), small (0.50-2.49 acres), medium (2.50-7.49 acres) and large (7.50 acres and above). Generally, landless and small farmers

have fewer resources than medium and large farmers.

Studies had been conducted on profitable markets and related issues in the study areas. Adhikary et. al (2001) undertook a study on production of various crops, gross margins, identifying transported goods, etc. in the whole northern part from a selected sample of farmers. The study showed increased farmer's margins, calculated by the differences between retail and farm gate prices. In that study, village based marketing networks, transportation costs, identification of profitable markets through net margins or net incomes received by farmers had not been considered. Therefore, this study attempts to identify the profitable markets through analysing net margins and net incomes received by farmers from case studies on vegetables covering different marketing arrangements.

II Methodology

The study was conducted in the Bogra District in the northern part of Bangladesh covering four villages under Amrool Union—Demazani, Poranbari, Jhalopara, and Kundoish. The study area is 16 km from Bogra District headquarters, 8 km from a business center Sherpur Upazila; 90 km from the Jamuna Bridge, and 215 km from the capital city Dhaka. The data were collected in August-September 2003 and compared to data for 1998. A total of 79 farmers, comprising 10 landless, 38 small, 24 medium and 7 large farmers, were interviewed in four selected villages using structured questionnaires. Several case studies were also conducted with farmers. Here, one case study on cultivation and marketing of potato has been analysed for different farmers comparing the years 2003 and 1998. The other study was on cucumbers in 2003. Each case study covers four farmers taking one each from landless (LL), small (SF), medium (MF) and large (LF) farmers highlighting production, marketing, net margins, income, etc. Besides, focus and open discussion were followed among the farmers/traders.

III Findings and Discussion

During the period from 1998 to 2003 a remarkable change in the northern part of Bangladesh was the construction of the Jamuna Bridge, which influenced the marketing of vegetables in terms of markets, buyers, selling quantities, means of transports and costs, net margins and net incomes, etc. These have been analysed below. Findings have been reported in three areas —the first on marketing of main vegetables by all the farmers, the second and third on production and marketing of potatoes and cucumbers respectively.

Part 1

(1) Marketing of Vegetables

1.1 Marketing Network for Vegetables

1.1.1 Markets and Selling of Vegetables by Different Farmers

In Bangladesh, a group of villages constitute a Union and Unions form an Upazila or District. Generally, markets surround or are near to these units and can be classified into three types—Primary, Secondary and Terminal. **Primary markets** are the principal centres for exchanging crops in the rural areas. They include Demazani and Noimail markets under Union level, usually held twice a week. The study villages surround Demazani within distances of 0.5—1 km. Noimail is a major roadside market, situated on both sides of the Dhaka-Bogra highway, where farmers and traders gather from surrounding Unions, Upazilas and other Distant markets. Demazani is 2.5 km from Noimail. **Secondary Markets** serve as wholesale outlets and also operate as assembly centers, and are a distribution mechanism from rural to urban centres. They includes Sherpur and Foteh Ali markets under Sherpur Upazila and Bogra District respectively. A **Terminal Market** is the major contact point between rural and

urban markets and includes the market Kawran Bazaar of the capital city Dhaka. Here, products are assembled from inside or outside of Dhaka, which are subsequently distributed to various retail markets. Figure 1 shows the markets Noimail, Sherpur and Kawran Bazaar that lie in one direction with Kawran Bazaar reached by crossing the Jamuna River; District market Foteh Ali is in the opposite direction.

Figure 1 Routes of the Markets from the Villages

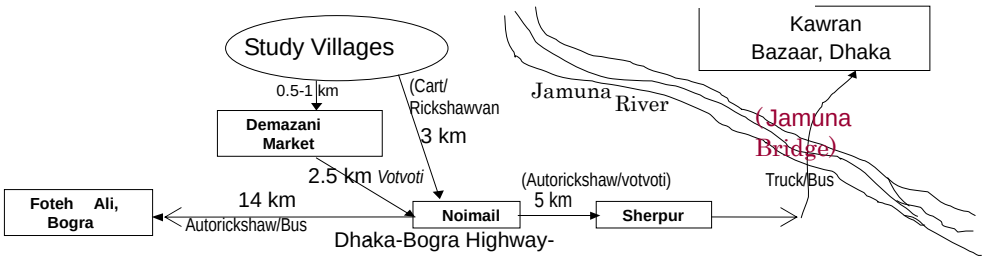


Table 1 shows the selling weights and vegetables prices for different markets. Sale volumes in Noimail, Foteh Ali and Kawran Bazaar were higher in 2003 than in 1998. They increased from a total of 48.02 to 141.78 metric tons (mt), from 3.90 to 33.20 mt and from 1.83 to 39.01 mt respectively. Volume increased 2.95, 8.51 and 21.32 times respectively compared to 1998 because of greater demands due to increasing number of buyers, easier access from nearer and distant markets and improved communication. Especially, Foteh Ali and Kawran Bazaar became more important from daily demand by Bogra town and capital city residents and the opportunities in Kawran Bazaar after the construction of the Jamuna Bridge. The opposite was observed in Sherpur market where volume fell from 66.96 to 40.58 mt. In the case of selling prices, average price was the highest (Tk 10.83/kg) in Kawran Bazaar. In 2003, price differential increased more (from Tk 5.24 to 6.32/kg) in Noimail than in Sherpur market (from Tk 6.12 to 6.88/kg) and the share of the total prices was the highest in Noimail (43.8%), followed by Kawran Bazaar (20.7%), Sherpur (14%), Foteh Ali (12.9%) and Demazani (8.7%), but it was reduced from 51.8% to 14% in Sherpur. So, here Noimail was mostly operated by the farmers and Kawran Bazaar and Foteh Ali also got especial importance to farmers.

Table I Distribution of selling weights and prices of vegetables by different markets and farmers

	Farmers	Demazani				Noimail				Sherpur				Foteh Ali				Kawran Bazaar				Total	
		Wt (mt)	Price (Tk)	%	Avg Prc	Wt (mt)	Price (Tk)	%	Avg Prc	Wt (mt)	Price (Tk)	%	Avg Prc	Wt (mt)	Price (Tk)	%	Avg Prc	Wt (mt)	Price (Tk)	%	Avg Prc	Wt (mt)	Price (Tk)
The Year 1998	LL	1.72	7809	26.3	4.54	2.58	13210	44.5	5.12	1.43	8652	29.2	6.05	-	-	-	-	-	-	-	-	5.73	29670
	SF	8.22	38141	17	4.64	16.44	85159	38	5.18	15.64	95404	42.6	6.1	0.8	5120	2.3	6.4	-	-	-	-	41.1	223824
	MF	7.51	33945	10.2	4.52	18.75	99750	30	5.32	29.03	177664	53.3	6.12	1.5	9750	2.9	6.5	1.83	11913	3.6	6.51	58.62	333022
	LF	2.65	12084	5.9	4.56	10.25	53505	26.2	5.22	20.86	128289	62.8	6.15	1.6	10560	5.2	6.6	-	-	0	-	35.36	204438
	Total	20.1	91979	11.6	4.58	48.02	251624	31.8	5.24	66.96	410008	51.8	6.12	3.9	25430	3.2	6.52	1.83	11913	1.5	6.51	140.81	790954
The Year 2003	LL	2.1	11760	16.4	5.6	7.34	45508	63.6	6.2	2.07	14233	19.9	6.87	-	-	-	-	-	-	-	-	11.51	71501
	SF	17.7	97958	16.1	5.55	56.85	355313	58.3	6.25	11.62	79713	13.1	6.86	6.5	51025	8.4	7.85	2.4	25392	4.2	10.58	95.02	609400
	MF	8.5	47770	6.5	5.62	42.09	269376	36.4	6.4	14.8	102120	13.8	6.9	15.9	125610	17	7.9	18.2	194740	26.3	10.7	99.49	739616
	LF	3.67	20479	3.3	5.58	35.5	225425	36.1	6.35	13.09	90059	14.4	6.88	10.8	86400	13.8	8	18.41	202510	32.4	11	81.47	624873
	Total	31.9	177966	8.7	5.58	141.8	895622	43.8	6.32	41.58	286126	14	6.88	33.2	263035	12.9	7.92	39.01	422642	20.7	10.83	287.49	2045390

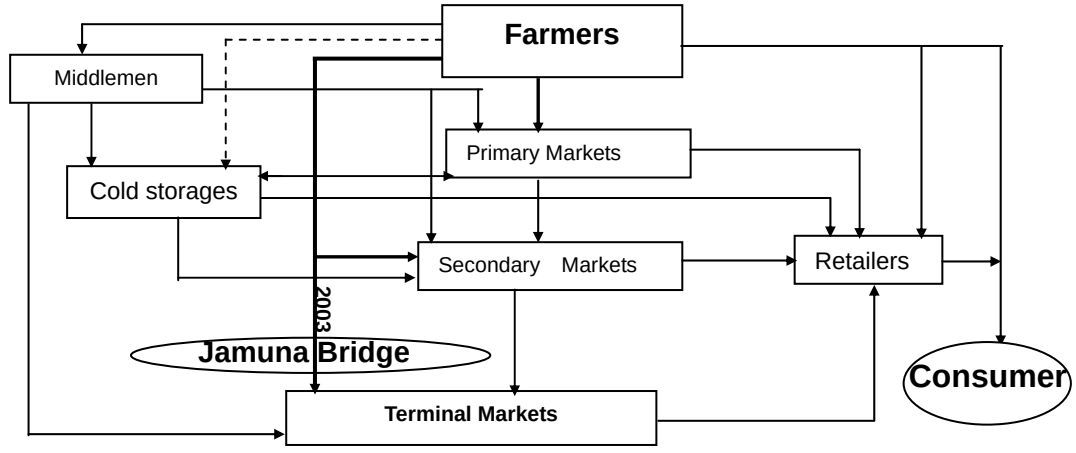
Note: calculated only main vegetables, Multiple selling in the markets and Price in Tk= Bangladesh Currency (Taka), mt=Metric ton, % calculated on total prices as farmers (Row wise). LL-Landless, SF-Small Farmers, MF-Medium Farmers and LF-Large Framers. Source: Field Survey 2003.

