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INTEGRATED WASTE MANAGEMENT

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Abstract

Integrated waste management is considered from a systems' approach, with a particular emphasis on advancing sustainability. The focus of the thesis is to examine the various subsystems as they apply in a New Zealand context and to scrutinize the developments of these subsystems in a time where there has been a renewed worldwide interest in sustainability.

Fonterra is evaluated as a prime industry example along with the Ministry for the Environment as the government representative. Both Fonterra and the government have made some progress in addressing the problem of waste and so far they have followed a similar path as their sectors worldwide in that they have addressed parts of the waste issue but not as an ongoing and systematic approach to provide a sustainable solution to waste.

The initial aim was to investigate the current state of practice to gain an insight into the integration of waste management. Research into the relevant literature along with a combination of data collection and interviews were organised with practitioners and stakeholders from Fonterra, the Ministry for the Environment, local government waste officials, local and central government politicians, consultants and non-governmental organisations.

The thesis identifies pockets of an integrated approach to waste management internationally and even some elements of a systems approach. The path to an integrated approach usually starts with a simple framework like a waste management hierarchy operating in one medium and progresses to multiple media. A range of existing tools provides the flexibility for a systems approach focusing on the processes that increase resource efficiency. The use of leverage points at opportune times can enable substantial improvements in a waste management system that provides opportunities for ongoing systems based integration and the saving of both money and resources.

Additionally, integrated waste management systems require agents including site managers, company head office, councils, central government and the community to work together in a cooperative, transparent and coordinated manner. The thesis has provided a way forward to move towards sustainability through an integrated approach to waste management.

Preface

The genesis of this thesis came about as a result of looking for a research-based direction for my life. I had been a programme director for the Bachelor of Engineering (Environmental) and the associated Diploma in Environmental Technology for five years. During that time I had led the degree from the stage of meeting the academic standards for accreditation to the Institution of Professional Engineers to full accreditation. I could have kept on doing the same thing for many years to come, but I wanted to have a new challenge in my life.

During the time I was a programme director I had been conducting research and publishing, and that was an area that excited me. While considering that I wanted to spend more time following my passion of research and publishing, I thought it would be good to undertake a coherent body of research – and that was the start of this thesis.

One of the hard bits is always deciding what area and what topic. I knew that something in the waste minimisation area was appropriate (having focused on this area in my lecturing and research) and I investigated the possibilities around this within the disciplines of engineering and science. In the end the technological aspects of engineering did not excite me so much as I knew that, while technology is extremely important in the area of waste, it was not the prime solution to New Zealand's waste problems – we have well engineered landfills that capture leachate and methane emissions, wastewater treatment plants that can almost produce drinking water quality outputs, filters and scrubbers to take care of air emissions and industrial energy-saving methodology was well known. To me there was more to waste minimisation than technology and with all the technology there was still a long way to go until New Zealand could say that we are a sustainable country.

It was with this in mind that the idea of integrated waste management evolved as a topic.

Integrated waste management has been around for a long time. In the earlier years, in the 1970's, it was centred on the newly invented concept of a waste management hierarchy. With the advent of the idea of pollution prevention in the 1990s waste researchers suggested the idea that the waste management hierarchy could also be applied to media other than solids – liquids, gases and energy.

Along with these expansions were an underlying set of tools that could be used to assist waste minimisation – voluntary, educational, legislative and economic.

To make the tools work required people to engage and move the frontier forward. The people come from all walks of life – central government, local government, business and people in the community.

Just as the main body of experimental work for this thesis was being completed the waste scene in New Zealand went through a momentous step forward with the introduction of New Zealand's first waste focused legislation. The opportunity arose for me to make a significant contribution to the passage of this legislation, by leading the team within the Ministry for the Environment

that was responsible for assisting Parliament in getting a workable piece of legislation enacted – the Waste Minimisation Act 2008 finally passed on 25 September 2008. It was quite an unorthodox process in that the Bill started off as a Private Member's Bill (the Waste Minimisation (Solids) Bill), was supported by the government and then was finally unanimously passed by Parliament. This provided valuable background to this thesis.

In developing the thesis I have seen a systems approach showing how people can work together (from disparate backgrounds and viewpoints) to use a variety of tools to minimise waste in an integrated manner. While elements of this are commonly found in many countries, this thesis brings them all together.

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My sincere thanks go to my initial primary supervisor, Dr Lesley Stone from the School of Environment who provided the initial vision for this topic and guided me through the initial phases to add the framework to the concept. Your ideas for a topic were by far the most exciting of all of those I surveyed and took me down the path I wanted and needed to go.

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I am especially grateful to Spring Humphreys from Fonterra Cooperative Ltd who has opened many doors to make this thesis possible. From our initial conversation sitting on a wall in Nelson where you gave instant support, through all the phases of working with Fonterra to achieve this successful outcome, I am eternally grateful. Your help and friendship has been a great support to me.

My wife Ljubica has been a constant source of strength, encouragement and motivation through the many phases of this project and even made allowances for those times when the mountain seemed endless and the inspirational discourse was hidden in mist. You provided to me the dose of reality and the beacon of hope for which I am continually indebted.

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Glossary

ACT	Australian Capital Territory
BOD	Biochemical oxygen demand
CIP	clean in place
CIWMB	California Integrated Waste Management Board
COD	chemical oxygen demand
DAF	Dissolved Air Flotation
Defra	Department for Environment, Food and Rural Affairs
EMAS	Eco-Management and Audit Scheme
EMS	Environmental Management System
EPR	Extended Producer Responsibility
EU	European Union
EUREPGAP	European Partnership for Good Agricultural Practice
EW	Environment Waikato
GRI	Global Reporting Initiative
HDPE	High Density Polyethylene
IE	Industrial Ecology
IPP	Integrated Product Policy
ISO	International Standards Organisation
KPI	Key Performance Indicator
LCA	Life Cycle Assessment
MAF	Ministry of Agriculture and Forestry
MfE	Ministry for the Environment
MoRST	Ministry of Research, Science and Technology
NGO	Non-Government Organisation
NH ₄ ⁺	Ammonium Ion
NO _x	Mixture of nitrogen oxides
NYC	New York City
OECD	Organisation for Economic Cooperation and Development
P2	Pollution Prevention
PM ₁₀	Particulate with a diameter smaller than or equal to 10 µm
RIS	Regulatory Impact Statement
RMA	Resource Management Act
RONZ	Recycling Operators of New Zealand
SMF	Sustainable Management Fund
SO _x	Mixture of sulfur oxides
TLA	Territorial Local Authority
UN	United Nations
UNEP	United Nations Environmental Programme
USEPA	United States Environmental Protection Agency
WasteMINZ	Waste Management Institute of New Zealand