Lincoln University

Te Whare Wānaka o Aoraki

CHRISTCHURCH·NEW ZEALAND

Lincoln University Digital Thesis

The relationship between carbon accounting systems and organisational learning

A thesis

submitted in partial fulfilment

of the requirements for the Degree of

Master of Commerce and Management

at

Lincoln University

by

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Lincoln University

2011

Abstract

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The focus of environmental management is mainly from the financial accounting perspective, which is measuring and reporting (Parker, 2000). However, studies on carbon accounting systems from the management accounting perspective deserve more attention. The purpose of this research is to explore and understand the relationship between carbon accounting systems and organisational learning. This research is one of few attempts to study this relationship in New Zealand.

The qualitative research method (a single case study) is applied to this study, with interviews and observations used as the primary data collection methods. The site for this research is an organisation that has adopted the carboNZero programme in recent years.

It was found that the implementation of a carbon accounting system can trigger generative learning in an organisation. However, it does not necessarily mean that all organisations which implement carbon accounting systems are learning organisations. In order to truly become a learning organisation any inherent problems of the organisation have to be considered and solved to remove resistance to changes in the organisation. The outcome of this research will provide a basis and direction for future research on similar topics. Practitioners will find the findings of this research useful in the implementation process of carbon accounting systems and in facilitating generative organisational learning.

Keywords: management accounting, carbon accounting systems, organisational learning, case study, qualitative research

Acknowledgement

First of all, I would like to thank my supervisor Dr Tracy-Ann De Silva, whose encouragement, guidance and support enabled me to develop an understanding of the subject

Then, I would like to give my deepest gratitude to my co-supervisor Jack Radford, who not only helped me to gain initial access to the research field, but also gave me great suggestions and critical comments to improve the quality of the research.

Lastly, I give my regards and blessings to all of those who supported me in any respect during the completion of this research.

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Chapter 1 Introduction

The increasing appearance of the phrase "carbon accounting" and "emission trading schemes" in various media has generated considerable interest worldwide. Of particular interest here is how carbon dioxide and other Greenhouse Gases (GHG) are related to accounting and how they affect our everyday life. The simple answer to this question is that the burning of fossil fuels, such as oil and coal, releases GHG, and global warming is increasingly attributed to GHG emitted into the atmosphere (Ratnatunga, 2007). The consequent increasing concentration of GHG is claimed to affect food production systems, human health, energy demand and water availability (Challinor, et al., 2009).

The Kyoto Protocol is regarded as a key point in beginning the process of slowing climate change. The protocol sets binding targets for member states to reduce GHG emission, in the period from 2008 to 2012, by 5.2% from their 1990s levels. It also allows individual governments to take steps to reduce GHG emission via different methods, such as the introduction of emission trading programmes, voluntary programmes, carbon taxes, and regulations and standards on energy efficiency and emissions (The World Business Council for Sustainable Development [WBCSD] & World Resources Institute [WRI], 2004).

New Zealand, being one of the earliest signatories of the protocol, has established an emission trading programme called The New Zealand Emission Trading Scheme (NZETS). The objective of this scheme is to achieve the GHG reduction targets set for New Zealand as specified in the Kyoto Protocol by using a market-based carbon trading scheme. At the organisational level, the GHG emissions will be measured and priced, so the financial impact of emissions will need to be incorporated into decision making processes (Ratnatunga, 2007; Sépibus, 2007). As a consequence, many organisations are seeking to improve the carbon-efficiency of their operations, fundamental to which is the need for an effective measurement system. This has led to an increased demand for comprehensive and credible carbon accounting systems.

A number of carbon emission measurement tools have been developed worldwide: Footprinter (UK) and CarbonNavigator (AU) are good examples. A recent business survey showed 34 different carbon emission measurement methodologies used among those 500 companies. As the current focus of environmental management and impact is mainly from

the financial accounting perspective, which involves measuring and reporting (Parker, 2000), these methodologies are simply counting tools without the ability to help users reduce their GHG emissions. In comparison, there are carbon accounting systems which include carbon emission measurement tools, but are far more comprehensive in scope. The question is now how such carbon accounting systems help the users to reduce their GHG emission.

It is claimed that more and more organisations are changing in order to reduce their emissions and other impacts on our environment. To make the change effectively and efficiently, organisations need to first learn how to change. A correlation between change and learning was shown by Kloot (1997), who claimed that changes in organisations positively lead to organisational learning, while Argyris (1977) described organisational learning as the process of detecting and correcting errors within the organisation to respond to both internal and external environmental changes. Carbon Accounting System (CAS) is a component of the Environmental Management Accounting (EMA) system, whereby the measured GHG emission information gathered by the CAS can be used by organisations "in making capital investment decisions, costing determinations, process/product design decision, performance evaluation, and a host of other forward-looking business decisions" (United Nations Division for Sustainable Development [UNDSD], 2000, p. 39). These decisions may relate to either planned or emergent changes in organisations at the fundamental level (Poole & Van de Ven, 2004), therefore, theoretically, these changes will lead to organisational learning which, Senge (2006) concluded, provides organisations with extensive knowledge bases directly related to superior performance. The development of a knowledge-based view of an organisation from the resource-based view of an organisation is very appropriate in the present economic context (Curado, 2006). For organisations that are operating in today's fast changing environment, facilitating organisational learning is a key to survival and long-term competitive advantage (Burnes, Cooper, & West, 2003; Kloot, 1997).

It is postulated that the relationship between carbon accounting systems and organisational learning is not dissimilar to that associated with the implementation of Total Quality Management (TQM) into organisations. It is claimed that TQM pursues continuous improvement through learning, and Barrow (1993) concluded that organisational learning is an intended outcome of TQM. However, research on the relationship between carbon accounting systems and organisational learning is scarce. In the current environment,

understanding the role of carbon accounting systems from the management accounting perspective deserves more attention. This is mainly due to the reason that carbon accounting systems may have the potential to be incorporated into the decision making process and lead to organisation learning. Thus, the aim of this research is to explore and understand the relationship between carbon accounting systems and organisational learning.

Theoretically, by applying Anthony's (1965) management control framework to the GHG emission information generated by the carbon accounting system, the carbon accounting system becomes an integral part of the management control system that interacts with and stimulates generative learning, which is discussed in details in Chapter 2 of this research, in the organisation to adapt to the environmental changes. In order to gain deeper and better understanding of this relationship, a single case study was undertaken. Data used in this research is mainly primary data collected from interviews and observations on site. Details of the research method and case selection criteria are given in Chapter 3.

The aim of this research is to study the relationship between carbon accounting systems and organisational learning by using a single case study method. The main focus of the researcher is on the management accounting natural of carbon accounting systems and their correlation to management control systems in organisations. Therefore, no indepth study was done by the researcher to the financial accounting part of carbon accounting systems, such as the measurement methods of emissions and the types of emission that get measured. These may be some potential resaerch directions for future research relates to this topic.

There are six chapters of this research. Follows the first chapter of introduction is the second chapter which reviews the relative literatures of the research topic. Then the research method is discussed in the third chapter. The fourth chapter presents the findings from the selected case and followed by the fifth chapter which discusses the findings by utilizing the literatures reviewed in the second chapter. The last chapter concludes the results of this research and suggestions provided for future relative researches.