1.1.2 Marketing Channels for Vegetables

Table I shows that farmers sold a large quantity of vegetables (287.49 mt) in 2003. This paper mainly focuses on marketing channels for vegetables. Figure 2 denotes different channels observed in this regard. Table I shows that marketing flows were increasing remarkably in Noimail (primary), Foteh Ali (secondary) and Kawran Bazaar (terminal). New channels in 2003 were: (i)

Farmers—wholesalers (terminal)—retailers—consumers, followed by farmers directly, (ii) Farmers—middlemen/traders/wholesalers (primary/secondary)— wholesalers (terminal) —retailers—consumers, followed by local and outside buyers. It was found that outside buyers came from the terminal and other distant markets to purchase produce directly in the primary/secondary markets or from the farmers, for sale at Kawran Bazaar. Local buyers also followed the same path. Now vegetables can be transported easily to Dhaka city in only four hours without wasting time and farmers/traders take this opportunity to enhance trading activities. Previously, it was a rare case. The Jamuna Bridge played an important role in creating new channels for marketing of vegetables from the study area, and of course, it had increased farmers` interest in vegetable production.

Figure 2 Marketing Channels for Vegetables



Note: ----------→ represents weak and ⟶ strong linkages. Source: Field Survey, 2003.

1.1.3 The Transport Modes for Vegetables

All the roads from villages to Demazani market are muddy/lateral, so transport in the rainy season is difficult. Generally, bullock cart and rickshaw van are used and sometimes *votvoti* (locally made engine driven van) in the dry season. The road between the Demazani and the Noimail market is partially covered by bricks and asphalt. *Votvoti* is employed from Demazani to Sherpur and generally autorickshaw/bus connect Noimail and Foteh Ali. Bus/truck run from Noimail to the terminal market Kawran Bazaar. All farmers except the landless used cart, rickshawvan, autorickshaw, *votvoti*, bus/truck for transport of vegetables to the markets. Landless farmers used family labour for transport to near markets.

The study found that transport modes had been gradually changing from manual to engine driven in 2003 connecting Union with Upazila, District and distant markets.

(2) Transport Costs from the Study Area to Local and Outside Markets

2.1 Local Transport Costs

Table II shows transport modes and their corresponding costs in 1998 and 2003. It indicates unit carrying costs were incremental with the increasing distance to the markets. Engine driven transport (*votvoti*, autorickshaw, bus) were cost effective and less time consuming in communicating primary and secondary markets than the traditional rickshaw van, cart or hired labour.

2.2 Transport Costs from the Study Area to the Terminal Market

Nine (11%) farmers sold vegetables directly to Kawran Bazaar, Dhaka in 2003. Generally, one truck carries 3,000 kg vegetables from Noimail. Total cost per truck was Tk 6,900, which includes Tk 3,000 for rent, Tk 1,500 for unauthorized subscription (toll) taken by musclemen/others in the streets/markets, Tk 750 for toll at the bridge gate, Tk 1,350 for truck loading-unloading and Tk

300 for packaging and others, a total cost of Tk 2.30/kg. In 1998, the costs of rent, subscription, ferry fare, loading-unloading and others were Tk 3,500, Tk 2,100, Tk 1,100, Tk 1,200 and Tk 330 respectively, orTk 2.74/kg, higher than the cost of Tk 2.30/kg in 2003. The cost was lower in 2003 because of a smaller toll rate at the Jamuna Bridge and reduced unauthorized subscription. It was compulsory to pay the subscription to the musclemen on both banks of the Jamuna River (Aricha and Nagarbari).

Table II Transportation costs (Tk/Kg) by different markets and different transports (Cost In Tk/kg)

Farmers	The Year 1998					The Year 2003				
	Demazani	Noimail	Sherpur	Foteh Ali	Kawran Bazaar	Demazani	Noimail	Sherpur	Foteh Ali	Kawran Bazaar
Hired labour	0.18	0.24				0.2	0.28			
Cart	0.12	0.14				0.14	0.16			
Rickshaw van	0.14	0.16				0.16	0.18			
Votvoti	0.2					0.22				
Auto Rickshaw		0.28					0.3			
Bus		0.3					0.35			
Truck		2.74					2.3			

Note: Costs are calculated as (1) Village to Sherpur: at first upto Demazani by cart/rickshawvan and then by votvoti to Sherpur, (2) Village to Foteh Ali: upto Noimail by cart/rickshawvan then by autorickshaw/Bus to Foteh Ali, (3) Village to Kawran Bazaar: Upto Noimal by cart/rickshawvan then by truck to Foteh Ali, Source: Field Survey 2003

(3) Selling Vegetables

The changes in land use and selling of vegetables are briefly discussed here. It was found that the acreage under double or triple crops had increased substantially in 2003. The cropping intensity rose from 179% to 223%, which was higher than the national average of 174% (BBS, 2001). The area in vegetables had increased from 31.32 to 94.37 acres. Land previously left as fallow or cultivated only on a limited scale, had been used more intensively and the cultivation of high value crops (tomato, eggplant, cucumbers, banana, papaya, etc.) had been expanded under different tenancy arrangements. Table III shows the quantity of main vegetables doubled from 140.83 to 287.48 mt between 1998 and 2003. A number of new vegetables were found to be grown and sold by the farmers. Farmers increased production of cabbage, red amaranth, Indian spinach, radish, tomato, yard long bean, watermelon etc., including cereals like maize; fruits like papaya, guava, banana and various spices. These changes occurred because of higher demand in the near and distant markets as well as quick transport over the Jamuna Bridge and better communication within the Districts.

Table III Changes in Selling Quantities of Vegetables by different farmers

Crops	LL			SF			MF			LF			Total		
	1998 (mt)	2003 (mt)	Change (%)	1998 (mt)	2003 (mt)	Change (%)	1998 (mt)	2003 (mt)	Change (%)	1998 (mt)	2003 (mt)	Change (%)	1998 (mt)	2003 (mt)	Change (%)
Potato	2.26	2.8	23.9	10.8	21.52	99.3	15.62	18.88	20.9	11.5	23.99	108.6	40.18	67.19	67.2
Red Amaranth	0.04	0.09	125	0.13	0.88	576.9	0.21	0.23	9.5	0.13	0.55	323.1	0.51	1.75	243.1
Pumpkin	0.12	0.35	191.7	5.79	13.92	140.4	8	10.81	35.1	2.08	3.83	84.2	16	28.92	80.8
Country Bean	1.06	1.43	34.9	3.84	4.63	20.6	2.36	2.89	22.5	0.96	1.82	89.6	8.22	10.77	30
Bitter gourd	0.23	0.31	34.8	2.3	3.28	42.6	6.05	8.99	48.6	2.39	7.29	205	10.96	19.87	81.3
Radish	0.29	0.38	31	1.11	3.46	211.7	1.28	2.69	110.2	0.36	1.86	416.7	3.04	8.38	175.7
Tomato	0.15	0.32	113.3	0.93	4.9	426.9	0.74	4.46	502.7	0.5	4.15	730	2.32	13.83	496.1
Cucumber	0.74	2.56	245.9	7.54	21.38	183.6	8.4	21.51	156.1	8.18	20.38	149.1	24.86	65.83	164.8
Eggplant	0.26	0.68	161.5	2.94	7.84	166.8	3.81	7.65	100.8	3.62	5.41	49.5	10.62	21.58	103.2
Pointed gourd	0.07	0.15	114.3	2.19	5.62	156.6	4.49	7.6	69.3	0.73	2.57	250.1	7.49	15.93	112.7
Taro	0.51	2.44	378.4	2.25	3.85	71.1	1.97	2.31	17.3	2.03	2.78	37	6.76	11.39	68.5
Watermelon	-	-	-	1.29	3.74	189.9	5.69	11.48	101.8	2.89	6.83	136.3	9.87	22.05	123.4
Total	5.74	11.51	100.5	41.1	95.02	131.2	58.62	99.49	69.7	35.36	81.47	130.4	140.83	287.48	104.1

Source: Field Survey 2003

Part 2

(4) Case Study on Production and Marketing of Potato

This part of the paper reports on potatoes for the different farm categories and discusses quantities sold, different channels and markets, marketing costs and selling prices, net margins and net incomes received by farmers. According to Scott and Bouis (95-96) the potato has evolved from a minor vegetable to the most important vegetable in the diet and an occasional partial substitute for rice. Faostat (2005) reports that production of potatoes has increased in Bangladesh by 118% (3,386,000 mt –1,553,180 mt) in 2003 compared to 1998. Bogra is the 4th largest potato growing area of the country (BBS, 2003).

4.1 General Scenario in Cultivation of Potato

The number of potato cultivators increased from 22 to 25. The numbers of LL, SF, MF and LF were 2, 10, 6 and 4 respectively in 1998; and 2, 12, 6 and 5 respectively in 2003. Their average area increased from 0.27 to 0.38 acres and for large farms (0.43 to 0.64 acres) and medium farms (0.37 to 0.47 acres). This same trend was followed in the case of small (0.18 to 0.26 acres) and landless farmers (0.16 to 0.20 acres). In producing potatoes, production costs included seed, labour, cultivation, irrigation, fertilizers, insecticides, fungicide, harvesting, etc. The costs/kg in 2003 for LL, SF, MF and LF were Tk 3.05, 3.06, 2.98 and 2.96 respectively; and for 1998 were Tk 2.63, 2.64, 2.63 and 2.65 respectively. The average cost for all farms was Tk 3.01/kg in 2003 and Tk 2.64/kg in 1998. Different input prices and changing input quantities altered production costs. Selling volume rose from an average of 1.83 mt to 2.69 mt, between 1998 and 2003, a 47% increase. Large farm yields increased by 108.6% in the same period (Table III).

