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**TOWARDS AN OPERATIONAL DEFINITION OF
SUSTAINABILITY IN NEW ZEALAND DAIRY FARMING**

A thesis presented in partial fulfilment of the
requirements for the degree of
**MASTER OF PHILOSOPHY IN RESOURCE AND
ENVIRONMENTAL PLANNING**

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ABSTRACT

Sustainability is increasingly viewed as a desirable goal of agricultural development and environmental management. The emergence of the sustainability concept has seen a concomitant rise in the interest of its measurement. It has been suggested that through the use of sustainability indicators, the attainment of the agricultural sustainability goal can be assessed.

It is therefore the aim of this thesis to develop indicators based on the concept of agricultural sustainability. An environmental accounting model is used as the framework within which these indicators were developed and evaluated.

The agricultural sustainability concept is first examined and defined, giving significance to its economic, ecological and social dimensions. It is emphasised that the attainment of sustainability involves the balance and trade-off amongst these dimensions, which can be demonstrated through the dynamic interactions of these dimensions.

The thesis then focuses on the discussion of the methodological considerations, which are important in developing an operational framework for measuring agricultural sustainability. The ideal properties and characteristics of sustainability indicators are identified and critically examined. An evaluation of the different types of input-output models that could be used in conjunction with such indicators were discussed. Input-output models were seen to be critical in developing an operational framework, as they

are capable of representing the interactions between the economic and ecological dimensions of sustainability.

The second part of the thesis concentrates on the application of the methodology to measuring changes in sustainability of New Zealand dairy farming industry. After a brief historical survey of dairy farming, a number of sustainability indicators for the industry are identified. These indicators were then operationalised using a spreadsheet-based input-output model of the New Zealand dairy farming industry. The model consisted of an eight-sector dairy farming sub-model (based on MAF farm types), connected to a 25-sector input-output sub-model of the New Zealand economy. The model focused on selected resource inputs and pollutants.

Indicators derived from the input-output model were developed to reflect the economic, ecological and social dimensions of the sustainability concept. These indicators then were evaluated by monitoring their behaviour in different scenarios for the future of New Zealand dairy farming, by using the environmental accounting method developed earlier. It is observed that the policy goal of sustainability in dairy farming generally can not be attained to the full satisfaction of all the economic, ecological and social indicators. Along the way, trade-offs and balances among these factors have to be made. It is up to the policy and decision makers to weigh the various alternatives, with the indicators providing adequate information upon which rational choices can be based.

This thesis demonstrated the possibility of formulating sustainability indicators and using them as an evaluation tool in spite of the current state of available data and

methodological constraints. It is recommended that a baseline of agricultural sustainability parameters should be established and associated relevant expertise be developed, if operational measurement of the agricultural sustainability goal is to be pursued.

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