Chapter 2 Literature review

In this chapter of the research previous studies that relate to this research topic are summarised and evaluated. It gives a theoretical basis for this research. This chapter of the research is divided into four sections. The first section presents the importance of carbon accounting. This is followed by the second section, which defines organisational learning and organisational change and the relationship between them, with the last part of Section 2 discussing the meaning and characteristics of learning organisations. Next, the first part of Section 3 reviews the relationship between TQM and organisational learning, and then the two key areas, namely carbon accounting systems and organisational learning, are linked together using the findings from the above literature, Kloot's (1997) research, and Anthony's (1965) management control framework. The last section of this chapter gives the proposition of this research.

2.1. The importance of carbon accounting

The focus of this research is to develop an understanding of the impact the introduction of a carbon accounting system has on an organisation from a management accounting perspective. Therefore, this section will look at carbon accounting systems in an environmental management accounting context.

The Kyoto Protocol advocated that a cap-and-trade scheme be used to control GHG emission. The European Union Emission Trading Scheme (EUETS) is an example of one of the earliest schemes, and is the largest multi-country cap-and-trade scheme. The EUETS has a cap that limits GHG emissions for its member states and, if the capped limit is exceeded, the member state has to buy credits from other countries to offset its over-emitted GHG. To make such a system work, there must be a mechanism that can accurately calculate the level of GHG emission. This mechanism is called "carbon accounting". As mentioned in Chapter 1, carbon accounting has been most often discussed from a financial accounting perspective (Ratnatunga, 2007), however, the situation is now changing.

Schaltegger, Bennett, Burritt and Jasch (2008) concluded that there are an increasing number of organisations that not only report on environmental information, but also incorporate environmental accounting into management accounting, which is known as Environmental

Management Accounting (EMA). The International Federation of Accountants (IFAC) described EMA as the identification, collection, analysis and use of two types of information for internal decision making:

- Physical information on the use, flows and destinies of energy, water and materials (including wastes); and

- Monetary information on environment-related costs, earnings and savings.

The main difference between EMA and traditional management accounting is the inclusion of environmental issues (such as GHG emission), which were not included in the traditional management accounting as emitting GHG was not monetised and, consequently, not recognised as a cost. The establishment of emission trading schemes have dramatically increased the recognition of environmentally-related costs and forced managers to consider GHG emissions into their decision making process. Furthermore, cases reviewed by Burritt's (2004) research show that using EMA can contribute to the reduction of both costs and environmental impacts.

From an external perspective, using a carbon accounting system to measure and report GHG emission can bring real and direct benefits to organisations (e.g. compliance with regulations). According to Ilinitch, Soderstrom, and Thomas (1998), environmental agencies (as regulatory bodies) are the most important stakeholders with an interest in receiving ecological statements. They have the enforcement power to require organisations to produce and deliver information on GHG emissions. They can make organisations take responsibility for not complying with the regulations (Schaltegger & Burritt, 2000). Qian and Burritt (2008) also suggested that the pressure from regulatory bodies is one of the main factors promoting the development of EMA. By complying with the regulations, an organisation can reduce the risk of punishment from regulatory authorities, and help present a positive image to the general public.

To effectively manage GHG emissions, organisations firstly have to be measured using a carbon accounting system. Historically, the focus of carbon accounting systems has mainly been on external measurement and reporting. Sarker and Burritt (2008) provided empirical evidence that the disclosure of environmental information is positively related to the impact on environmental investment decision making by managers. In other words, the more environmental information available, the more environmental issues and future environmental risks are considered by managers in their decision making process.

In contrast to external environmental reporting, EMA is a set of principles and approaches which is more than an environmental management tool, it is an integral part of management accounting. Organisations are faced with an increasing number of management decisions that require environmental issues to be considered, for example, increasing environmentally-related costs. In some countries with strong environmental regulatory regimes, the costs associated with pollution control and monitoring, emission fees and pollution clean-up are significant. For example, according to the public medias, BP's Gulf of Mexico oil spill may cost the company 40 billion USD. Therefore, it is vital to take these costs into consideration when making managerial decisions. In addition, EMA uses both financial and physical information. The financial information may not make much sense to some departments in an organisation, whereas the physical information provided by EMA may be more useful for those, such as production lines, which do not directly deal with financial activities. For example, it is easier for the production lines to understand if the accounting department tell them to reduce their coal usage by 100 tons rather than tell them to reduce their environmental cost by 2%. Furthermore, the researcher concluded that GHG emission information produced by carbon accounting systems can be used in different ways when different frameworks are applied to it. The potential of carbon accounting systems as part of a management control system can no longer be ignored, and CAS should be involved in managerial decision making, strategic formulation and implementation, and control processes.

2.2.   Organisational learning and organisational change

This section discusses organisational learning and organisational change separately. Two organisational learning models are discussed followed by the introduction of the concept of organisational change.

2.2.1 Organisational learning

There are several accepted definitions of organisational learning. According to Argyris (1977), organisational learning is the process of detecting and correcting errors within the organisation to respond to both internal and external environmental changes. Fiol and Lyles (1985) concluded that organisational learning is the process of improving actions through better knowledge and understanding, while Senge (2006) described organisational learning

as a fundamental change in people's minds which enables the environment to be perceived differently, identifies the problems and creates solutions.

Although researchers have different definitions of organisational learning, there is a reasonable level of agreement on one issue, that organisational learning is a useful concept for organisations operating in a fast changing environment. This commonly accepted conclusion is supported by a very important model of organisational learning proposed by Argyris (1995).

The Argyris (1995) model
According to the Argyris (1995) model, there are two different types of organisational learning – single-loop learning and double-loop learning. The differences between these two models are discussed bellow.

Single-loop learning (see Figure 2.1 below) is a simple one-way process that involves detecting errors and correcting errors. Corrective actions are taken when errors are detected in the organisation. The outcomes of the corrective actions are compared with expected results and stop when the outcomes match the expectations. In single-loop learning, the existing core strategies, structures and cultures of the organisations are not changed. Changes are only made at the behaviour level of the organisations. In many cases, changing the organisation's behaviours is not good enough. It may resolve the problem temporarily, but not in the long term.

Figure 2.1 Single-loop learning

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        ┌─────────────┐
        │ Fundamental │
        │ Principles  │
        └──────┬──────┘
               │
               ▼
        ┌─────────────┐◄──────┐
        │   Actions   │       │
        └──────┬──────┘       │
               │              │
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        ┌─────────────┐       │
        │    Error    │       │
        │  Detected   │       │
        └──────┬──────┘       │
               │              │
               ▼              │
        ┌─────────────┐       │
        │ Corrective  │       │
        │   Actions   │───────┘
        └─────────────┘
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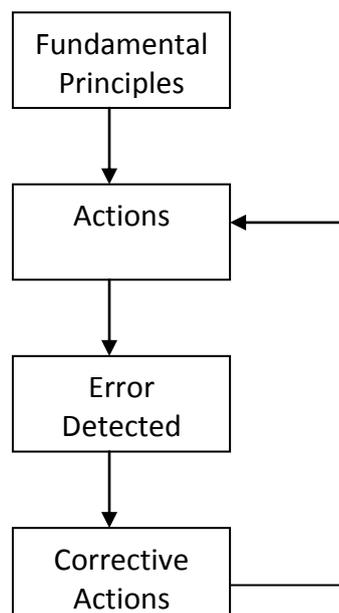
Another approach to correct the errors is to change the underlying factors, or so called 'master programme', that led to the behaviours. This approach is known as double-loop (or generative) learning which allows the organisation to question its assumptions such as strategies, structure and organisational goals. Changes are then made in these fundamental areas to develop better behaviours. Outcomes are not only used to compare with expectations, but also as information resources for the organisation to design new strategies. New strategies lead to better behaviours, and the outcomes give feedback to the organisation for further development, forming a positive circle (see Figure 2.2 below). As a result of this proactive learning approach, the organisation becomes a learning organisation where there is a continuous effort in the organisation to strive for perfection (Lim & Chan, 2004).