4.2 Marketing Channels and Selling of Potatoes in Different Markets

Six marketing channels for potatoes were identified in the study area. Channels in the primary and secondary markets were: (i) Farmers–consumers, (ii) Farmers–retailers–consumers, (iii) Farmers–middlemen/traders–retailers–consumers, (iv) Farmers–wholesalers–retailers–consumers; and the channels up to the terminal market were: (v) Farmers–wholesalers–retailers–consumers, followed by farmers selling directly after construction of Jamuna Bridge. (vi) Farmers–middlemen/traders–wholesalers–retailers–consumers, followed by the middlemen/traders from Noimail to Kawran Bazaar (terminal). Farmers had weak links with cool stores for seed and non-seed purposes as this is a risky business with volatile market prices and quality deterioration due to unstable power supply. Few cool stores exist and these are not in the study area but in Bogra District and Sherpur Upazila.

Table IV shows that the quantity of potatoes sold for all except landless in 1998 was highest in Sherpur (52.4% of the total), followed by Noimail and Demazani, but in 2003 the highest was in Noimail (49.2%) followed by the newly added Kawran Bazaar (15.9%), Foteh Ali (14.8%), Sherpur (12.8%) and the lowest in Demazani (7.4%).

Table IV Selling quantities of Potato by different farmers and various markets

Farmers	Demazani		Noimail		Sherpur		Foteh Ali		Kawran Bazaar		Total Sale (Kg)	
	1998	2003	1998	2003	1998	2003	1998	2003	1998	2003	1998	2003
LL	200 (26.7)	500 (27.8)	550 (73.3)	1300 (72.2)	-	-	-	-	-	-	750 (100)	1800 (100)
SF	525 (20.6)	525 (14.5)	775 (30.4)	2350 (64.8)	1250 (49.0)	750 (20.7)	-	-	-	-	2550 (100)	3625 (100)
MF	570 (12.8)	270 (4.8)	1185 (26.6)	2900 (51.2)	2700 (60.6)	792 (14.0)	-	1700 (30.0)	-	-	4455 (100)	5662 (100)
LF	711 (14.9)	-	1445 (30.4)	2100 (32.3)	2600 (54.7)	700 (10.8)	-	900 (13.8)	-	2800 (43.1)	4756 (100)	6500 (100)
Total sale (%)	2006 (16.0)	1295 (7.4)	3955 (31.6)	8650 (49.2)	6550 (52.4)	2242 (12.8)	-	2600 (14.8)	-	2800 (15.9)	12511 (100)	17587 (100)

Note: Upper values in cells are selling quantity in kg and parenthesis indicate percents of the sold quantity

In the case of markets and buyers, landless farmers used only Demazani and Noimail market but concentrated on Noimail selling to consumers. Small farmers extended their markets to Sherpur but also concentrated on Noimail selling to consumers and retailers. Medium and large farmers used the same markets but included Foteh Ali in 2003, where 14.8% of the total potato crop was sold. Their main buyers were retailers and wholesalers. Another remarkable point was that large farmers sold a high share (43.1% of their total) to wholesalers in the Kawran Bazaar.

4.3 Prices in Different Markets and Marketing Costs from the Study Area

Table V shows prices and marketing costs per kg in different markets. Selling prices varied in different markets according to transportation and other costs. The Table indicates that prices and costs increased with distance of the markets from the study area. It was found that Demazani was the cheapest (Tk 3.35/kg) with lowest transportation cost but large farms received the highest price (Tk 11/kg) in Kawran Bazaar spending more on marketing (Tk 2.57/Kg). In transportation to Demazani, marketing cost was lowest for landless farmers who used family labour. Medium farmers had occupied the highest selling prices in Noimail, Sherpur and Foteh Ali in 2003.

Table V Selling prices and marketing costs by different farmers and corresponding markets (The unit is Tk/kg)

Farmers	The Year 1998				The Year 2003					
	Demazani	Noimail	Sherpur	Averages	Demazani	Noimail	Sherpur	Foteh Ali	Kawran Bazaar	Averages
LL	3.42 (0.10)	4.15 (0.26)	-	3.79 (0.22)	4 (0.10)	5 (0.27)	-	-	-	4.5 (0.22)
SF	3.45 (0.22)	4.1 (0.25)	5 (0.43)	4.18 (0.33)	3.95 (0.24)	5.05 (0.26)	5.6 (0.47)	-	-	4.87 (0.30)
MF	3.4 (0.23)	4 (0.25)	5 (0.44)	4.13 (0.36)	3.8 (0.25)	5.15 (0.26)	5.7 (0.47)	7 (0.57)	-	5.41 (0.39)
LF	3.35 (0.22)	4.1 (0.25)	5.1 (0.43)	4.18 (0.23)	-	5.1 (0.24)	5.65 (0.46)	6.9 (0.58)	11 (2.57)	7.16 (1.32)
Averages (Tk/Kg)	3.41 (0.19)	4.09 (0.25)	5.03 (0.43)	4.07 (0.28)	3.92 (0.20)	5.08 (0.26)	5.65 (0.47)	6.95 (0.58)	11 (2.57)	5.49 (0.56)

Note: Upper values in cells are selling prices/kg and parenthesis indicate marketing costs/kg.Source: Field Survey 2003

4.4 Net Margin Received by the Farmers

Table VI shows net margins per kg received by farmers in different markets. Net margin is the selling price/kg less the costs/kg (production, marketing and others).

It was found that large farms got 138.3% higher net margin (Tk 1.54 to Tk 3.67/kg) in 2003, followed by medium (52.6%), landless (30.6%) and small farms (13.9%). Large and medium farm net margins were higher due to selling more of their output in Foteh Ali and Kawran Bazaar. Large farmers got the highest net margin in kawran Bazaar (Tk 5.47/kg) in 2003 compared to the net margin of Sherpur (Tk 2.02/kg) in 1998. Medium farmers, in 2003, got higher net margins in Noimail, Sherpur and Foteh Ali. Landless got their highest net margin in Demazani (Tk 0.85/kg) in 2003 from good selling price and having no transportation costs, by using family labour. High net margins were received by large and medium farmers for timely selling in the markets according to demand and the ability to use distant markets.

Table VI Net Margin/kg according to different markets by farmers` (Cells are in Tk/kg)

Farmers	The Year 1998				The Year 2003						Changes (%)
	Demazani	Noimail	Sherpur	Averages	Demazani	Noimail	Sherpur	Foteh Ali	Kawran Bazaar	Averages	
LL	0.69	1.26	-	1.11	0.85	1.68	-	-	-	1.45	30.6
SF	0.59	1.21	1.93	1.44	0.65	1.73	2.07	-	-	1.64	13.9
MF	0.54	1.12	1.93	1.54	0.57	1.91	2.25	3.45	-	2.35	52.6
LF	0.48	1.2	2.02	1.54	-	1.9	2.23	3.36	5.47	3.67	138.3
Averages	0.57	1.2	1.96	1.41	0.69	1.8	2.18	3.4	5.47	2.28	61.7

Note: Calculated from data. Source: Field Survey 2003.

4.5 Rate of Net Margins Received by the Farmers

Rate of net margin is defined as the net margin as a percentage of the selling price. Table VII shows that large farmers had the highest net margins, increasing from 34% in 1998 to 46.2% in 2003, followed by medium, small and landless farmers. Among all the markets in 2003, Kawran

Bazaar was the most profitable (49.7%), followed by Foteh Ali (49%), Sherpur, Noimail and Demazani. Rates of net margin in Sherpur were almost the same in this period but Noimail as the nearer market got especial attention from farmers and businessmen, whose rates of net margin increased from 29.3% to 35.5%.

Table VII Rate of net margin according to different markets by farmers` (Rate of Net Margins in %)

Farmers	The Year 1998				The Year 2003					
	Demazani	Noimail	Sherpur	Avg Rate	Demazani	Noimail	Sherpur	Foteh Ali	Kawran Bazaar	Avg Rates
LL	20.2	30.4	-	28	21.3	33.7	-	-	-	30.7
SF	17	29.6	38.6	32.6	16.3	34.2	37	-	-	32.8
MF	16	28.1	38.7	34	15.1	37	39.5	49.2	-	41.1
LF	14.3	29.3	39.6	34	-	37.2	39.5	48.8	49.7	46.2
Avg Rates	16.9	29.3	39	34	17.6	35.5	38.7	49	49.7	37.7

Source: Field Survey 2003

4.6 Farmers` Net Incomes from Potatoes

Table VIII shows net incomes/kg from potato in the same years. Net income is the net margin less the cost of family labour, own transport, etc. Net income/kg was 126.3% higher for large farmers, followed by medium, landless and small farmer. The position of landless was improved by selling produce directly to consumers without any transportation cost to Demazani.

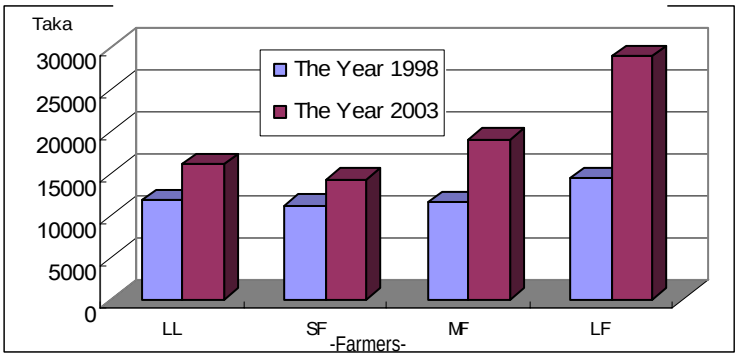
Table VIII Net income (Tk/kg) by different farmers

Farmers	The Year 1998	The Year 2003	Change (%)
LL	1.87	2.22	18.7
SF	1.67	1.97	18.0
MF	1.7	2.52	48.2
LF	1.67	3.78	126.3

Net incomes/acre in 1998 for landless, small, medium and large farmer were Tk 11,708.33, Tk 11,209.87, Tk 11,462.80 and Tk 14,418.62 respectively, and Tk 16,008.00, Tk 14,291.50, Tk 19,038.13 and Tk 28,932.94 respectively in 2003. The percentage increase were 36.7%, 27.5%, 66.1% and 100.7% respectively.

