

# Enablers and barriers to the development of Life Cycle Management in the manufacturing sector of New Zealand

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**Abstract** Life Cycle Management (LCM) is a product management system that aims to reduce the environmental impacts of a product throughout its life cycle and across its supply chain. Within the New Zealand manufacturing sector there are significant numbers of small and medium enterprises (SMEs) that are relatively new to the concept of LCM. This paper focuses on the findings from an LCM pilot project initiated in 2008 seeking to build capability for LCM within the manufacturing sector. The project included workshops for SME staff training to increase understanding and use of Life Cycle Assessment (LCA) for each participant company, and a research project supported by several business, government and research organisations. Despite a strong focus on methodological issues of LCA, literature examining adoption factors for LCM is sparse. The enablers and barriers for LCM adoption encountered by six case-study companies are discussed. Examples of barriers and enablers from business functions – including management focus, sales and marketing, product design, and supply chain management – are provided and compared with international research findings on enablers and barriers to implementing LCM in manufacturing firms. Results identify 23 potential key enablers and 23 key barriers experienced by the SMEs. Results also indicate that having a strong business case that includes financial rewards is critical for successful LCM adoption, as is tailoring elements of the project for each firm.

## 1 Introduction

The LCM project is a collaborative project between Landcare Research, the Ministry of Economic Development, the Ministry for the Environment, Business

New Zealand, and New Zealand Trade and Enterprise. The 5-year project (2008–2013) seeks to build capability among New Zealand manufacturing companies for product-oriented environmental management.

This paper discusses the results of a 20-month pilot project (between April 2009 and December 2010) with six case-study small to medium sized enterprises (SMEs) investigating the enablers and barriers experienced in adoption of LCM. Results from the case studies are intended to inform the development of wider use of LCM and spread knowledge to other New Zealand companies. SMEs make a significant contribution to New Zealand's economy – in 2009 they accounted for 41.9% of the economy's total output, and 97.2% (463,278) of enterprises employ 19 or fewer people [1].

## **2 The LCM pilot project**

The activities in the project consisted of several different work streams made up of 19 different components. The research presented here was an integral part of the project activities and completed in parallel to the project and training activities listed below. The main activities of the project included:

- The appointment of a Champion to act as a focal point for activity;
- 10 training workshops to teach the Champions about different aspects of LCM, including environmental supply chain management and carbon footprinting;
- A streamlined life cycle assessment completed by Landcare Research to quantify the environmental impacts of a product for each of the case study firms;
- Enrolment in an environmental management scheme (Enviro-mark) for a year.

## **3 Methodology**

Several different research techniques were employed during the project. Primarily, data were collected through interviews, survey analysis and training and evaluation workshops with the LCM Champions. The research into enablers and barriers was completed in two stages.

The first stage allowed a baseline to be established for the measurement of LCM adoption. The second stage allowed changes to the LCM pilot project to be captured through follow-up interviews that were completed approximately 18 months after the companies had embarked on the project. These interviews included assessment of the variables that contributed either to successful implementation or to difficulties.

Key enablers and barriers experienced by the case-study firms were established by assessment of potential sequencing and timing of enablers and barriers, and the influence of a firm's defining characteristics including company size, type of product and growth strategy on the enablers and barriers observed.

#### **4 Literature review**

An international literature review identifying LCM adoption factors was undertaken against which case-study findings could be assessed [2]. The review found that LCA/LCM research to date had largely focused on the methodological issues of LCA, while few studies focused on how findings from LCA studies have been implemented by firms.

To supplement the sparse LCM adoption research, literature on environmental supply chain management and cleaner production was reviewed. The review identified seven adoption factors (among 10 overall adoption factors) operating at the organisational level: clear strategic intent and ability to tailor LCM to the firm's context; ongoing management commitment; an existing sustainability culture and practice; the ability to apply LCM pragmatically across the firms' functions; the firm's ability to learn and change; and LCM benefits outweighing the costs.

Twenty-five enablers and barriers were identified that influence those adoption factors and collectively they highlight the degree of organisational change management required in LCM adoption. The review also found that successful LCM extends beyond organisational boundaries, with new inter-organisational collaboration required to manage a product's environmental impacts across its supply chain.