Figure 2.2 Double-loop learning

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      ┌──────────────────┐
      │   Fundamental    │
  ┌──▶│   Principles     │
  │   └──────────────────┘
  │            │
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  │   ┌──────────────────┐
  │   │     Actions      │◀──┐
  │   └──────────────────┘   │
  │            │             │
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  │   │      Error       │   │
  │   │    Detected      │   │
  │   └──────────────────┘   │
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  │            ▼             │
  │   ┌──────────────────┐   │
  │   │   Correction     │   │
  └───│    Actions       │───┘
      └──────────────────┘
```
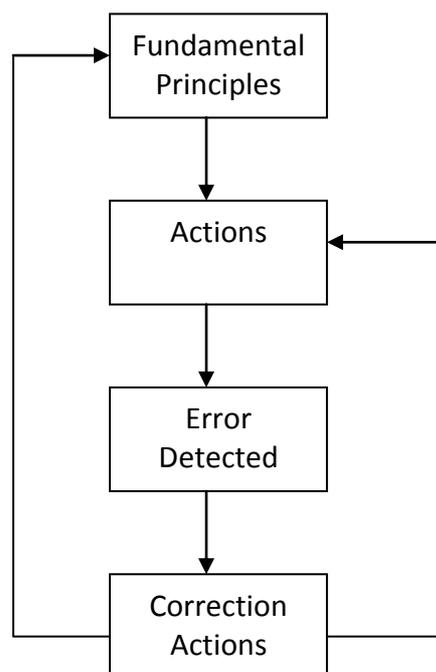
Single-loop learning is useful for organisations in a stable environment that operate under strict rules and routines, such as military organisations as well as some hazardous industries such as nuclear power plants and chemical factories. Changes in these organisations may cause dysfunction, or even disasters. On the other hand, generative learning is the key to facilitating long-term sustainable advantages when organisations are facing a rapidly changing environment. In this case, change at the individual/behaviour level is inefficient,

and learning activities in the organisation should be a continual process. To survive the changing environment, organisations should learn for the future rather than react to the past (Senge, 2006). Therefore, it can be concluded that the existence of generative learning is desirable for most organisations operating in a contemporary business environment.

Thomsen and Hoest (2001) concluded that the learning organisation and organisational learning are two sides of the same coin, with organisational learning as the central activity in the learning organisation. To identify learning organisations, we need to know their characteristics. Some characteristics of learning organisations were concluded by previous studies (e.g. Chen, 2005; Senge, 2006; Sudharatna & Li, 2003; Watkins & Marsick, 1993). Table 2.1 below shows that many of these characteristics were identified in more than one study which means that, although learning organisations are unique and different from each other, they do share some common characteristics. Some of these characteristics are used later in this research to discuss whether or not an organisation is a learning organisation.

Table 2.1: Characteristics of learning organisations

	Watkins & Marsick (1993)	Sudharatna & Li (2003)	Chen (2005)	Senge (2006)
Promote inquiry and dialogue	Yes	Yes	Yes	Yes
Create continuous learning opportunities	Yes	Yes	Yes	Yes
Encourage collaboration and team learning	Yes	Yes	N/A	Yes
Establish systems to capture and share learning	Yes	Yes	Yes	Yes
Connect the organisation to its environment	Yes	N/A	Yes	Yes
Analytical skills to predict how challenges will influence the organisation	N/A	N/A	Yes	Yes
People's commitment	N/A	Yes	N/A	Yes
Decentralised decision making and employee empowerment	Yes	Yes	N/A	N/A

2.2.2 Organisational change

The constancy of change is commonly accepted in the literature on organisational development (Smith, 2011). Burnes (2004) suggested that changes exist both in organisations and the environment in which the organisations operate. Therefore, there should be no doubt regarding the importance of organisational change. The highly competitive and fast evolving world brought about by new technologies and globalisation, requires organisations to make fast organisational changes to survive (Graetz, 2000). However, many companies have struggled when facing major changes such as entering

overseas market, downsizing, and restructuring. Balogun and Hailey (2004) claimed that about 70 % of all changes initiated in organisations ended up in failure or partial failure.

Change has different meanings in different contexts. From the perspective of organisational development, change is, but not limited to, the alteration of strategies, values and behaviors of organisational members for the purpose of improving organisational performance (Porras & Robertson, 1992). Organisational changes may also happen in different ways, but the literature is dominated by planned and emergent change perspectives (Bamford and Forrester, 2003).

The concept of planned change was introduced by Lewin in 1946 (Burnes, 2004). According to Lewin (1951), a planned organisational change project has three steps. The first step is "unfreezing", which means old structures, strategies, behaviors and goals are reviewed and questioned. This first step forms the organizational basis for the second phase, known as "movement", to take place. Here, new approaches are developed to replace the areas suspended in the first step. The final step is "refreezing", when all changes from the second step need to be maintained and incorporated into the organisation, known also as "institutionalisation". This three-step model has been commonly adopted as a general framework for understanding organisational change. During the last sixty years, this three-step model has also been further developed by several researchers to make it more practical (Todnem, 2005). For example, both Bullock and Batten's (1985) four-phase model and Cummings and Huse's (1989) eight-phase model of planned change are based on Lewin's model.

Although the planned change concept is long established and commonly adopted, it has received some important criticisms from researchers such as Wilson (1992) and Burnes (2004). Wilson (1992) argued that planned change is a top-down process, all changes are made in a pre-planned manner. Therefore, this process is highly dependent on senior managers in the organisation and, in many instances, those involved in the changing process do not have a clear understanding of the changes they are making or the consequences of their actions. Burnes (2004) questioned planned change from another perspective. He argued that the planned change approach presumes that all stakeholders are willing to fully participate in the change project and that common agreement can be reached in the organisation. However, this presumption does not always stand up as it ignores

organisational politics and conflict and assumes these issues can be easily identified and resolved (Burnes, 2004). In response to these criticisms, the concept of emergent change was developed.

The concept of emergent change is based on the assumption that organisations are connected to their environment and it is the recognised uncertainty of both the internal and external environments which make it more appropriate than the planned change approach (Bamford & Forrester, 2003). It is also claimed that the pace of change is often too rapid for managers to identify, plan and implement the necessary organisational responses (Kanter, Stein and Jick, 1992). Therefore, rather than being top-down driven, the emergent change approach is a bottom-up process, highly dependent on the majority of an organisation – the lower and middle level members (Bamford & Forrester, 2003). Kanter et al.'s (1992) Ten Commandments for Executing Change, and Kotter's (1996) Eight-Stage Process for Successful Organisational Transformation are examples of practical emergent change models (Todnem, 2005). From these models it appears that the key element of the emergent change approach is understanding change through the change project and at all levels of the organisation. Burnes (1996) argued that, under the assumption of all organisations operating in uncertain and unpredictable environments to which they constantly have to adapt, the emergent change approach is suitable for all organisations, all situations and at all times.

Both planned and emergent change approaches have supporters and applications in academia and practice. Researchers, such as Bamford & Forrester (2003), believe that there is no one best way to initiate change in organisations. By studying practical experience, Burnes (2004) corrected himself and claimed that planned and emergent change are not competitors, mutually exclusive or incapable of being used together but can be combined in a change project with each one appropriate to particular change situations, but neither appropriate for all change situations.

Finally, the relationship between change and learning is indivisible. Mezirow (2000) noted that the entire process of learning is a journey of change – change that is growth-enhancing and developmental. Furthermore, according to Hendry (1996), learning is involved in all three steps of Lewin's planned change model.

2.3 The relationship between TQM and organisational learning

As mentioned in Chapter 1, research in the area of the relationship between carbon accounting systems and organisational learning is scarce. However, there is a stream of research examining the relationship between management control systems and organisational learning. Among these, one of the most popular themes is the relationship between TQM and organisational learning. Brower (1994) described TQM as a structured system for creating organisation-wide participation in planning, and the implementing of a continuous improvement process to meet and exceed customer needs. The TQM concept consists of five strategic principles which are customer focus, process focus, team work, employee participation, and continuous improvement (Murray & Chapman, 2003). Researchers have argued that the impact of the implementation of TQM and carbon accounting systems have some attributes in common. They both:

♦ try to create a culture that facilitate changes in the organisation;

♦ encourage employees to develop at personal and team levels;

♦ encourage employees to actively participate;

♦ use fact-based information for problem solving;

♦ focus on long-term objectives rather than short-term;

♦ collect knowledge from a wide scientific field for application.

Many researchers, for example Senge (2006), Roche (2002), Savolainen (2000) or Sohal & Morrison (1995), have identified a direct relationship between TQM and organisational learning. These researchers claimed that implementing a TQM system can develop organisational learning. Hackman and Wageman (1995) studied organisational learning in the TQM context by using a case study. Their results show that the implementation of TQM can provide learning tools to the employees in the organisation and build a learning organisational culture. They argue that employees in TQM companies acquire knowledge through both single-loop and double-loop learning. Although the above research is mainly qualitative in nature, it provides a sound basis for further empirical studies in the area. Martı́nez-Costa and Jime ńez-Jime ́nez's (2008) empirical study was undertaken on this basis, and the relationship between TQM and the creation of organisational learning in a company was tested statistically with a wide range of Spanish companies. They concluded that there is a positive relationship between TQM and organisational learning, which supports the previous studies. These findings motivated the current research to explore the relationship between carbon accounting systems and organisational learning.

2.4 Carbon accounting systems and organisational learning

Before linking carbon accounting systems with organisational learning, the relationship between management control systems and organisational learning has to be explored.

2.4.1 Management control systems and organisational learning

Kloot (1997) established a clear relationship between management control systems and organisational learning from the "adaptation of changes" perspective. Kloot described organisational learning as detecting and correcting problems within the organisation to fit with the environment, and detecting environmental changes that can cause the fitting problem between the organisation and the environment, then providing solutions to adapt to environmental changes.

Similarly, Lowe (1970, cited in Emmanuel, Otley, & Mechant, 1985, p.8) defines management control systems as:

> …a system of organisational information seeking and gathering, accountability and feedback designed to ensure that the enterprise adapts to changes in its substantive environment and that the work behaviour of its employees is measured by reference to a set of operational sub-goals (which conform to overall objectives) so that the discrepancy between the two can be reconciled and corrected for.

Both of these definitions emphasise the idea of changing the organisation to fit with the environment and Kloot (1997) concludes that the relationship between management control systems and organisational learning is interactive. Management control systems influence how the organisation views environmental changes, and generative learning, as a result, provides solutions (such as restructuring and/or developing of new strategies) to adapt to those changes. This finding is the bridge that links carbon accounting systems to organisational learning. The following considers the relationship between carbon accounting systems and management control systems.

2.4.2 Carbon accounting systems and management control systems

According to Anthony (1965), from the management control perspective, information is useful when organised around a framework (see Figure 2.3). He argued that it is not the information itself that makes sense it is the different frameworks that can be used to make

sense of the information. Applying different frameworks to the same information means the information can be interpreted in different ways and, as a result, it may lead to totally different decisions. Carbon accounting is a process of recording, summarising and reporting the quantity of GHG emissions by direct and indirect human activities. It can provide information on the proportion of different kinds of GHGs, the total amount of GHG emitted, and the allocation of emission from different departments of the organisation. As such, Anthony's (1965) management control framework can be applied to the information provided by the carbon accounting system. In this framework, there is a hierarchy of planning and control activities with strategic planning at the top, management control in the middle, and task control at the bottom. In management accounting, the emission information can be used in five broad categories (Simons, 2000), which include all three levels of Anthony's classification. The five categories are:

i) **Decision making (Strategic planning)**: Environmentally concerned organisations can use the information provided by the carbon accounting system to set goals and future operating directions; for example, decisions as to whether to offset the GHG emission or to completely shut down a heavily polluted sector.

ii) **Signalling (Management control)**: Senior level managers putting focus on the GHG emission information sends clear indications to all the employees that this issue is important, and positive actions are desired by top management.

iii) **Education and learning (Management control)**: Carbon accounting systems provide organisations with information as to what damage their activities have caused to the environment, how the damage happened, and how much damage they have done. Understanding the problem is the first step to finding the solution.

iv) **Control (Task control)**: Managers can use the GHG emission information to analyse the environmental risks that the organisations are facing, and evaluate the improvement/regression that they made on environmental issues.

v) **External communication (External uses)**: The GHG emission information can be used to communicate with external stakeholders (e.g. suppliers, customers and policy makers). The emerging NZETS may influence future performance of the organisations, thus disclosures of GHG emission information can help stakeholders gain more comprehensive knowledge.

Figure 2.3 Insertion of GHG information into Anthony's (1965) framework

In addition, the definition of a management control system by Lowe (1970, cited in Emmanuel *et al.*, 1985) also includes gall three levels of Anthony's classification (Kloot, 1997). Hence, it can be concluded that a carbon accounting system is part of a management control system, when Anthony's (1965) management control framework is applied to the emission information.

2.5   Proposition

Based on the forgoing, the proposition is:

By applying GHG emission information generated from a carbon accounting system, the carbon accounting system becomes an integral part of the management control system and the implementation of the system stimulates organisational changes and generative learning in the organisation. Finally, the organisation transforms to a learning organisation.

This proposition is examined and discussed in the following chapters of this research.

Chapter 3 Methodology

This exploratory research studies the relationship between carbon accounting systems and organisational learning, and examines whether the implementation of carbon accounting systems in organisations can initiate generative organisational learning. This chapter explains the selection of an appropriate research approach and the research method for this study.

3.1.   Research approach

Strauss and Corbin (1990) claim that qualitative research can be used to study phenomena from a new perspective and to gain better understanding. Unlike quantitative research which employs experimental methods and quantitative measures to test hypothetical generalisations, qualitative research seeks illumination and in-depth understanding of the phenomena (Hoepfl, 1997).

There are three important attributes of qualitative research concluded by Bryman and Bell (2007):

i)   The inductive view of the relationship between theory and research believes that the theory is an outcome of the research. In this research, by studying the phenomenon of the changing of learning activities in an organisation, the intent is to develop a theory of the relationship between carbon accounting systems and organisational learning.

ii) The epistemological position is interpretive (Bryman & Bell, 2007) . This means that the focus of the research is to understand how implementing a carbon accounting system brings about organisational learning.

iii) The ontological position is constructional. It means that the changing of the learning activities of an organisation caused by implementing a carbon accounting system does not separately exist from the members of the organisation, but rather continually interact with each other.