Figure 3 shows the net incomes/acre and obviously large farmer's income had been increased remarkably, followed by medium, landless and small farmers. Medium and large farmers both used Foteh Ali and only large farmers sold to Kawran Bazaar, increasing net income/acre by 100.7%.

Figure 3 Net Income/acre by Different Farmers



Source: Field Survey, 2003

Part 3

(5) Case Study on Cultivation and Marketing of cucumber

Part III is based on cucumbers for the year 2003 to identify the current situation in using markets by different farmers and other related marketing phenomenon, buyers, marketing costs and selling prices, net margins received by farmers, etc. Cucumber has been chosen because production quantity was higher (5.6mt/acre) than the average production (1.7 mt/acre) in the Bogra District (BBS, 2003). Findings will be reported as for potatoes.

5.1 Marketing Channels for Cucumbers

Five marketing channels were identified for cucumbers. Four channels were used by all farmers and the channel to the terminal market was also followed by the large farmer.

Figure 4 Different marketing channels

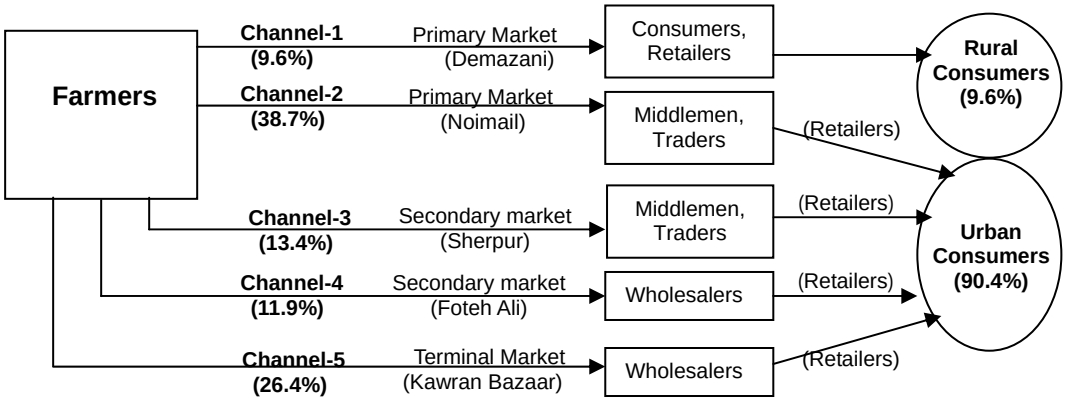


Figure 4 & Table IX shows the largest volume of sales in Noimail (38.7%), followed by Kawran Bazaar (26.4%), Sherpur (13.4%) and Foteh Ali (11.9%) markets. The lowest volume was in the nearer market Demazani (9.6%). Cucumbers were marketed mostly to urban consumers. Landless farmers sold mostly in Noimail (56.6%). All farmers except the large farmer used mostly Noimail market. The large farmer sold 85.7% of his cucumbers to wholesalers in Kawran Bazaar. Small and medium farmers also extended their markets up to Foteh Ali. Landless farmers were concentrated in the nearer markets of Demazani and Noimail. An important point is that there was high demand for cucumbers in the Noimail market for easily accessible roadside sales beside the highway and also Kawran Bazaar got special attention for easy communication through the Jamuna Bridge.

Table IX Selling weights by different markets and farmers

Markets / Farmers	Demazani	Noimail	Sherpur	Foteh Ali	Kawran Bazaar	Total
LL	435 (26.4)	930 (56.6)	280 (17.0)	-	-	1645 (100)
SF	465 (12.2)	1850 (48.7)	835 (22.0)	650 (17.1)	-	3800 (100)
MF	402 (10.1)	1894 (47.5)	714 (17.9)	978 (24.5)	-	3988 (100)
LF	-	600 (14.3)	-	-	3600 (85.7)	4200 (100)
Total	1302	5274	1829	1628	3600	13633
(%)	(9.6)	(38.7)	(13.4)	(11.9)	(26.4)	(100)

Note: The uppervalue in cells indicate weight in kg and Parentheses indicate percents of the weightss. Source: Field Survey, 2003.

5.2 Prices in Different Markets and Transportation Costs from the Study Area.

Table X shows prices and the transportation costs per kg in different markets. Selling prices varied and not every farmer could use all markets. Prices and costs were incremental with distance of the markets from the study area. Demazani market was the cheapest selling price and lowest transportation cost and the highest price (Tk 13/kg) was selling in Kawran Bazaar as were transportation costs (Tk 2.46/Kg).

Table X Selling prices and transportation costs (Tk/Kg) by different farmers

Markets / Farmers	Demazani	Noimail	Sherpur	Foteh Ali	Kawran Bazaar
LL	5.7 (0.14)	6.68 (0.17)	7.05 (0.37)	-	-
SF	5.75 (0.14)	6.7 (0.17)	7.1 (0.37)	7.8 (0.47)	-
MF	5.72 (0.14)	6.71 (0.17)	7.15 (0.37)	7.85 (0.47)	-
LF	-	6.7 (0.16)	-	-	13.0 (2.46)

Note: Upper value and parenthesis indicate price and transportation costs

5.3 Net Margins Received by Farmers

Table XI shows the net margins received by the farmers in the different markets. The large farmer got the highest net margin (Tk 7.31/kg), followed by medium, small and landless farmers. The large farmer received the highest margin (Tk 7.88/kg) in Kawran Bazaar by selling 85.7% of his cucumbers in this market. The net margin of the landless farmer was the lowest (Tk 3.53/kg) due to production costs and also getting lower price in the nearer markets. The medium farmer got the highest net margin (Tk 2.92/kg) in Demazani, Sherpur (Tk 4.11/kg) and Foteh Ali market (Tk 4.69/kg). The large farmer got the highest margin in Noimail (Tk 3.89/kg) and Kawran Bazaar (Tk 7.88/kg). It is evident that the highest net margins were received by the medium and large farmers for timely selling and using distant markets.

Table XI Net margin (Tk/kg) by different markets and farmers

Farmers	Demazani	Noimail	Sherpur	Foteh Ali	Kawran Bazaar	Averages
LL	2.80	3.75	3.91	-	-	3.53
SF	2.91	3.83	4.02	4.60	-	3.89
MF	2.92	3.88	4.11	4.69	-	4.02
LF	-	3.89	-	-	7.88	7.31
Averages	2.88	3.84	4.02	4.65	7.88	4.69

Table XII shows the large farmer with the highest rate of net margin (60.4%), followed by medium, small and landless farmers. Kawran Bazaar was the most profitable (60.6%) market. The rate of net margin for every farmer was more in Noimail than in Demazani and Sherpur. Excluding the distant markets of Foteh Ali and Kawran Bazaar, farmers gave more attention to the Noimail market.

Table XII Rate of net margins(%) received by different farmers

Farmers	Demazani	Noimail	Sherpur	Foteh Ali	Kawran Bazaar	Total
LL	49.1	56.2	55.5	-	-	54.4
SF	50.6	57.2	56.6	59	-	56.7
MF	51	57.8	57.5	59.7	-	57.7
LF	-	58.1	-	-	60.6	60.4

Table XIII shows that large farmers have the highest net incomes per kg and acre followed by medium, small and landless farmers. Large farmers earned almost twice that of landless and small farmers.

Table XIII Incomes by different farmers (cells are in Tk)

Income	LL	SF	MF	LF
Net Income/kg	3.59	3.91	4.10	7.34
Net Income/acre	20133.94	21953.19	23055.19	40714.29

For potato and cucumber, Kawran Bazaar became profitable markets after construction of the bridge, followed by Foteh Ali, Sherpur, Noimail and Demazani. Nearer Noimail is used more for road side easy access and farmers started to use also District market Foteh Ali as is clear from the figures and Tables. By using profitable markets, farmers` incomes were increased, as production of vegetables had

expanded from farmers` knowledge of cultivating vegetables by modern methods.

V Conclusion

Infrastructure developments which improved access to markets helped farmers to get better prices for their produce. The study found that construction of the Jamuna Bridge played a vital role in creating the channels from the study area to Kawran Bazaar in the terminal market creating convenient communication for carrying goods, reduction of total transportation time, increasing number of buyers and raising demand in the primary and secondary markets. More vegetables have been sold in Noimail, Foteh Ali and Kawran Bazaar (Table 1, 4, 9). Farmers got the highest net margin/kg from Kawran Bazaar, followed by Foteh Ali, Sherpur, Noimail and Demazani. The last three markets are nearer to the study area but Noimail was mostly used by farmers for its easy roadside access. Medium and large farmers produce more vegetables and sell in the local and distant markets but the opposite was observed for landless and small farmers. Large farmers` and medium farmers' incomes had increased from higher prices in using different markets but incomes of the landless and small scale farmers had not benefitted to the same extent, but they were higher than in past years. In marketing both potato and cucumber, large farmers benefitted the most as they used the distant market Kawran Bazaar and also Foteh Ali. Farmers` received different net margins from different markets. Using profitable markets helped farmers in increasing income. Another point is that marketing cost from the study villages up to the Kawran Bazaar had fallen but the opposite result occured in the case of local transportation for under-developed roads.