## **5 Company case studies**

The two firms highlighted were chosen to provide examples of different approaches to LCM adoption by firms in the project. Both firms are also among the most successful adopters. The following discussion of each company focuses on some of the distinguishing features of adoption of LCM in each case.

### ***5.1 Fletcher building roof tile group case study***

The Fletcher building roof tile group's main product is a steel roofing tile coated with a crushed stone or paint finish before installation. The company is a traditional manufacturing company that employs 130 staff and has a major presence in the domestic housing market and strong export sales to 80 countries worldwide.

Unlike several other companies within the project, the firm is large enough to have invested in improving its environmental performance, e.g., working towards ISO14001 certification for their environmental management system (EMS) and employing a full-time environmental coordinator.

The building group had received a growing number of requests for environmental information, and was confused over how to respond strategically to 'green' product requirements. LCM activities helped structure responses to product environmental issues and highlighted methods for future proofing the business against potential product requirements by providing a deeper understanding of the issues through the use of LCA.

The enablers to initiate LCM adoption within the firm were particularly strong. For example, during the project the LCM Champion's role was switched to the Group Engineering & Product Development Manager who operated at a senior level in the company. This switch noticeably benefited LCM adoption and implementation by providing a better link to the senior management of the firm and increasing the influence of the Champion's activities on others. Alongside the advantage of an influential Champion, LCM adoption was well aligned to projects already operating within their EMS; in particular, improved waste reduction provided quick financial returns.

Due to its strong links within one of New Zealand's larger companies and the relatively simple supply chain for the product, the firm believed it had the scale and influence necessary to make major changes upstream through LCM adoption. The company perceives that environmental aspects are 'part and parcel' of good business practice among suppliers who operate responsibly.

## *5.2 Verda case study*

Verda supplies the market for outdoor timber products in Australia and Europe. The company develops and manufactures decking, raised gardens, fencing systems, balustrades, pergolas and furniture made using plantation-grown Forest Stewardship Council (FSC) Radiata. Verda aims to reduce environmental impacts in all aspects of its operations.

Verda had recently undertaken a re-branding process with sustainability becoming a core part of their brand as part of a shift from commodity timber products to value added export products for Australia and Europe. The company aims to reduce environmental impacts in all aspects of its operations including sustainable manufacturing and using sustainable supplies.

Primarily, the LCM project was used as a demonstration of the firm's environmental commitment to customers in new markets, e.g., France. The LCM project activities enabled Verda to show their strategic approach to tackling those issues important to customers and to maintain the firm's licence to operate in an environmentally sensitive market. Verda decided to communicate their participation and aims in the project internally as early as possible, and also to involve senior managers in the project to ensure LCM adoption was prioritised across different business functions.

Project activities were focussed on several areas within the supply chain and combined with ongoing efficiency projects such as Lean. Lean manufacturing is focussed on increasing efficiency and decreasing waste in business processes and operations based on principles originally developed by Toyota [3]. Upstream cost savings were identified by simplifying energy use at the sawmill and by upgrading chemical management for timber coating. Downstream changes were made to packaging, generating further cost savings. LCM activity increased productivity and growth.

Verda accepted that life cycle thinking needed to be introduced into their product development processes to design out problems in the disposal of the product and provide further unique selling points for the company's product.

## **6 Discussion**

While the research was conducted on a small sample of six companies, it was able to follow the companies closely during the adoption process, which facilitated the identification of a number of rich insights.

The enablers and barriers experienced by the six firms are clustered into six foundation activities that describe the sequence of essential activities needed for LCM: building a strong business case; commitment of the senior management; capability of company to initiate LCM; integration of LCM thinking into everyday operations; supply chain management; and development of commitment to continuous improvement, as shown in Figure 1. The first three foundation activity areas relate to enablers and barriers in the set up of the project. For example, a business case captures the reasoning for initiating a project or task and clarifies the investment has value and strategic importance. The latter three areas are required for implementation to develop opportunities for continuous improvement.

