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Physical performance / financial performance.... Ne'er the twain shall meet?

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ABSTRACT

The historic development of farm reporting systems has meant an overemphasis upon accounting concepts and formats. The compulsion, in New Zealand, of compliance reporting inhibits reports which reflect progress toward farmer and farm objectives and the underlying nature of the production processes. The utilisation of more sophisticated planning tools and the uptake of objective measures of system performance provide an opportunity to rethink and reconstruct farm management report contents and formats.

A model report is presented which attempts to harmonise the physical production processes and the financial consequences of these processes. The report undertaken for a winter milk dairy farm; extends the concept of enterprise to separate land, conservation, herd and replacement activities; clarifies input-output relationships within and between these activities; and analyses financial consequences of these relationships.

The model provides; a framework for understanding the relationship between production and finance; a framework for developing comparative measures of performance which take account of systems differences which current industry benchmark's ignore; and a basis for meeting the compliance demands all individuals face.

Keywords: Economic Value Added(EVA); value chain; profitability; intra-farm analysis.

INTRODUCTION

Accounting, farm management and agricultural science professionals have a need to communicate to agricultural industry participants the results of their respective appraisals, findings, recommendations or opinions. The nature of the industry has meant that this communication process has relied heavily upon 'standard' or 'average' benchmarks to place this information in perspective.

The tools for analysis of farming performance have evolved, in the main, from macro analysis undertaken for policy purposes (Ministry of Agriculture and Fisheries, Livestock Improvement, NZ Meat and Wool Boards' Economic Service etc). Important in the logistics of these developments is the need to use readily available data sources. As all farming businesses are required to file a return of assessable income these have become the base for industry statistical analysis.

The use of such "standards" based on averages whether physical or financial was debunked thirty years ago (Candler and Sargent, 1962; Mauldon and Schapper, 1970), individual differences in operating environment and farming objectives disqualifying comparison.

The accountant derives a measure of assessable income. The rules for compilation are derived from the Income Tax Act, and guided by accounting standards and generally accepted accounting principles (GAAP). Despite the disclaimer warning users that the financial statements have been prepared for taxation purposes and therefore should not be relied on for any other purpose, financial statments are used by a range of people and for a variety of purposes including:

- the farmer, as an indicator of past period 'profitability'.
- the financier, as a compulsory element in client appraisal.
- agencies such as Livestock Improvement Corporation Ltd and New Zealand Meat and Wool Boards' Economic Service as a base for industry analysis.

Assessable income as derived for Inland Revenue falls short of the economists view of income which was described by Hicks in 1946 as; *the maximum value which one can consume during a week, and still expect to be as well off at the end of the week as one was at the beginning.*

The adjustments made to assessable income to derive measures of economic profitability (Effective farm surplus, rate of return on total farm capital etc) by the New Zealand Meat and Wool Boards' Economic Service, or Common Farm Surplus as used in the analysis for the Tui Milk Dairy Farmer of the Year, highlight some of the differences between 'income' and 'assessable income'. The adjustments made relate to treatment of; managerial reward, unpaid family labour, valuation of assets, interest, depreciation and differing accounting practices (e.g treatment of Goods and Services Tax or accruals).

Evidence from the Tui Milk Dairy Farmer of the Year 1992 competition (Lowe *et al.*, 1992) indicated there was no significant correlation between a ranking by assessable income and one by 'common farm surplus'. The question arises, if farmers aspire to a level of profitability, what measure should be used to plan and monitor achievement?

Partial measures of systems performance (particularly productivity and cash flow) capture neither the holistic or whole farm view espoused by farming systems researchers (Parker *et al.*, 1994), nor the value creation activities undertaken by farmers to either sustain system performance or enhance future values (e.g toward security, succession or retirement).

Despite the development of: a more holistic view of farm management, a more refined understanding of production functions (via agricultural research), and an increasing array of 'objective' measures on-farm (weighing livestock, pasture monitoring, herd testing, etc.) traditional measures of economic performance have changed little over the past decade.

This paper approaches performance assessment with the view that a concept of income, and resources committed to deriving that income, can be developed which subsumes system characteristics and personal needs. The primary purpose for such assessment is to enhance farmer understanding of systems relationships and how these interact with personal objectives. The proposed model is designed to align: physical and financial performance; past, present and future performance and position and enable inter-farm comparison from a base of intra-farm analysis.