The study identifies some drawbacks: (i) muddy roads in the rainy season make it difficult to connect villages with markets, leading farmers to sell their produce at low prices; (ii) lack of cold storage facilities for vegetables; (iii) unauthorized subscription during transportation taken by the musclemen raising transportation costs. This study elucidates the necessary measures in these regards, which may strengthen farmers` capabilities to boost crop production and as a result, the agricultural economy will be strengthened which may help alleviate rural poverty.

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Examining the Relative Competitiveness of Milk Production: An Irish Case Study (1996 – 2004)

F.S. Thorne[*] & W. Fingleton

Abstract

This paper examines the competitiveness of Irish milk production compared to that of other EU and non-EU countries. The analysis was based on two main data sources – the Farm Accountancy Data Network (FADN) for years 1996-2003 and the International Farm Comparisons Network (IFCN) for 2004. Results showed that the Irish competitive position for milk production compared to other EU and non-EU countries was very positive when total cash costs were considered indicating a positive outlook for Irish milk production in the short to medium term. However, as the opportunity costs of owned resources are not included in 'cash cost' calculations, total economic costs which include imputed charges for owned resources were considered to examine the longer term outlook for the competitiveness of the sector. Using this measure, the competitive ranking for the Irish dairy sector slipped relative to the other countries. It was found that the main reason for the relatively high economic costs on Irish dairy farms was the high imputed land and labour costs. These findings could be considered as a warning signal for the future competitive performance for the average sized Irish dairy farm. However, based on FADN data the 'larger' Irish dairy farms (in the 50-99 dairy cow size category) did manage to maintain their competitive position within Europe even when total economic costs were considered. Hence, it could be concluded that part of the explanation of the deterioration of competitive ranking for the average Irish dairy farm when total economic costs are considered relates to the relatively low scale of primary agricultural activity in Ireland. This result is indicative of the small scale farming that predominates in the Irish dairy industry relative to competing industries. But, it could be concluded that as Irish dairy farming transforms to larger scale production, the competitive position will be strengthened and better able to cope with a cost/price squeeze, given current projections for a decline in farm milk prices.

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Introduction

The competitiveness of the European and International market for agricultural commodities, including dairy products, has been at the forefront of much debate in recent times in the context of recent reforms to the Common Agricultural Policy (CAP), increasing trade liberalisation brought about as a result of World Trade Organisation (WTO) negotiations, and increasing globalisation of the world economy (Newman and Matthews, 2004). Consequently, the objective of this research was to examine the relative competitiveness of Irish specialist milk producers vis-a-vis selected EU and international countries for a baseline period, 1996 to 2004, to provide an insight into the ability of Irish producers to react to the aforementioned influences.

The EU countries chosen for comparison, within the European Commission's Farm Accountancy Data Network (FADN), included: Belgium, Denmark, France, Germany, Italy, the Netherlands, the UK, and Ireland. Country specific information on the extent of intra-EU trade in milk products is not available but over 85% of the EU production of butter and cheese is accounted for by the countries specified (Eurostat, 2003). Furthermore, additional analysis was conducted on 'representative' farm types from the International Farm Comparisons Network (IFCN), based on a number of major international milk producing countries, to determine the relative international competitiveness of 'representative' Irish specialist milk producers.

The data sources used and methodology involved in the computation of the various indicators of competitiveness employed in the analysis are outlined in the following section. The results of the various indicators of competitiveness are then outlined and the conclusions from the research identified.

Measurement and Methods

Farm Accountancy Data Network (FADN)

The EU FADN, was the main source of the data used for this analysis. Data analysis was confined to specialist dairy farms as defined by FADN (Farm Type 411), on which the standard gross margin from dairying accounts for at least two-thirds of the farm total gross margin. This allows a greater degree of accuracy in the allocation of costs (which are presented on a whole farm basis from FADN) to the dairy enterprise than would be the case if all farms with a milk enterprise were selected for analysis (Fingleton, 1995)[i].

Two measures of cost comparison were used for specialist dairy farms (farm type 411):

- Total costs as a per cent of dairy output, and
- Total costs per unit volume of milk production.

The value of dairy output was calculated as milk receipts plus dairy calf sales. Fingleton (1995) found that the omission of calf output values effected dairy enterprise comparisons between countries. Subsequently, it was decided for this analysis to include the value of calf output. Whole farm calf sales were apportioned to the dairy enterprise based on the ratio of dairy cows to other cows on the farm. Due to data constraints it was only possible to include a value for dairy calf sales and not possible to impute a charge for calves born from the dairy and transferred to a beef enterprise.

Most studies which examine the costs of milk production are made on a raw milk volume basis which does not account for possible variation in milk constituents between different countries (Fingleton, 1995). Results from these studies using this approach are biased in favour of countries where the levels of milk constituents are relatively low. To overcome this bias Fingleton (1995) measured unit costs per kilogramme of milksolids (i.e. butterfat plus protein). Average fat and protein percentages for each country were used to convert the milk volumes obtained from the FADN data into the equivalent quantities of milksolids. This approach was also adopted in this study. However, a higher weighting was applied to the protein content of milksolids than to the fat

content which reflects the higher market value of milk protein.[ii] The average fat and protein percentages used for the analysis were obtained from Eurostat (Eurostat, 2005).

For the purpose of examining costs of production, costs were defined as:

(i) Total cash costs, which include all specific costs, directly incurred in the production of a given commodity, for example fertiliser, feedstuffs, seeds etc. plus external costs such as wages, rent and interest paid, plus depreciation charges.

(ii) Total economic costs, which includes all of the cash costs identified above, except interest charges, plus imputed resource costs for family labour, equity capital and owned land[1].

The calculation of total economic costs for each of the countries was one of the most problematic exercises in this analysis. The estimation of opportunity costs must be considered carefully because the potential income of farm owned factors of production in alternative uses is difficult to determine. In the short run, the use of own production factors on a family farm can provide flexibility in the case of low returns when the family can choose to forgo income. However, in the long run opportunity costs must be considered because the potential successors of the farmer will, in most cases, make a decision to continue or exit the business after assessing the best alternative returns from own production factors, in particular for their own labour input[iii].

Another important issue in measuring competitiveness is the distinction between the different levels of competitiveness. All too often research on the topic of competitiveness tends to focus on indicators of competitive performance and indicators of competitive potential are ignored (Harrison and Kennedy, 1997). Consequently, the indicators presented in this research go some way towards identifying the sources of competitiveness in addition to presenting results of competitive performance. The individual measures (i) costs as a per cent of output and (ii) costs per kg of milksolids provides an insight into the competitive performance of the countries examined, over the time period 1996 to 2004. However, they do not provide an insight into the sources of competitive advantage or disadvantage. Hence, partial productivity measures were considered as indicators of competitive potential.

The partial productivity measures used in this analysis for the dairy sector were defined by Fingleton (1995). The measures relate to animal, land and labour productivities. They are:

- Milk yield per cow (kg)
- Milksolids per cow (kg)
- Stocking rate (LU/ha)
- Milk production per hectare (kg)[iv]
- Milksolids per hectare (kg)[iv]
- Milk production per labour unit (tonne).

International Farm Comparisons Network (IFCN)

In addition to the comparison of costs within Europe using data from the FADN, international cost competitiveness was examined using data from the IFCN (Hemme *et al.,* 2004). The IFCN is a world-wide partnership that links agricultural researchers, advisors and farmers to create a better understanding of milk production and the costs and returns of production world wide. The cost calculations within the IFCN network are based on individual representative farms, rather than on the results from stratified random samples of the population as is the case with FADN data. None the less IFCN data provides a source of data which can be used to examine the relative international competitiveness of 'representative' Irish milk producers. Like the methods outlined above, IFCN data also presents costs as total 'cash' costs and total 'economic' costs with opportunity costs calculated for farm-owned factors of production.

[1] Borrowed interest has been excluded from the calculation of total economic costs given that an interest charge for owned resources is included in total economic cost calculations. A double counting of interest charges would be incurred if borrowed interest was again included in total economic costs, as in the case of cash cost calculations.

Results

FADN Results

The results for the dairy enterprise based on data from the FADN are presented in two sections: (i) partial productivity measures and (ii) comparative costs of production.

Comparison of partial productivity measures on EU specialist dairy farms

In Figures 1 and 2 below the partial productivity measures identified above are shown for the eight EU countries compared in this analysis. The results presented here for each of the countries is the average for the years 1996 to 2003 and indexed relative to Ireland.