This research is exploratory in nature: it studies the relationship between management control systems and organisational learning from a new perspective - the carbon accounting system. As discussed in Chapter 2, there is no established relationship between carbon accounting systems and organisational learning. However, the proposition developed from

related literature which suggests that, theoretically, there could be a positive interaction between the two areas. The aim of this research is to explore and understand this relationship, gaining in-depth understanding of this relationship rather than a simple "Yes or No" answer. Thus, a qualitative research approach is suitable for this study.

Several qualitative research methods are suggested by Creswell and Miller (2000) and Denzin and Lincoln (2008), such as case study research, ethnography and grounded theory. The ethnography method requires involvement in the day-to-day operating of the organisation to enable the researcher to understand it from an insider's point of view. However, a long time period is needed for this method, which is not feasible in this research.

Strauss and Corbin (1990) defined grounded theory as a process of using data collected by multiple methods to produce a theory of the research subject, hence the first step of grounded theory research is data collection. This method is not suitable because some theories are developed as the basis of this research at the beginning stage.

Case study research allows the researcher to explore "in depth a program, an event, an activity, a process, or one or more individuals. The case(s) are bounded by time and activity, and researchers collect detailed information using a variety of data collection procedures over a sustained period of time." (Stake, 1995, as cited in Creswell, 2003, p.15). Stake (2003) claims that case study research is a common way to conduct qualitative inquiry. Yin (1994) claims case study research is the preferred research method for explanatory research questions such as "how" and "why", because "such questions deal with operational links needing to be traced over time, rather than mere frequencies or incidence." (Yin, 1994, p.18).

Therefore, case study research method is adopted in this study because it can be better fitted into the given one-year time frame.

Case studies can be undertaken using the single-case method or multiple-case method. According to Stake (2003), multiple-case study research is useful when a given case may not be understood without knowing about other related cases. Also, according to Yin (1994), multiple-case study research can increase the chance of producing meaningful results. However, even when there is more than one case that needs to be studied, while studying each case, there is a need to concentrate on the case and put considerable effort into

understanding its complexities (Stake, 2003). Rowley (2002) concluded that single-case studies are appropriate when the case has something special to reveal and single-case studies work well as preliminary research for future multiple-case studies. The nature of this research is exploratory rather than a replication and the topic of this research is unique within the New Zealand context. In addition, using single-case study research enables timely and cost effective research. Therefore, the single-case method is used in this study.

3.2. Data collection

Unlike quantitative research, the meaning of generalisability is different from the qualitative researcher's perspective (Stoddart, 2004). According to Golafshani (2003), the quality of a research is positively related to the generalisability of the findings. However, it does not lead to the conclusion that the quality of qualitative research is necessarily poor. The validity or trustworthiness of qualitative research can be tested and improved by converging multiple and different sources of information. This method is called triangulation, which can help researchers eliminate their bias and increase the truthfulness of propositions (Golafshani, 2003). Triangulation is "a validity procedure where researchers search for convergence among multiple and different sources of information to form themes or categories in a study." (Creswell & Miller, 2000, p.126). Therefore, in order to increase the quality of this research, multiple sources of data will be collected. The four main data collection methods adopted are:

i) Interview (primary data)

The interview is probably the most popular method of data collection in qualitative research (Bryman & Bell, 2007). There are two major types of qualitative interview: the unstructured interview and semi-structured interview. The semi-structured interview is preferred in this research. Unlike an unstructured interview, which is very similar to a conversation where the interviewee is allowed to answer freely, a semi-structured interview is more organised and clearer on the topics to be discussed. Although the interview may not exactly follow the schedule, most of the questions and wording will be used as prepared.

ii) Non-participant observation (primary data)

Non-participant observation is adopted in this research to collect information in a work setting. It is a research technique whereby the researcher watches the subjects of the study, with their knowledge, but without taking an active part in the situation under scrutiny. To compare with participant observation, non-participant observation allows the

collection of rich and directly observed data within the working environment over a short period of time and for relatively lower cost (Cooper, Lewis, & Urquhart, 2004). By considering the timeframe and budget for this study, non-participant observation is preferred.

iii) Historiography (secondary data)

Historiography helps researchers to better understand the organisation's past. Hence, it enables comparison of past activities with present activities and focuses on the changes that have been made. In addition, the historical context can provide links and bases to the researcher for interview design.

iv) Document analysis (secondary data)

Document analysis is best used as a supplemental data collection method. It can enrich and enhance the data gathered via other methods (Yin, 1994). Potential documents for use include meeting minutes, letters, memos, publications, internal/external reports, newspapers and magazine articles. It is very important to assess the quality of the documents before using them. According to Scott (1990), the quality of the documents can be assessed based on four criteria: authenticity, credibility, representativeness and meaning. Bryman and Bell (2007) rate this set of criteria as extremely rigorous.

3.3. Case selection

This section discusses why the carboNZero programme was chosen for this research, and discusses the selection criteria for the research site.

There are two carbon accounting systems currently available in New Zealand: the carboNZero programme and FoundationFootprint. Both of them were developed in New Zealand by New Zealand owned organisations. FoundationFootprint is a web-based carbon accounting system developed by Revolution ID Limited in Auckland, and is currently being used by the North Shore City Council. In comparison, the carboNZero programme has the following advantages that make it the preferred carbon accounting system:

- carboNZero is internationally recognised. It was the first GHG certification scheme in the world to receive international accreditation under the auspices of the International Accreditation Forum (IAF).
- carboNZero is more widely used than FoundationFootprint; at the time of writing, more than 200 companies are seeking carboNZero certification, and thus it provides a larger population of organisations to choose from.

- The carboNZero programme at the time this research commenced was developed about eight years ago, and many of its features have been improved during this period. In contrast, FoundationFootprint is still under development. Some of its features were not available until late 2009.

3.3.1. The carboNZero Programme[1]

The carboNZero programme is a certification process that complies with the GHG Protocol[2] and ISO 14064[3]. Landcare Research New Zealand developed the carboNZero programme in 2001 based on over a decade of research on climate change, GHG measurement and carbon monitoring. Landcare Research is a New Zealand Crown Research Institute owned by the New Zealand Government. The carboNZero programme is a leading practice with the goal of providing robust tools for individuals, organisations and events to reduce their GHG emissions or carbon footprint, and mitigate the effect of any remaining unavoidable emissions, with the highest level of credibility and integrity. It is the first GHG certification scheme in the world to receive international accreditation under the auspices of the International Accreditation Forum (IAF). This accreditation means the carboNZero programme offers a framework for businesses in New Zealand and overseas to measure and report their carbon footprint that has been verified against a global standard and which is accepted in 50 major world economies.