The structural underpinning for the model comes from strategic analysis and management (non-farming) literature and is applied within the context of a winter milk production dairy unit. Whilst the model builds on farmer perceptions and needs, the concepts utilised (e.g. value chain, economic value added) enable development of comparisons on an industry or international basis.

STRUCTURAL UNDERPINNING

Historically primary sector management has been characterised as being fundamentally different from manufacturing or service sectors. Evidence is mounting that generic business managment skills are applicable in farm management, for instance, Total Quality Management systems applied to beef production. Harling (1992) found that successful farm managers think more strategically about their businesses than do less successful farm managers. Harling claimed his results reinforced the call for the farm management profession to draw on conceptual tools developed in business management to provide a sounder understanding of what farm managers do.

Strategic analysis has two main thrusts (Grant,1991):

- the link between strategy and the external environment,
- the role of the firms resources as the foundation for firm strategy.

The former supplies an instrument for portraying the assumption of value through the value chain; a concept developed by Porter (1985) in which he claimed an understanding could be used to:

- identify sources of differentiation,
- choose the breadth of competitive scope,
- improve organisational design
- perform cost and efficiency analysis
- identify sources of interrelationships between business units.

The premise which underpins the value chain concept is that any business operation exists to provide one or more products that are of value to others. This applies for the firm as a whole or within business units. Whilst a farm (in our example a dairy farm) is portrayed as a single entity we believe that intra farm comparison of resource allocations will provide a valuable insight into farm performance.

In New Zealand the vertically integrated dairy industry assumes an ownership interest throughout the chain: land based feed production, conservation of feed, animal conversion to whole milk, storage/transportation of liquid whole milk, whole-milk processing, fat based extraction and processing, protein based extraction and processing, storage, distribution, wholesale, and retail. Individual farmers are remote to end users and have no influence on price. Milk quality is the one significant factor they control that does affect price. The industry value chain suggests the individual has no influence past the initial processor yet Industry ownership resides with suppliers, and, the products marketed by the NZ Dairy Board are in competition with product sourced elsewhere. As the raw material producer generally absorbs the inherent business risk of downstream processing, distribution and marketing, it is important that these producers have an awareness of the role they play in the value chain and the value added within each link of that chain.

The second thrust of strategic analysis sits comfortably with the first if we extend the value chain into the business. It also reflects a common view of the farming business, resting as it does on the two premises;

- internal resources and capabilities provide the basic direction for a firms strategy
- resources and capabilities are the primary source of profit for the firm.

Corporate managers and analysts are continually searching for measures of performance which provide greater insight into sustainable performance. A recent measure capturing attention is Economic Value Added (EVA).

Stewart, (1991) introduced the concept of EVA as a residual after deducting from operating profits for each line of business, a capital charge relating to both the cost of debt and cost of equity. EVA will increase if operating profits can be made to grow without tying up any more capital, if new capital is invested in **any or all** projects that earn more than the full cost of capital, and if capital is diverted or liquidated from business activities that do not cover their cost of capital (Stewart, 1991).

EVA, at the simplest level, takes into account the total cost of capital, both debt and equity. Macro-analysis has traditionally standardised for a return to management in the derivation of Economic Farm Surplus, but not the cost of capital as returns are subsequently looked at in relation to debt, equity or total assets.

The merging of the concepts of value chain, resource based foundation for strategy and Economic Value Added, has been used to develop the framework for analysis of intra-farm performance.

THE MODEL FRAMEWORK

The Farming System

Massey No.1 farm was chosen as an example for development of the framework. The farm was converted to a winter milk production (WMP) unit in 1988 and has been farmed as a commercial unit since that date. Considerable data is available from routine measurement, e.g.; weekly measurement of pasture cover and growth rates; monthly liveweight and

condition scores; weekly climatic measures; herd testing; paddock records for soil type, fertility, pasture composition and fertiliser/production history; and quantification of harvested and purchased supplements.

In the observed year mating commenced on the 1 June 1992 with a 96% submission rate being achieved during the six weeks of artificial insemination. Pregnancy testing undertaken in October recorded 88% as pregnant. Two hundred and four cows were in milk at 20 July 1992. All cows were dried off by 5 February 1993 calving in 1993 commenced in early March with production peaking in April at 1.43 kg milksolids per cow per day. Seventy three replacement weaners were reared and one hundred and fifty eight calves reared for sale. Replacements, both weaner and heifer, were grazed off during the period. Thirty hectares was shut for pasture silage and six hectares for maize silage production. Pasture production was 12442kg dry matter equivalent per hectare for the year with an increase in average pasture cover at closing (1685kgdm) over opening (1441kgdm). A major influence on farm production in 1992 was the flooding of 90 hectares for 12 hours on 23 July. 12 hectares affected by silt requiring reseeding. Grazing, supplements, maintenance and performance consequently were adversely affected.