Figure 1 ***Partial Productivity Measures for selected EU countries***

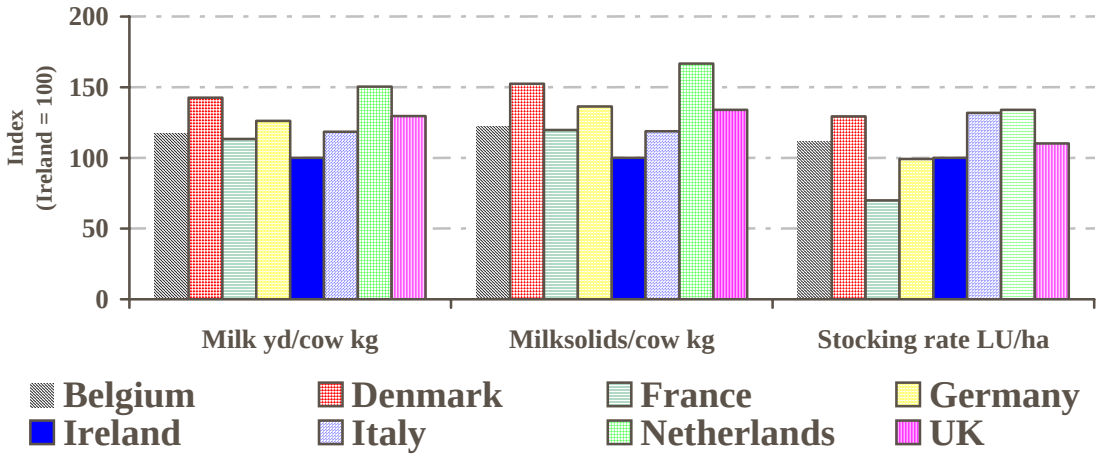
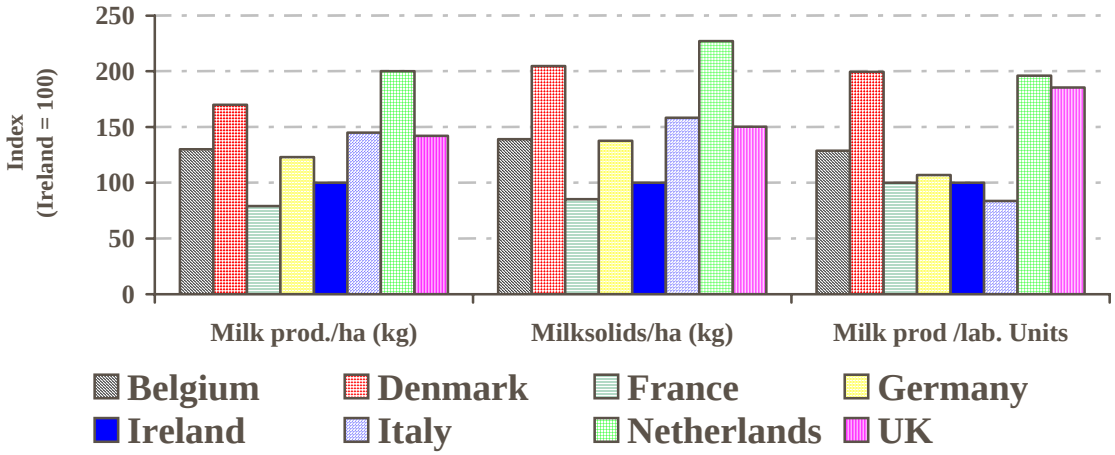


Figure 1 shows that average milk yields per cow were much lower in Ireland relative to the other countries in the analysis. Average yields were highest in the Netherlands and Denmark. Comparisons of milksolids per cow showed an even greater disparity between Ireland and the other countries. In particular, milksolids per cow in the Netherlands and Denmark were 66 per cent and 52 per cent higher respectively than in Ireland.

The levels of land productivity in the Netherlands and Denmark were 34 per cent and 30 per cent higher respectively than in Ireland. Only France and Germany had stocking densities equivalent to or lower than Ireland.

Figure 2 ***Partial Productivity Measures for selected EU countries***



The combination of the generally lower stocking densities and lower milk yields for Ireland are aggregated in the next two measures of productivity. Milk production and milksolids per hectare were lower in Ireland than all other countries except France. The Netherlands and Denmark again exhibited productivity well in excess of the other countries examined, with milk production per hectare 70 per cent higher in Denmark and 100 per cent higher in the Netherlands compared to Ireland. Differences in milksolids per hectare were even more pronounced in other countries relative to Ireland, with levels in Denmark more than double those for Ireland.

The final partial productivity measure – milk production per labour unit was again highest in the Netherlands and Denmark, with levels in the UK also relatively high. Italy was the only country with lower labour productivity than Ireland, but levels in France and Germany were very similar to that for Ireland.

The results presented in Figures 1 and 2 are based on estimates of all specialist dairy farms in the respective countries. However, the results are influenced by distribution differences in the sample of farms included in the FADN survey for the different countries (Fingleton, 1995). For this reason the productivity measures for farms with 50-99 cows were also examined in each country. However, despite the variations in sampling procedures adopted in the FADN survey there was no evidence of pronounced differences in average productivity levels between the sub sample and the whole sample. In general, the productivity rankings between the countries were similar in the two samples but the relative differences tended to be reduced in the more homogeneous sample of the 50-99 cow farms. This case was particularly evident in the land and labour productivity measures, where the large disparities between the countries in the average sample of farms were reduced in the sub sample of 50-99 dairy cow farms size category.

The results presented in Figure 1 and 2 above show the average indicators of partial productivity over the period 1996 to 2003. However, the results for the individual years were examined using a linear regression model which was fitted to these results to measure the trend over time for Irish dairy farms in relation to the average for all countries examined. The average sample of all specialist dairy farms did show a significant trend over time for three of the six partial productivity measures, namely: milksolids per cow, stocking rate per hectare and milksolids per hectare. Of these indicators, milksolids per cow for Irish dairy farms did increase significantly relative to the average of all countries examined; by on average 0.012 kgs per cow per year. In contrast, stocking rate (cows per hectare) and milksolids per hectare decreased relative to the average of all countries examined; by on average 0.01 cows per hectare and 0.09kgs of milksolids per hectare respectively, relative to the average, over the time period examined.

However, the sub sample of specialist dairy farms, with 50-99 dairy cows, did not show a significant relationship between any of the relative productivity measures in Ireland vis-a- vis European competitors.

Comparison of costs and returns in selected EU dairy farms

The first measure of comparative costs of production used in this analysis was costs as a per cent of total dairy output. Fingleton (1995) citing *Boyle et al., (1992)*, outlined the relevance of this measure, whereby '…*it reflects the resilience with which a sector of production could cope with a cost/price squeeze. If, for example, there was a substantial fall in milk prices, producers locked into a high cost structure would have much lower chances of survival, other things been equal'* (p.11). Given the current projections that Irish farm milk prices will be 15 per cent lower in 2012 from the average of 2000 to 2002 (Binfield *et al.,* 2003), this approach to measuring competitiveness seems appropriate.

Figure 3 below shows the cost/output results for the eight year average, for each of the selected countries, for all specialist dairy farms in the FADN sample.

Figure 3 Cash and Economic Costs for all Specialist Dairy Farms in selected EU countries (1996-2003)

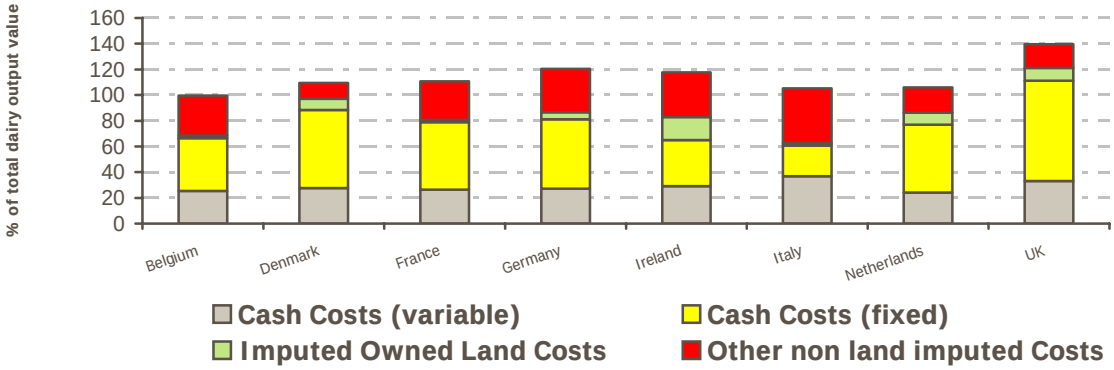


Figure 3 shows that total cash costs (variable and fixed components) as a per cent of output were relatively low in Ireland over the period 1996 to 2003. Italy had the lowest total cash costs as a per cent of output at 61 per cent, but the cost structure in Ireland and Belgium was only slightly higher at 65 and 66 per cent respectively. The low total cash cost to output ratio evident in Italy could be attributed to the high milk price paid in Italy relative to other EU countries rather than low costs of production. The highest total cash costs as a per cent of output were in Denmark where cash costs were 88 per cent of total output, which was due largely to the high level of borrowing in Danish agriculture. Overall, the variations in the fixed cost component of cash costs appeared to be more variable between the individual countries than the variable cost component of total cash costs.

Further analysis of the specialist dairy farms in the 50-99 dairy cow size category did not show substantial deviation from these results.

When total economic costs are considered the competitive position of the countries changes. The competitive advantage experienced by 'average' Irish producers worsens when all imputed charges for owned resources are taken into consideration. Total economic costs as a per cent of output were highest in Germany where costs were 120 per cent of the dairy enterprise output followed by Ireland with economic costs at 118 per cent of output. The main imputed cost that contributed to the relatively high total economic costs in Ireland was that for owned land. This was

due to the relatively high imputed rental charge coupled with high levels of land ownership in Irish dairy production. The relatively low stocking rates and milk yields per hectare on Irish dairy farms over the period also must be considered as a contributing factor. The high costs associated with owned land in Irish dairy farming will inevitably become a impediment to future competitiveness as competing countries have already borne the cost associated with land in the current system, whereby land costs, in the form of land rent, are already included in their cash costs.

The lowest total economic costs were in Belgium, where nearly 1 per cent of dairy output remained as profit for dairy producers on average over the eight year period (i.e. total economic costs were 99 per cent of total dairy output).