In total, 23 potential key enablers and 23 potential key barriers were identified. The six foundation activities emphasise that LCM extends beyond organisational boundaries, and while firms undertaking LCM initially need to focus on organisational adoption, new forms of inter-organisational collaboration are also often required to manage the environmental impacts of a product throughout its life cycle. Some factors also affect the business culture of the firm but present problems, e.g., the lack of environmental reporting in New Zealand often means there is little pressure to provide public information as a mechanism of stimulating improvements in LCM adoption. It is the pattern of the different enablers and barriers in each individual case study, in combination with the balance between these factors in each foundation area, that provides the greatest insights into LCM adoption.

The research indicated the smallest firms experienced common enablers and barriers in attempting LCM adoption. For example, it was harder for smaller firms to invest in dedicated Champions and systematic implementation of LCM. Smaller firms also tended to have less historic data collection, creating barriers to LCA

assessment. The firms' small size, however, made it easier to communicate to staff and integrate LCM across business functions.

In contrast, the ability of the larger firms to communicate and integrate LCM across functions depended both on having effective formal processes and on the degree of influence the LCM Champion had across each organisation. However, these two barriers were tempered by enablers due to brand or operational values held by company employees to deliver the project objectives.

**Fig.1: Key enablers and barriers experienced by the majority of the six firms (highlighted in bold). Enablers and barriers not in bold were highlighted by some firms but not the majority.**

One of the critical tasks in identifying the key enablers and barriers involved analysing the influence of different firm characteristics, including the reasons for adopting LCM, company size, product type, market type, supply chain issues, data management, and time in the LCM project. The application of LCA in the companies and the use of environmental management were also assessed.

Establishing a clear strategic intent and tailoring the LCM approach to the firm's context was identified as fundamental to the success of LCM adoption in all cases. Articulating the b



was also completed during the recent global economic recession and this event undoubtedly influenced the firms' approach to LCM adoption, e.g., emphasising the need for quick financial wins. Further research is therefore needed to investigate whether this finding would represent a true reflection of widespread LCM adoption.

**Table 1: Enablers and barriers explicitly highlighted during the LCM project from those described in the international literature at the organisational level**

Adoption factor categories	Enablers	Barriers
Clear strategic intent and ability to tailor LCM to firm's context	Culture of investment in long-term strategic benefits Consideration of environmental issues embedded into operations Influential senior manager involvement	Low engagement by board Competing priorities (e.g., rapid sales growth) Lack of corporate reporting
Cost/benefit of LCM adoption	Business growth in environmentally sensitive markets	Delayed and intangible nature of LCM benefits
Ongoing commitment	Dedicated LCM champion	Small firms lack resources
Existing sustainability culture and practice		Alignment with other initiatives and environmental product objectives in staff evaluation
Ability to apply LCM in processes and functions	Aspects of product process cannot be changed Lack of firm data to demonstrate LCM performance	Formal product development procedure Early tailored internal communications
Ability to learn		Lack of data to monitor or drive change and inability to link change to business case

Skills of key staff		Non-cross-departmental approach to LCM

## 7 Conclusions

While a number of key enablers and barriers can be identified for LCM adoption, these will play out differently from one firm to the next. The strengths and weaknesses of each firm need to be identified and projects tailored accordingly before LCM adoption activities begin. A one-programme-fits-all approach should be avoided in the design of LCM support projects; instead, an overall framework approach that can be flexibly customised to each organisation is required.

Developing a business case for LCM requires senior management to be more strategic and innovative in the way they address environmental issues and potential economic benefits, particularly when the requirements of the markets in which they seek to operate are factored in. The short-term nature of strategic plans in many SMEs poses a significant barrier for LCM adoption, which tends to work best on medium- or long-term strategic and operational objectives, e.g., developing new, greener products, working with suppliers to reduce environmental impacts or future-proofing the business against upcoming environmental product standards.

- [1] [www.med.govt.nz/templates/ContentTopicSummary\\_\\_\\_\\_39289.aspx](http://www.med.govt.nz/templates/ContentTopicSummary____39289.aspx), (Accessed 04.05.2011).
- [2] Mortimer C, Enablers and barriers to adoption of Life Cycle Management. NZLCM Centre Working Paper 01/11, New Zealand Life Cycle Management Centre, Palmerston North. 2011.
- [3] [www.lean.org](http://www.lean.org) (Accessed 15.05.2011)