For the purposes of illustration a husband and wife partnership has been assumed with an imposed capital structure consistent with a couple obtaining ownership in 1987 after ten years of contract milking and eight years of partnership with senior family members on this property.

Links in the Chain

The on-farm links in the chain used were, land based feed production, conservation of feed and the milking herd. Whilst weaner and heifer rearing do not form a direct part of the chain, competition for resources requires that their contribution to the enterprise is subject to the same scrutiny as the core activities.

Within each activity (i.e.land, conservation, herd, heifers and weaners) the analysis follows the following steps:

\+ Outputs
\- Inputs
= **Contribution Margin**
\- Capital Charge
\- Asset Maintenance/Replacement
\+ Fixed Asset Value Change
\+ Livestock Value Change
= **Economic Value Added**

Each activity generates outputs which have a market value, eg the pasture transfer between conservation, herd, weaners and heifers is made on the basis of opportunity cost of leasing the land at 6% of market value in relation to dry matter produced. The other transfers; silage, milk solids, calves to weaners, weaners to heifers and heifers to herd are made at farmer defined market values. By acknowledging intermediate markets the model is able to explicitly recognise the interdependence of the activities.

Inputs and outputs are expressed in financial as well as physical units. Outputs are expressed in terms of kilograms dry matter equivalent (Land and conservation), kilograms of live weight (Replacement weaners and heifers), and kilograms milk solids and kilograms of liveweight (Herd and Totals). Inputs are expressed in terms of kilograms of dry matter equivalent.

Pasture allocation, conserved feed production and consumption, purchased supplements, grazing, urea, opening and closing pasture cover were sourced from the feed budget. Financial data associated with outputs and inputs were sourced from standard accounting records.

Labour is allocated to each activity by the owners. The costs of labour are charged to activities at an hourly rate which incorporates; a pre-tax return necessary to sustain the family unit to ensure they are as well off at the end as at the beginning; actual expenses incurred by way of wages, accident compensation levy and administration etc; a charge for capital, asset maintenance and asset replacement for assets used by the farm family or employees eg house and car. These human resource costs are allocated to activities prior to calculation of the contribution margin.

After calculation of contribution margin adjustments are made for;

- Capital charge - a reflection of the cost associated with the financing of assets (including opening stocks of pasture and feed, livestock, working capital, investment in Tui Milk Products and fixed assets measured in terms of opening market values) committed to each activity. In our example this charge comprises the actual interest cost of debt finance (9.1%) and an imputed charge on equity (6.5%).
- Asset maintenance - current year expenditure on maintenance of assets.
- Asset replacement - a charge against current year production for the ultimate replacement of assets required in the production process ensuring the sustainability of current operations by maintaining operation capability. The charge is derived from; closing replacement values, plus the difference between opening and closing replacement value less residual value; this total is then divided by the life of that asset type.
- Fixed asset value change - the difference between opening and closing market value of fixed assets.
- Livestock value change - the difference arising from revaluation of closing livestock, which are valued at opening market values in contribution margin calculations, to closing market values.

Analysis

Table 1 summarises total system performance. Economic value was added for the system as a whole ($81709 or 5% of assets committed).

Table 2 illustrates EVA by activity. Value was added through conservation ($6760 or 15% of committed assets) and the herd ($94279 or 22% of committed assets). The activities related to land (-$8757 or -1% of assets committed) and replacement rearing (-$5028 for weeeners and -$5545 for heifers or -25% and -11% of committed assets respectively) did not add value. The former may be a reflection upon economic 'realism' (or lack thereof) attaching to lease rentals (6% of market value) which have been used to value dry matter produced. The latter

TABLE 1: EVA Analysis System Total

		Total Kgs	Total $
+ Total Outputs		122374	579069
- Total Inputs		1682144	365763
= Contribution Margin			213306
Conversion kg per 1000kg		70	
Contribution Margin			37%
Less			
Capital Charge	Rate	% Capital	
- Debt	9.1%	39%	53697
- Equity	6.5%	61%	59055
		% Assets	
- Asset Maintenance/Replacement		5%	69491
Add			
+ Fixed Asset Value Change		5%	73615
+ Livestock Value Change		-8%	-22969
Equals			
= Economic Value Added		5%	81709
Asset Committed			$1,498,403

illuminates a case which has been costed and debated in a number of forums yet not in quite such stark relief (Luscombe *et al.*, 1985; Jackson, 1983; Ridler, 1983).