There are five key steps in the carboNZero programme (Craig, 2007):

i) *Measure:* Measuring GHG emissions raises awareness of climate change impacts and identifies opportunities to manage and reduce emissions.

ii) *Manage:* Reducing GHG emissions is good for the atmosphere and good for business. It requires organisations to make changes to the ways that they manage energy, water, waste and biodiversity. In taking up the challenge to reduce GHG emissions, organisations are setting out on a sustainability journey that will bring many other benefits.

iii) *Mitigate:* Offsetting the remaining unavoidable emissions creates funding that is invested in projects such as native forest regeneration and renewable energy generation.

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[1] Retrieved from carboNZero web site at http://www.carbonzero.co.nz/index.asp.
[2] The Greenhouse Gas Protocol (GHG Protocol) is the most widely used international accounting tool for government and business leaders to understand, quantify and manage GHG emissions.
[3] The ISO 14064 standard consists of three parts. For more details about ISO 14064, see http://www.iso.org/iso/search.htm?qt=14064&sort=rel&type=simple&published=on.

iv) ***Verify:*** External verification is required to ensure the emission reduction plan is followed by the participating organisation. It helps the carboNZero programme to continue to reflect international best practice.

v) ***Marketing:*** The carboNZero logo can be used by qualified organisations in their advertisements.

Landcare Research New Zealand has also developed tools for carboNZero which support the programme. EMANAGEMENT is a good example of such a tool. It is a system that can be adopted and used by companies to monitor their daily emissions. These tools are available to all companies and it is their decision whether to adopt or not.

3.3.2. Case selection criteria

According to the carboNZero's database, there were 77 companies/organisations/events that have adopted the carboNZero programme. Some selection criteria have to be identified in order to find the most suitable case for this research.

Representativeness is an important criterion in case selection, because it is positively related to the generalisability of the findings. A typical case may represent a larger population than an atypical case. However, sometimes the potential for learning of the case is the primary criterion (Stake, 2003). Stake argued that learning a lot from an atypical case is better than learning a little from a typical case. In addition, factors such as accessibility and information availability may also influence the potential of learning.

This research is about the relationship between carbon accounting systems and organisational learning. Therefore, the target case should, first, be an organisation. The selection of the organisation is based on the following criteria:

- A well structured organisation that can represent a group of organisations;

By studying a well structured organisation can increase the generalisability of the findings of this research. It enables other researchers to apply this research to other similar well structured organisations. It also reduces the influence of other organisational factors that may have on the result of this research.

- An organisation that has recently adopted the carboNZero programme and claimed success;

This criterion makes sure that the data collected is valid and the findings are up-to-date, especially in this research where most data used is primary data that collected from

interviewees. The data collected from people who have recent memory of the implementation of carboNZero programme can increase the validity of the data. Organisations satisfy this criterion should also have better documentation of the whole implementation process and willing to cooperate with the researcher.

- An organisation that makes a commitment to the community and social responsibility; and

This kind of organisations is more than likely to participate in this research, because they see themselves as corporate social citizens who are responsible for improving the society.

- An organisation with a good level of accessibility and information availability.

This research involves in-depth study of the organisation once it has been selected. The organisation must be able to provide a high level of accessibility and information availability to enable the researcher to gain deep and wholistic understanding of the phenomena.

Few organisations were identified as meeting all of the above criteria.

3.3.3. Gaining access

In a case study, many researchers suggest using relationships with relatives (e.g. family members, friends, supervisors) to initially approach the target organisation (Buchanan *et al.*, 1988). In this case, the initial contact was organised by the researcher's Associate Supervisor, who is a business associate of the Chief Executive Officer (CEO) of one of the target organisations. During one of their meetings, the Associate Supervisor mentioned this research to the CEO, who was interested and passed the information on to several of his senior managers.

Before finally deciding to use this organisation as the research case, a meeting was arranged with the Environment Manager. During the meeting, it was explained how the study might be of value to the organisation and how the organisation might assist in the study. At the end of that meeting, a mutual agreement was made between the two parties, and permission to conduct interviews and observe employees' operations was granted. Relative documents which were not available to the public, such as meeting minutes and internal reports were provided by the Environment Manager during the research process. Other secondary data, for example published financial statements and news article, used in this research was all

collected from public accessible sources such as company website and magazines. Details of the organisation are given in Chapter 4.

3.4. Interview Questions

It was discussed in Section 3.2 that a semi-structured interview is preferred in this research. Before conducting the interviews, a list of questions was drawn up, (see Appendix A) based on the initial contact with the organisation. The questions were asked in different orders and some of the questions were not asked at all, depending on the circumstance of each interview. The question list was used only as a guideline. These questions set the boundaries of the interviews and enabled a certain level of control to be maintained by the interviewer. To reduce the likelihood of leading most of the questions were open in nature, which allowed the interviewees to answer freely. By using these questions, the researcher tried to encourage the interviewees to provide in-depth and vital information, and inspired the interviewees to come up with different opinions. The researcher tried not to use closed questions that could be answered with "Yes" or "No". The questions were asked to prompt conversations, which then led to new questions. For example, "How does this programme relate to your daily work?" be followed by "Do you think this programme has any impact on your personal life?" Depending on how the interviewees responded to such questions, useful information was obtained by asking for examples.

The question list was developed during the research process, based on information collected from previous interviews since many levels of the case company, from the CEO to the general employees were covered. Some questions were put to only certain employees. Sometimes the questions required changing prior to the interviews, due to the interviewees' responsibilities and positions in the company. For example, questions such as "What is the motivation for adopting the programme?" can be better answered by interviewees from the management level. The questions were designed to reduce some research bias and none of the questions mentioned organisational learning.

3.5. Conducting and transcribing the interviews

In this case study research, primary data was mainly collected from interviews conducted over several visits. Seven formal interviews, involving the CEO, three department managers, two senior managers, and a group of two employees from the same department were held

and several informal interviews conducted in the company's cafeteria. The interviewees were between 35 and 50 years old.

The interviewees were often contacted by email to confirm the interview time and venue. Formal interviews were conducted in the interviewees' offices and company's meeting rooms. Informal interviews were conducted in the company's cafeteria. Before the interviews started, the researcher asked for permission to use the digital voice recorder. All the formal interviews were recorded on a digital voice recorder and transcribed by the researcher. Several of the employees who were interviewed informally felt uncomfortable with the voice recorder, so the interviews were recorded by note-taking. Further notes were made immediately after the interviews to record data gained from observations, or for example, when the researcher was able to have a close look at the employees' offices, the maintenance workshop, the operating plant, and some employees' daily activities.

