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PERFORMANCE
OF NEW ZEALAND IRRIGATION SYSTEMS
AFTER TRANSFER

A thesis presented in fulfillment of the requirements for the degree of
Master of Applied Science
in Agricultural Engineering
at Massey University

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ABSTRACT

This paper discusses the performance of irrigation schemes after they were transferred from Government control to irrigation companies in New Zealand. This study tested two hypotheses: a) privatisation of irrigation schemes in New Zealand has produced very large efficiency gains, and b) the privatisation of irrigation schemes in New Zealand has been very successful.

These hypotheses were proven.

Water costs for the same scheme would have been higher if it had not been privatised. The staff size was at minimum level. The companies seemed to be consistent with the O&M budget for water charge. Legal, financial and technical advice and services from professional groups were made available to the irrigation companies.

The water costs were controlled by irrigation companies. The schemes received strong physical, financial and spiritual support from farmers and shareholders. No evidence of documented environmental side-effects was found. The farmers indicated that they would stay with the current management instead of returning to the past system under which they received financial supports from the Government.

However, as the resource consents were thought to be a strategic threat and the irrigation companies seemed not to be prepared to enforce their capability in human resource management, technology development and company infrastructure, the irrigation companies could face difficulties in the future.

A number of recommendations were made as follows:

1. The water costs should be calculated on the basis of life cycle-costing.

2. The irrigation companies should consider contributing funds for training and research activities in order to achieve high efficiency for irrigation systems and irrigation techniques. Research would not only bring about improvement of efficiency in irrigation, but also gain glory for New Zealand science in the international arena.

3. The irrigation companies may need to consider re-establishing the New Zealand Irrigation Association to act as a focal point for the irrigation companies. This type of organisation would facilitate the networking of information, and the sharing of experience amongst its members.

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ABBREVIATIONS

FTE	Full-Time Equivalent
MAF	Ministry of Agriculture and Fisheries
MWD	Ministry of Works and Developments
PIM	Participatory Irrigation Management
PPI	Producer Price Index, compiled by Statistics New Zealand, is a series of quarterly economic indicators designed to measure the change in the prices received by producers in the New Zealand economy ("output") and the change in the prices of goods and services paid for by producers in the economy ("inputs") (New Zealand Official Yearbook, 1997)
RWC	Relative Water Costs
WUA	Water Users' Association
LCA	Life Cycle Analysis
LCC	Life Cycle Cost
PER	Personnel Employment Ratio
OMR	Operation and Maintenance Ratio
SOE	State Owned Enterprise

CHAPTER 1

INTRODUCTION

1.1 Overview of New Zealand

1.1.1 Physical Setting

New Zealand has an area of some 270,000 square kilometres. The country is long, narrow and very mountainous, with less than a quarter of the land below sea level. The country is divided across its centre into two more or less equally sized main islands: the North and South Islands. The country stretches for 1800 km between latitudes 34^0S and 47^0S. Mean daily maximum temperatures in Summer range from 25^0C in Northland to 18^0C in Southland. In Winter, the corresponding range is 14^0C to 8^0C, respectively (Choudhary and Baker, 1994). It has a population of 3.78 million people (on 31 December 1997, from New Zealand Official Yearbook 1998) and has traditionally been dependent on its agricultural industry. Agricultural products constitute nearly 60 percent of New Zealand's export earnings. Only 9% of New Zealand is considered arable.

The native Maori name for New Zealand is ***Aotearoa***, meaning "land of the long white cloud." This is how the first Polynesian Maori canoe travellers first perceived the country in their sightings from journeys across the Pacific Ocean. Such "long white clouds" are the basis of a benign temperate climate (Choudhary and Baker, 1994) which permits year-round plant growth and/or double-cropping in most farming areas.

The average annual rainfall ranges between 650 and 1500 mm in productive areas. This ensures that 40% of the land mass remains under permanent introduced pasture, with intensive animal grazing year-round (Choudhary and Baker, 1994). The pattern of rainfall determines the use in different areas;

pastures, gardens, and crops are raised in the dry east, while cattle raising and dairy-farming dominate in the wet west. Irrigation is required only in the semiarid areas such as the Otago district of South Island (Fukuda, 1976).

1.1.2 Water Resource Development in New Zealand

Water resource development in New Zealand began when the first European settlers arrived in 1840 (Viner, 1987). As a result, society has put increasing demands on New Zealand's water resources (see Appendix 1).

Population centres became established on the coasts of both islands and, in addition to that required for domestic needs, water was needed for agricultural industries. The introduction of refrigeration in 1882, which allowed the export of butter, cheese, and meat, in addition to wool, increased the demand for water. Rivers were used for access to the interior of the country, initially in search of grazing lands. Internal migration in the South Island was stimulated by the Central Otago gold rush in 1861. A new population pattern emerged at the beginning of the twentieth century in association with urbanisation and industrialisation. In the 1880s, almost two-thirds of the population lived in the South Island, but with increased industrialisation there was a general drift to the North Island.

The growth of industry has resulted in greater demands being made on water resources, and for treatment of industrial wastes. In the 1920s, hydro-electric power development began to harness the considerable river potential (Natusch, 1964). Agricultural intensification and diversification since World War II also have changed water use, particularly with the irrigation boom in the period 1965-1975. By 1978, agriculture used almost twice as much water as industrial and domestic uses put together.