Table 3 and 4 reconcile physical inputs and outputs shown in total in Table 1 to those shown by activity in Table 2. These tables illustrate the greater detail available (both in physical and financial terms) in activity reports which support the summaries contained in Tables 1 and 2.

TABLE 3: EVA Analysis Outputs.

	Activity				
	Calves	Herd	Weaners	Heifers	Total
Kg Milk Solids					
Tui Dairy Products		66814			66814
Calves		6090			6090
Household		431			431
Kg Liveweight					
Sales	18960	18615			37575
Stock Change		18070	534	-7140	11464
Transfers-Out	6205		14850	33750	54805
Transfers-In		-33750	-6205	-14850	-54805
Sub Total	25165	76270			
Total	101435		9179	11760	122374

TABLE 4: EVA Analysis Inputs.

	Activity				
	Calves	Herd	Weaners	Heifers	Total
Kg Dry Matter Equivalent					
Milk solids	6090				6090
Meal	6000	23780			29780
Haylage		9563			9563
Urea		77600			77600
Silage		361500			361500
Pasture		1014935	24782	77725	1117442
Grazing Off			31101	49068	80169
Sub Total	12090	1487378			
Total	1499468		55883	126793	1682144

The model in Table 2 provides an insight into the often hidden cost of dry matter production. Direct costs attributable to this activity amount to $37 per tonne of dry matter. Additional costs associated with the assets committed take that cost to $102 (37+24+26+15=102) per tonne of dry matter, a figure more appropriate for comparison with non-land systems. The positive Fixed Asset Value change ameliorates this cost by $57 per tonne of dry matter.

Conversion rates calculated (Herd, 68kg (milkfat + liveweight) per tonne (dry matter equivalent) input; Weaners, 164kg(Liveweight); Heifers, 93kg(Liveweight)) can be compared with expectations based on research both to calibrate the model and to assess performance.

The purpose of this paper is not to report the analysis but to demonstrate the framework. The results revealed are sufficient to confirm the model provides a fresh perspective of dairy system performance. The ability of the model to accommodate system diversity including personal objectives, as well as providing a rational base for international comparison, supports our contention that physical and financial performance can be integrated to give valuable insights into economic performance.

The analysis does not purport to 'reveal all' and interpretation is enhanced when complemented by information derived from herd testing, mating, breeding, paddock records, calving spread etc. records. Acknowledgement is made that measures used in the analysis incorporate subjectivity, eg personalised profit is a subjective concept. The objectivity implied by current measures of assessable income is illusory, implying an accuracy and precision which is unwarranted. A disclaimer which may well attach to our analysis . . . *is that EVA has been prepared for the farm owner only, based on principles of income described by Hicks and principles of production continually being upgraded by agricultural science, which are not in conformity with generally accepted accounting principles(GAAP). Accordingly EVA should give an insight into system performance which bears little resemblance to assessable income previously computed and reported as required by the Income Tax Act.*

Future enhancements

A refinement of the calculated conversion ratio which could enhance comparability would be the recalculation of output units in terms of milk solid equivalents. Introduction of explicit measures of waste and quality will further enhance the model.

No attempt has been made to measure consumable stores (other than conserved feed). Investment, and year to year variations in these items can be substantial. Sensitivity of EVA to the introduction of these items will be tested.

The Massey No.1 dairy unit is viewed as an atypical dairy farming system. A revised balance date of 28 February would appear more appropriate for this particular system. Whilst our contention is that there is no typical farm (dairy or other) extensive calibration of the model is required over a range of farming systems.

TABLE 2: EVA Analysis by Activity.