All interviews were conducted during the company's operating hours. Therefore, it was important to keep in mind the limited time available. The length of the formal interviews ranged from 25 to 60 minutes each. The length of the informal interviews was not recorded. However, from the amount of information collected through informal interviews, the researcher estimated approximate time of 20 to 30 minutes. Five out of the seven formal interviews were ended by the researcher due to the researcher's awareness of the timing issue. The researcher tried not to interrupt the interviewees' work and reduce the impact of this research to the organisation.

3.6. Coding and analysis

The researcher used Microsoft Word 2003 (MS Word) for the coding and analysis of the interview transcript. QSR Software's NVivo 8 was considered as a tool for coding and analysis, but it was not adopted for this research. Comparing NVivo 8 and other similar systems with MS Word, using MS Word has the following advantages:

1. The researcher is already familiar with the MS Word. It is one of the software being used everyday by the researcher for the last few years. Many functions provided by MS Word which are useful for the coding and analysis process for this research can be proficiently utilised by the researcher. Using a system which the researcher already has sufficient knowledge enables the researcher to be more focused on the

data and the research itself rather than spending a lot of time on learning a new system.

2. The researcher used MS Word for the transcription. Data contained in the transcriptions was easily copied and pasted between different MS Word documents when researcher did the coding and analysis. By using MS Word for the coding and analysis, there are no data importing/exporting issues which may occur if NVivo 8 and other similar systems were used.

3. MS Word is a popular software which is widely installed on millions of PCs. Using MS Word for coding and analysis gave the researcher the convenience to be able to work at different places and PCs. In comparison NVivo 8 and other similar systems are only available at very few numbers of places such as universities, it limits the researcher's and other interested parties' accessibility to the research.

Therefore, although NVivo 8 is a comprehensive and powerful tool that specifically designed for data coding and analysis, it was felt that using MS Word was more efficient in this research.

The first step of coding was to get each interview recorded and the relative hand-written notes transcribed into a MS Word document. Information and data collected from other resources such as company meeting minutes, internal company reports, internet articles, newspapers/magazines and published financial statements were transcribed into different MS Word documents separately named by the information resources. All these documents are the source of the data contained in this research. The second step was to get answers from interviewees to a similar question transferred to one document and each interviewee is identified by a different text colour. Information collected from other resources that relates to the questions asked was also colour coded and transferred to the document created. Therefore, each document created in this step contains answers and information from other sources that relate to a similar question. In the last step issues and key points relate to the research question of this research were extracted from each of the documents created in the second step and concluded in a new MS Word document. During this step, the researcher found that most information in the newly created document is related to three issues. Therefore, the data from the interviews and other resources were finally categorised into three groups:

- Motivation for implementing the carboNZero programme;
- Changes in the company brought about by the programme; and

- Resistance to the changes.

To analyse the data contained in the three groups mentioned above, Seidel's (1998) three parts qualitative data analysis process "Noticing, Collecting, and Thinking" was followed. According to Seidel (1998) these three parts are interlinked and cyclical. For example, when the researcher was thinking about issues that have already been identified, other interesting issues that relate to the research topic were noticed and further information was collected by adding interview questions and/or researching relative documents. Seidel and Kelle (1995) also suggested that the coding process has three levels:

- Codes are acting as collection points for significant data
- Codes are acting as pointers to the way the researcher's analysis
- Codes enable the researcher to make discoveries about realities in the data that is referenced by the codes.

In this research items relating to the topic were noticed and classified into the three groups, and then sense was sought out of the information collected. Finally, patterns and linkages between the information and the research topic were established which generated general discoveries about the phenomena. The coding and analysis process used in this research is inductive rather than deductive. For example, the codes emerged from the data as part of the noticing process as Seidel described in his study. This coding and analysis process directly led to the findings (Chapter 4) and discussions of these findings (Chapter 5), proving a highly effective tool.

Chapter 4 The case study organisation and findings

According to the case selection criteria discussed in the previous chapter, an organisation that met most of the selection criteria was carefully selected. The case company is XYZ Limited[4]. This chapter discusses the background and structure of the case company and the implementation of the carboNZero programme at the company. The latter section answers the questions why the carboNZero programme was adopted, how the programme was implemented, and what happened after the implementation.

4.1. XYZ Limited

This section gives a brief overview of the background and structure of XYZ Limited.

4.1.1. The company background

XYZ Limited manages an airport in New Zealand. The airport is the gateway for the local people and businesses to connect to the world's trade and tourism markets. The current company vision is "To be recognised as New Zealand's leading tourism gateway". The purpose of the company is "To target success through customer service, efficiency and diversification across our key portfolios…" In the latest (2009) Statement of Intent, XYZ's objectives are summarised as to:

- Deliver sustainable growth in revenue and earnings;
- Grow local tourism and position XYZ as a shaper of future tourism growth;
- Deliver superior customer service;
- Provide "fit for purpose" infrastructure with the flexibility to meet future growth;
- Provide an environment where staff is high performing and fully engaged; and
- Operate in a sustainable manner and be recognised as a positive contributor to the community.

These objectives are delivered through seven strategic platforms:

- Infrastructure development;
- Commercial diversification;
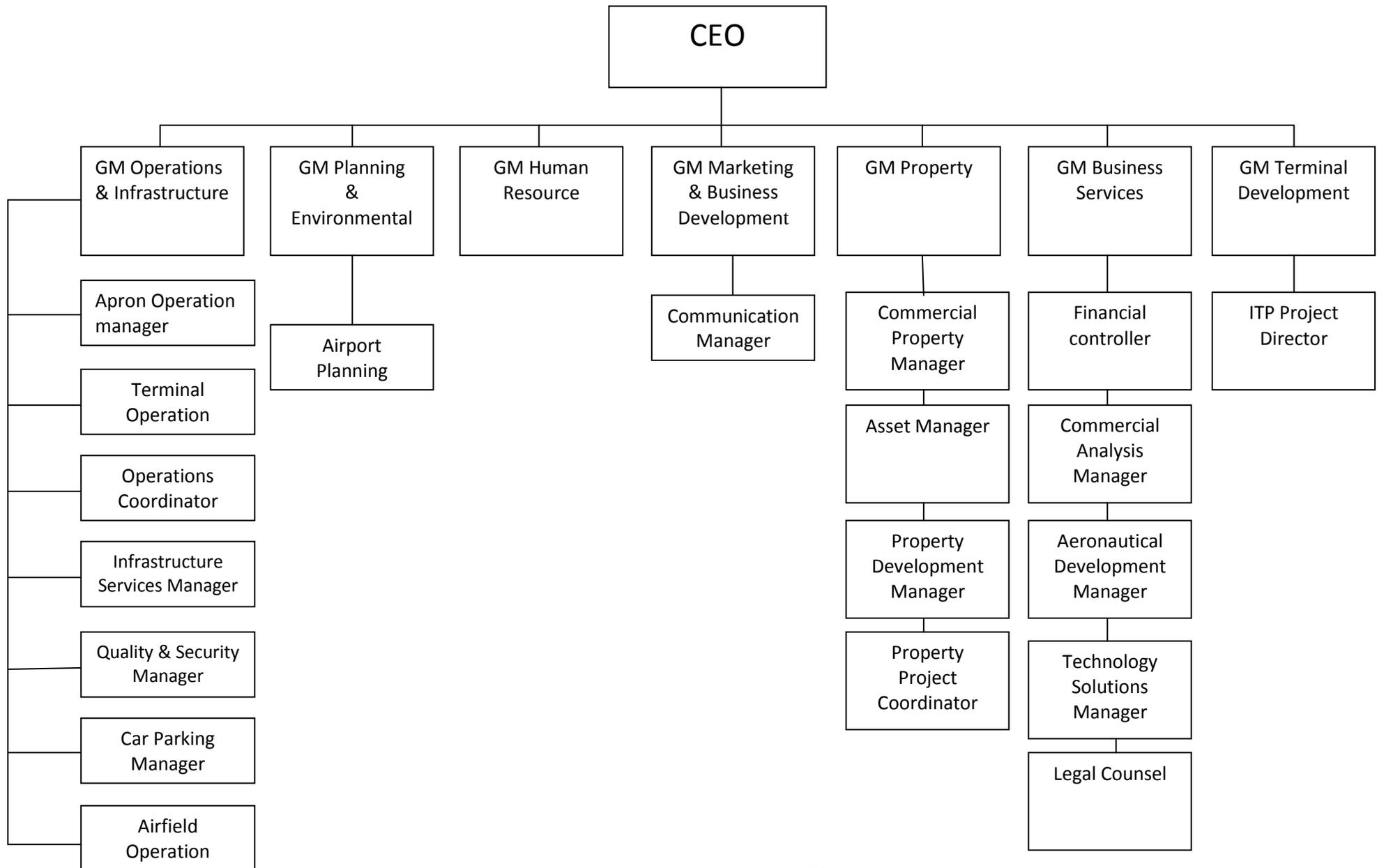- Tourism gateway;
- Aeronautical development;

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[4] The real name of the organisation is not given for anonymity purpose.

- Best practice operational capability;
- Corporate social responsibility; and
- Financial capability.

4.1.2. The company structure

XYZ Limited was established in the 1980s, and is jointly owned by the local city council and the New Zealand Government. The company is responsible for the everyday running of the airport facilities and maintaining the relationships with some key stakeholders, including the tourists, airlines and tenants on the airport campus. It currently employs about 160 full-time equivalent employees in the areas of administration, airport fire services, customer services, management, property, facilities services, and travel and information services, and generates airport-precinct-related jobs for nearly 5000 people. The airport employees are located in many different parts of the airport campus. The two main offices of the company are in two separate buildings on the airport campus. A total of approximate six million passengers travelled in or out of the airport during the period 1 August 2008 to 31 July 2009. The total revenue of XYZ for the year ended 30 June 2009 was close to NZD $90 million, and the total after tax surplus was about NZD $15 million. The organisational structure is shown in Figure 4.1.

Figure 4.1 Organisational chart

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                                        ┌──────────────┐
                                        │     CEO      │
                                        └──────┬───────┘
   ┌──────────┬──────────┬──────────┬──────────┼──────────┬──────────┐
┌────────┐┌────────┐┌────────┐┌────────┐┌────────┐┌────────┐┌────────┐
│GM      ││GM      ││GM Human││GM      ││GM      ││GM      ││GM      │
│Operat. ││Planning││Resource││Market. ││Property││Business││Terminal│
│& Infra.││& Env.  ││        ││& B.Dev.││        ││Services││Develop.│
└────────┘└────────┘└────────┘└────────┘└────────┘└────────┘└────────┘
```