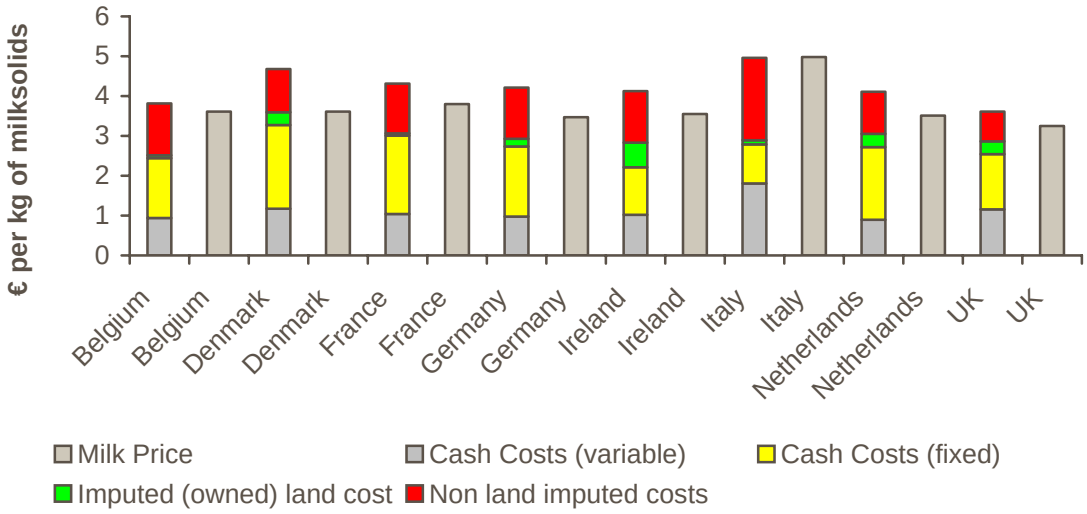
When total economic costs were considered as a per cent of output for specialist dairy farms in the 50-99 dairy cow size category, the ranking changed from that shown in Figure 3. Total economic costs for this sample of farms were generally substantially lower then the average for all specialist farms. Total economic costs were reduced by 13 per cent for Italian farms, which resulted in Italy replacing Belgium as the lowest economic cost producer. In addition, these larger Irish dairy producers (with 50-99 dairy cows) also substantially improved their competitive position relative to competing countries, compared to the average Irish producers; total economic costs as a per cent of output were reduced by 15 per cent on these farms relative to the average producer in Ireland, which ranked these larger Irish producers as the third lowest total economic cost producer relative to all countries examined.

Based on the costs presented in Figure 3 a 'competitiveness index' (following Boyle *et al*., 1992; Fingleton, 1995) was developed, whereby the cost:output ratio for Ireland was expressed as a per cent of the simple average of the cost:output ratios for all countries examined[v]. This index presents conflicting results depending on whether or not the imputed charges for owned land are included in the analysis. Ireland was at a competitive disadvantage relative to the average for all the countries studied, when total economic costs are taken into consideration. Over the period 1996 to 2003, 'average' Irish dairy farms had on average 7 per cent higher total economic costs relative to other competing countries in the EU, while total economic costs for the sub sample of dairy farms with 50-99 dairy cows were equal to the average of all countries examined. These results indicate that the opportunity cost of land will have a major impact on the competitive position of Irish milk producers in the longer term.

The second measure of comparative costs and returns used in this analysis was costs per kg of milksolids produced. The average cash and economic costs per kg of milksolids produced, over the period 1996 to 2003, for each of the countries in the analysis is presented in Figure 4. Further detail on the cost components of the cash and economic costs are presented for all specialist dairy farms and for the sub sample of farms in the 50-99 dairy cow size category can be obtained in Thorne (2004).

Figure 4 shows that level of milksolids production, has a considerable influence on the competitive position of the countries examined. Based on total cash costs per kg of milksolids, Denmark had the highest cost structure, significantly higher than Ireland. On a total economic cost basis, the UK and Belgium had the lowest costs per kg of milksolids, Ireland was ranked in fifth position and Italy had the highest costs. Furthermore, when the sub sample of farms with 50-99 dairy cows were examined cash costs did not change noticeably but economic costs were reduced significantly for these farms. The magnitude of the differences was much less between the countries. The ranking between countries also changed with Ireland now having the second lowest total economic costs per kg of milksolids.

Figure 4 Cash and Economic Costs per kg milksolids for all specialist dairy farms – 8 year average (1996 – 2003)



Based on the competitive index of total economic costs, it appears that Ireland was struggling to maintain its competitive position over the time period. When the average sample was examined total economic costs per kg of milksolids were on a par with the average. However in the specialist sub sample average costs for Ireland were 5 per cent lower than the average for the competing countries. Furthermore, when imputed charges for owned land were excluded, the competitive position of the average sample and the sub sample for Ireland improved somewhat. In both cases costs were approximately 17 per cent lower than the average of the countries examined.

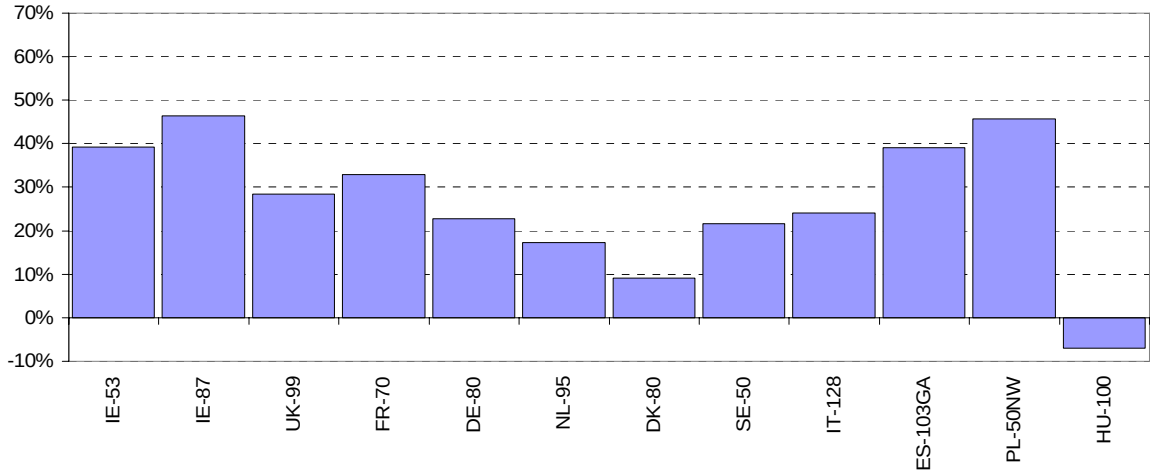
While the cost and return indicators presented in Figures 3 and 4 above represent average performance over the period 1996 to 2003 it is also important to determine whether or not the competitive position of Irish dairy producers has shifted over this time period. Hence, a linear regression model was fitted to the data to observe trends within the data. For the average sample there was no apparent significant trend over the period, whereas with the sub sample of larger producers there was a significant improvement in cash and economic costs per kg milksolids for Irish producers relative to the average. Cash costs improved at rate of 2 cent per kg of milksolids per year and economic costs at a rate of 3 cent per year relative to the average of all countries.

IFCN Results

The comparisons from the IFCN data are presented on a 'two-tiered' basis. One group of comparisons include results from typical Irish specialist dairy farms of 'average' and 'larger' sizes with results from typical dairy farms in ten other EU countries, including two new member states.

Figure 5 shows the profit margin on the whole farm as a per cent of total returns (output). This measure indicates how well placed typical farms would be if prices or costs moved adversely, especially in the short to medium term. This measure shows that typical Irish dairy farms appear to have a relatively good position compared to all other countries except for Spain and Portugal, which show similar results, i.e. from 40 per cent to 46 per cent of output was retained as farm income in 2004. In contrast farms in Germany, Netherlands, Denmark and Sweden are more exposed to income pressures if milk prices fall and/or costs rise. Typical farms in the UK and France were retaining around 30 per cent of output with Italy at a lower level.

Figure 5 Whole Farm Profit Margin (farm income as per cent of total returns): Ireland v other EU countries (2004)



In Figure 6 the same measure (profit margin) shows how 'typical' Irish dairy farms compare with important non-EU milk producing countries.

Figure 6 Whole Farm Profit Margin (farm income as per cent of total returns): Ireland v other non-EU countries (2004)

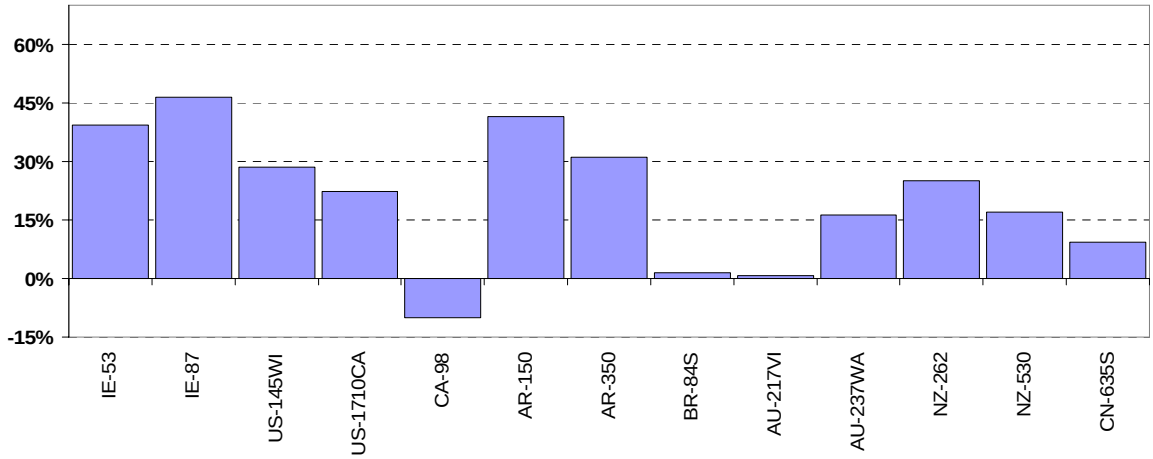


Figure 6 shows that in 2004, typical Irish farms were in a relatively strong position compared to most other non-EU dairy countries with only Argentina showing a comparable profit margin. The typical farms in the US and in New Zealand were in intermediate positions with 22 per cent and 28 per cent profit margins respectively. But the results from typical farms in Australia, Brazil, the larger typical farm in New Zealand and China show profit margins ranging from less than 20 per cent with some even below 10 per cent. Therefore, these farms would be more vulnerable to a cost/price squeeze.