	Land			Conserved			Herd			Weaners			Heifers		
	Kgs	$	$/100kg Ouput	Kgs	$	$/100kg Output	Kgs	$	$/100kg Output	Kgs	$	$/100kg Output	Kgs	$	$/100kg Output
+ Total Outputs	1415762	54689	39	269000	57326	213	101435	429762	4237	9179	15237	1660	11760	22055	1875
- Total Inputs		51414	37	269000	28883	107	1499468	240899	2376	55883	17908	1951	126793	26660	2267
= Contributions		3275	2		28443	106		188863	1861		-2671	-291		-4604	-392
Conversion kg per 1000kg							68			164			93		
Contribution Margin		6%			50%			4%			-18%			-21%	
Less															
Capital Charge Rate															
-Debt 9.1%		33917	24		1669	6		15520	153		714	78		1876	160
-Equity 6.5%		37302	26	1835	7		17069	168		785	86		2063	175	
	% Assets			% Assets			% Assets			% Assets			% Assets		
- Assets Maintenance /Replacement	2%	21419	15	27%	12479	46	7%	32468	320	8%	1604	175	3%	1521	129
Add															
+ Fixed Asset Value Change	9%	80606	57	-12%	-5700	-21	-0%	-1151	-11	-0%	-70	-8	-0%	-70	-6
+ Livestock Value Change							-12%	-28375	-280	6%	816	89	10%	4590	390
Equals															
= Economic Value Added	-1%	-8757	-6	15%	6760	25	22%	94279	929	-25%	-5028	-548	-11%	-5545	-472
Asset Committed		$45,569	173		$433,098	4268		$19,926	2171		$52,355	4452			

CONCLUSION

The stimulus for this contribution was an unease with measures currently used for ascribing relative system performance. The main obstacles to new measures were seen to be accounting formats which failed to reflect the personality of farming systems. The strictures of accounting in turn limit organisations such as Livestock Improvement Corporation in their development of industry benchmarks from readily available data sources.

Forums such as the NZ Society of Animal Production continue to enhance understanding of production functions. Farm management research is developing an increasingly holistic and personal orientation. Despite such advancements the measures of economic performance have remained the same.

There is a need for a 'truer and fairer' framework in which to explore on-farm and beyond farm performance. Production functions and value chains are not routine reading for most farmers but annual accounts and budgets are. We have demonstrated that financial statements can be effectively used to communicate messages which, whilst based on complex theory or technology, reflect the underlying systems' characteristics and the economic consequences of decisions.

The activity based/EVA framework described and illustrated in this paper provides a perspective for evaluating system potential and bridging the chasm which has existed between production and finance.

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REFERENCES

Candler, W.V. and Sargent, D. (1962). Farm Standards and the Theory of Production Economics. *J.A.E. Vol.* **15**, No. 2, Dec 1962, pp.282-290.

Grant, R.M. (1991). *The Resource-Based Theory of Competitive Advantage: Implications for Strategy Formulation*, California Management Review, Spring 1991, pp.114-135.

Harling, K.F. (1992). A test of the applicability of strategic management to farm management. *Canadian Journal of Agricultural Economics*, **40:** 1992, p.129-139.

Hick, J.R. (1946). Value and Capital. Oxford:Clarendon Press.

Jackson, R.G. (1983). What is an Optimum Replacement Rate, *Dairy Farming Annual 1983*, Department of Animal Science, Massey University, pp.97-101.

Livestock Improvement, 1993 Economic Survey of Factory Supply Farmers, Livestock Improvement Corporation, Nov. 1993.

Lowe, K.I., Lynch G.A., Stone J.A. & Kirton, I.F. (1992). The Tui Farmer of the Year Competition, *Dairy Farming Annual* **1992,** Department of Animal Science, Massey University, pp.78-84.

Luscombe, P., Scott, G., Sanderson, J. (1985). Building up From Within, Proceedings Large Herds Conference, South Taranaki 1985, pp.32-33.

Mauldon, R.G. and Schapper, H.P. (1970). Random Numbers for Farmers, *The Journal of the Australian Institute of Agricultural Science*, Dec 1970, pp.281-284.

NZ Meat & Wool Boards' Economic Service. The New Zealand Sheep and Beef Farm Survey 1991-92, *NZ Meat & Wool Boards' Economic Service*, Nov. 1993.

Parker, W.J. Gray, D.I. Lockhart, J.C., Townsley, R.J. (1994). Farm Management Research in New Zealand and It's Contribution to Animal Production, New Zealand *Society of Animal Production Proceedings* **54:** 357-362.

Porter, M.E. (1985). Competitive Advantage, Glenwood, Illinois. The Free Press, 1985.

Ridler, B.J. (1983). The Cost of Replacements, *Diary Farming Annual* **1983,** Department of Animal Science, Massey University, pp.103-108.

Stewart, III, G.B. (1990). The Quest For Value: a guide for senior managers. HarperCollins, United States of America, pp.118-119.