1.1.3 Irrigation in New Zealand

Irrigation reduces the risk of drought, doubles the output of traditional farming products and provides the opportunity for diversification into more intensive types of land use (Mosley, 1992). Irrigation, which uses 1.1km^3 per year (in 1988), is the major consumptive use of water in New Zealand (Mosley, 1992).

In 1995, New Zealand had 285,000 hectares of irrigated land. New Zealand has achieved a high level of irrigation development, nearly similar to the United States, with about 0.080ha of irrigated area per head of population. This is high compared with 0.041ha per head of population for mainland China, 0.051ha per head of population for India, and 0.045ha per head of population for the World (FAO Production Yearbook, 1996).

There are three main types of irrigation in New Zealand: surface, sprinkler and trickle irrigation. The method used depends to a large extent on what the farmer intends to do with the land, i.e., cropping, horticulture or grazing. It depends also on the farmer's personal preference, labour requirements, the shape of the farm, its terrain, soil types and availability of water (Ministry of Works and Development, 1984; Farley, 1994).

Irrigation's arrival in New Zealand was closely linked with the Central Otago gold rush of the 1860s (Ministry of Works and Development, 1984), as shown in Appendix 1. It was the miners who first constructed contour races, sometimes kilometres long, to take water to their claims for sluicing gold. The settlers learnt to adapt their water races to irrigate the land. Where irrigated, the land showed great potential for both pastoral farming and orchard development. This attracted the Government of the time into financing some 12 community irrigation schemes in Central Otago between 1910 and 1935, beginning with the Ida Valley Scheme (Ministry of Works and Development, 1984; Farley, 1994).

Irrigation began with small diversions in the Canterbury Plains in 1878 (Fukuda, 1976). But it was not until the 1930s, that the Government turned its attention to the Canterbury Plains (Ministry of Works and Development, 1984). In 1959, the Department of Agriculture produced evidence from the Ashburton-Lyndhurst area to show that partial irrigation, on smaller holdings, could double stock-carrying capacity and income per hectare. Thus, irrigation was proving a worthwhile investment and received financial assistance from Government, which expected an acceptable return on capital costs.

In 1988, New Zealand had 234,000 hectares of irrigated land, of which some 45 percent was supplied by the Government constructed irrigation schemes. The remainder was largely private irrigation comprising of individuals or small groups of (up to six) irrigators using primarily groundwater (Farley, 1994).

It should be noted that great technological efforts have been made to improve water utilisation in irrigation. But the existence of obsolete administrations prevents the widespread use of these techniques in agriculture (Chambouleyron, 1996). If the irrigation management is decentralised, farmers and other stakeholders could play a more important role in the management of water resources (Keating, 1993).

The privatisation of the irrigation schemes was initiated in the early 1990s under the Irrigation Schemes Act, 1990. New Zealand is one of many countries which has adopted a programme transferring the management authority for irrigation systems from government to local irrigation companies.

1.2 Statement of the Problem

There was a strong interest in finding out about the potential benefits of privatisation of irrigation schemes in New Zealand. For these reasons, it is relevant to obtain and examine the evidence available on the privatisation of irrigation schemes with key indicators. Therefore, performance parameters are

required in order to assess the dynamic changes before and after transfer of the irrigation systems. This was an important focus of this study.

1.3 Objectives of the Study

The main aim of this study was to evaluate the transfer of New Zealand irrigation systems through the findings of performance indicators, before and after their transfer from Governmental control to irrigation companies.

The study was divided into 5 interrelated objectives:

1. To review literature related to the performance of irrigation and water supply systems;
2. To establish potential performance indicators related to efficiency gains and success of the privatisation of irrigation and community water supply schemes at pre- and post-transfer times.
3. To identify irrigation and community water supply systems to study;
4. To design a questionnaire and to collect data; and
5. To analyse data and write up the report.

1.4 Importance of the Study

The change of irrigation management approach from that of the state-run system to that of the private entities has great significance in irrigation history. The transfer offered an opportunity to farmers who used water to manage and control the schemes by themselves. Subsequent performance of the irrigation and community water supply would indicate how the transfer programme was working.

The finding would provide guidance to policy makers, water resource managers, researchers, irrigation companies and individual farmers, and

identify ways to develop better management systems. Finally, this study takes its place in the extensive body of literature on irrigation management and will enable further research activities in irrigation management to be carried out.

1.5 Thesis Outline

Chapter One - Introduction - provided a brief overview of New Zealand and agricultural development trends in New Zealand and their connection to irrigation policy. The problem was then stated, and the objectives were defined. Moreover, the importance of the study and the outline of the thesis were presented.

A review of literature followed in the next chapter. This discussed relevant studies and publications on such aspects as: irrigation, participatory irrigation management approach, privatisation of irrigation schemes in New Zealand and performance indicators of the transfer.

The methodology used in the study was outlined in Chapter 3. This included a description of the conceptual framework and the research design used. The location of the study area was presented and the types of data collected were discussed.

The results of the study were presented and discussed in Chapter 4. Tables and graphs were illustrated to provide or give a clearer understanding of the various discussions.

Chapter 5 presented the case studies of irrigation schemes visited. Finally, the closing Chapter summarised the results from the study and conclusions were drawn. A set of recommendations and related areas for further research was also provided.