The set of comparative results includes measures of total cash costs, depreciation and imputed charges. Also shown are milk prices and other non-milk returns for the dairy enterprise such as calf values and replacement costs. Hence, the following inter-country comparisons in Figure 7 and Figure 8 should provide further evidence as to the relative competitive strength of Irish dairying both within the EU and on a broader world wide front. The US dollar was chosen as the

common currency measure for all countries and in both Figures 7 and 8 the y-axis shows measures expressed on US$ per 100kg milk (ECM)[vi].

Figure 7 shows that in 2004 Irish farms had relatively low cash costs per 100kg compared to all other EU countries, apart from Poland. Spain, the UK, France, Germany, and the Netherlands had more 'intermediate' unit cash costs, with values at the higher end for farms in Italy, Hungary, Sweden and Denmark. The addition of depreciation charges did not significantly alter the ranking between countries. However, when total economic costs were measured, the addition of imputed charges tended to push the Irish results closer to several other countries, in particular the UK and Spain. Total economic costs per unit of milk were lowest in Poland, which also showed a substantial economic margin even with the relatively low milk prices received in Poland. In all other EU countries, except Spain, total economic costs exceeded milk prices and only in Ireland, the UK and in France was the addition of other dairy enterprise returns sufficient to bring returns equivalent to or slightly greater than total economic costs. There were notable shortfalls between total returns and economic costs for typical farms in Germany, The Netherlands, Sweden and Italy.

Figure 7 Total Costs and Returns of the Dairy Enterprise: Ireland v other EU countries (2004)

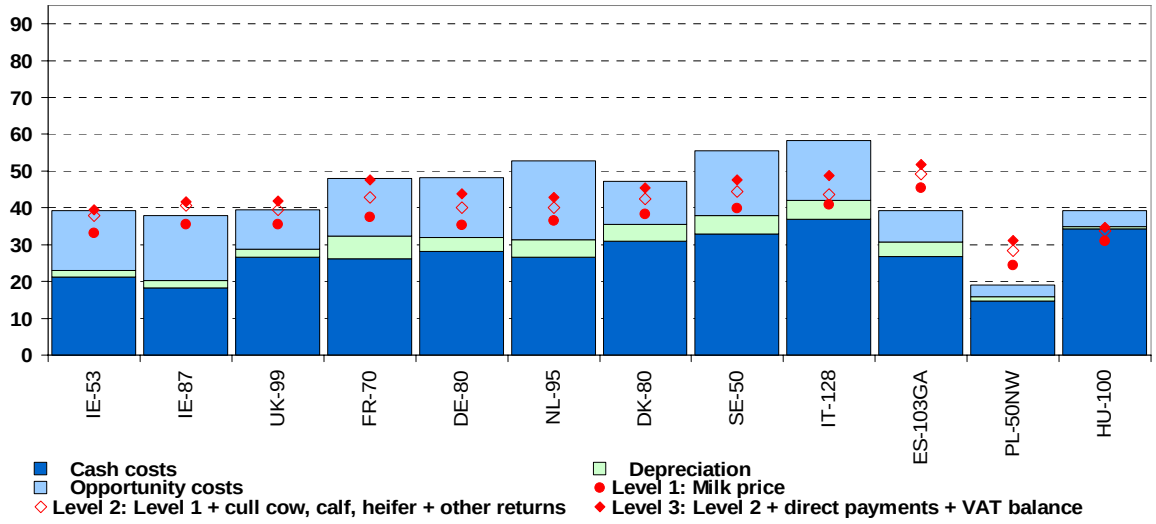


Figure 8 compares Irish and non-EU typical dairy farms. The comparisons are made in US$ and exchange rate differences and movements in a particular year may unduly effect results.

Figure 8 Total Costs and Returns of the Dairy Enterprise: Ireland v other non-EU countries (2004)

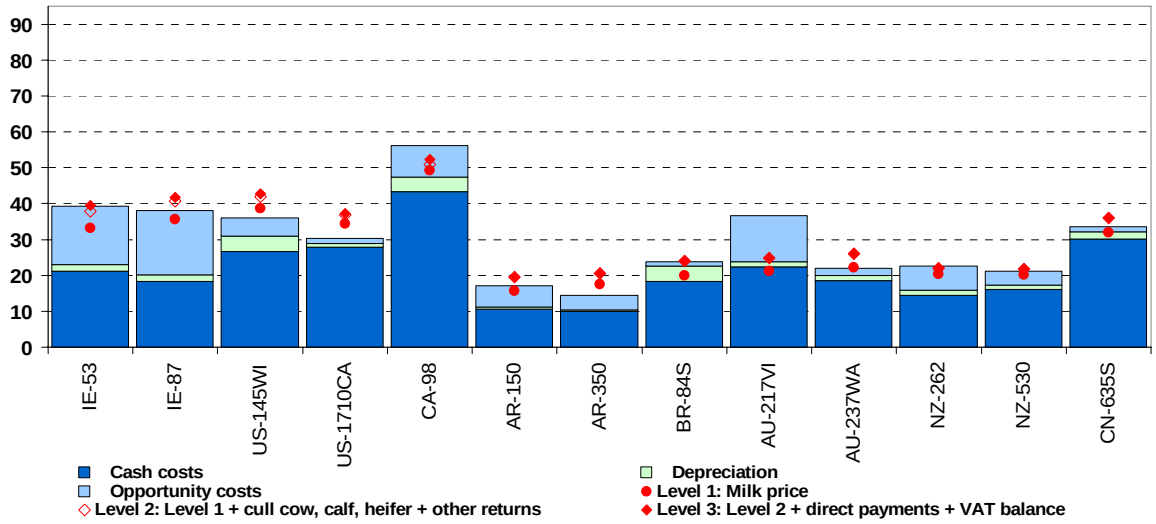


Figure 8 shows that cash costs per unit of milk production are reasonably positive for Irish farms. Canadian dairying had by far the highest cash costs (and also the highest total economic costs). Farms in the US also had relatively high cash costs, with cash costs being somewhat lower for Australian, Brazilian and Irish farms. Unit cash costs were lower again on New Zealand farms, but Argentinean farms had the lowest cash costs. However, Ireland's comparative position deteriorated very substantially when total economic costs were compared. Canada had the highest economic costs followed by Ireland, with the Australian-Victoria and the US-Wisconsin typical farms at a slightly lower level. Typical farms in Argentina, New Zealand, Brazil and Western Australia exhibited the strongest long term competitive position in 2004. Finally, there were only three countries (US, Argentina and Western Australia) where the price of milk was greater than total economic costs per unit. Perhaps surprisingly, given the size of the dairy farms in New Zealand, neither the 'average' or 'larger' typical farms showed a positive margin over total economic costs.

Discussion & Conclusions

In summary, for the period 1996 to 2004, the competitive position for Ireland, was positive when cash costs were considered and imputed charges for owned resources disregarded. Based on FADN data the only other EU country examined that had lower cash costs as a per cent of output was Italy, and Ireland actually appeared to have the lowest cash costs per unit of output during this period. Furthermore, based on data from the IFCN the competitive position for representative Irish dairy farms within Europe was again confirmed. Moreover, on a broader worldwide basis, representative farms in Argentina were the only farms that had higher profit margins than Irish dairy farms.

However, as the opportunity cost of owned resources are not included in the cash cost calculation this measure of future competitiveness can only be considered to be valid in the short to medium term. In the longer term adjustment within the sectors will be a reality which will be dependent on relative resource use and in this situation relative resource costs are needed to understand and analyse the adjustment process. Hence, total economic costs which include imputed charges for owned resources were considered to examine the longer term outlook for the competitiveness of the sector. In this situation, the competitive ranking for the Irish dairy sector slipped relative to the other countries. These findings could be considered as warning signals for the future competitive

performance for the average sized Irish dairy farm. However, based on FADN data the larger Irish dairy farms (in the 50-99 dairy cow size category) did manage to remain competitive within Europe when total economic costs were considered.

Boyle (2002) concluded that part of the explanation of the deterioration of competitive ranking for the average Irish dairy farm when total economic costs are considered relates to '*the relatively low scale of primary agricultural activity in Ireland*' (p.177). This result is indicative of the small scale farming that is predominant in the Irish dairy industry relative to competing industries. Furthermore, it could be concluded that larger scale producers in Ireland will be in a superior competitive position relative to the smaller scale producers in the long run, due to their ability to cope with a cost/price squeeze, given current projections for a decline in farm milk prices. Further work on the ability of marginal cost producers to compete in an increasing global market place is planned to complement this research, when additional variables and access to data is obtained from the FADN.

In conclusion, the results of this study provide a baseline position against which the change in competitiveness of Irish dairy farming can be measured. EU enlargement, trade liberalisation in the context of WTO negotiations and reform of the CAP will all have major influences on the competitive position of the Irish dairy sector, which can be monitored against the baseline position outlined by this research, given access to additional farm level data from the sample of farms in the FADN database.

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End Notes

[i] It was necessary to devise a method whereby the costs were apportioned to the dairy activity. This allocation method was based on that used by Fingleton (1995) and further developed in a similar study carried out by the FADN (Vard, 2001). Further details on these allocation methods can be obtained in Thorne (2004).

[ii] A 60% : 40% weighting factor was applied in favour of protein content.

[iii] The valuation methods adopted for the research in this study are outlined in further detail in Thorne (2004).

[iv] By definition this partial productivity measure will be heavily influenced by relative stocking rates.

[v] This competitiveness index was constructed following the methodology outlined by Boyle *et al*., (1992); Boyle (2002); and Fingleton (1995). Alternative denominators to a simple average of all countries were investigated but were rejected due to the problems associated with selecting an appropriate measure that would be relevant for all enterprise analysis.

[vi] ECM shows that each countries milk prices have been standardised for fat and protein.