CEO

- GM Operations & Infrastructure
  - Apron Operation manager
  - Terminal Operation
  - Operations Coordinator
  - Infrastructure Services Manager
  - Quality & Security Manager
  - Car Parking Manager
  - Airfield Operation
- GM Planning & Environmental
  - Airport Planning
- GM Human Resource
- GM Marketing & Business Development
  - Communication Manager
- GM Property
  - Commercial Property Manager
  - Asset Manager
  - Property Development Manager
  - Property Project Coordinator
- GM Business Services
  - Financial controller
  - Commercial Analysis Manager
  - Aeronautical Development Manager
  - Technology Solutions Manager
  - Legal Counsel
- GM Terminal Development
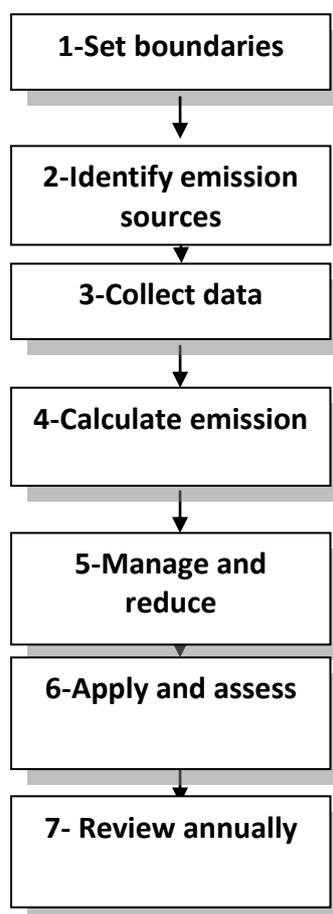 - ITP Project Director

4.2. The utilisation and implementation of carboNZero programme at XYZ

This section gives details of how carboNZero programme is being utilised in XYZ and the implementation of the programme.

4.2.1 Utilisation of carboNZero programme in XYZ

At XYZ, the implementation of the carboNZero programme was carried out in seven steps (see Figure 4.2).
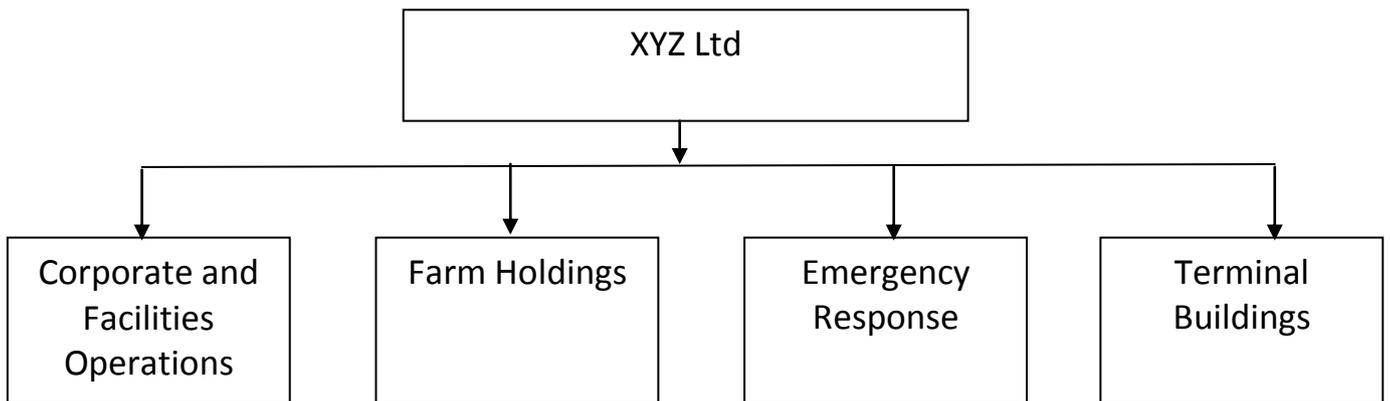
Figure 4.2.1 Implementation steps

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┌─────────────────────┐
│  1-Set boundaries   │
└─────────────────────┘
           │
           ▼
┌─────────────────────┐
│ 2-Identify emission │
│       sources       │
└─────────────────────┘
           │
           ▼
┌─────────────────────┐
│   3-Collect data    │
└─────────────────────┘
           │
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┌─────────────────────┐
│ 4-Calculate emission│
└─────────────────────┘
           │
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┌─────────────────────┐
│   5-Manage and      │
│      reduce         │
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┌─────────────────────┐
│  6-Apply and assess │
└─────────────────────┘
           │
           ▼
┌─────────────────────┐
│  7- Review annually │
└─────────────────────┘
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Step 1: Set boundaries

The first step in the implementation process is to set the boundaries of emission reporting. The company needs to clearly understand the emissions associated with their activities and distinguish them from those that are *not* produced by their activities. There are two different approaches to determining emission reporting boundaries: Equity Share and Control. In the Equity Share approach, GHG emissions are measured according to their share of equity in

the operation. In the Control approach, the GHG emissions are measured only if the company has financial or operational control of the operations. In this case, XYZ has adopted the Control approach with GHG emissions inventoried at four operation centres of which XYZ has 100% control (see Figure 4.3).

Figure 4.3 XYZ's emission boundaries

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                    ┌─────────────────────┐
                    │       XYZ Ltd       │
                    └─────────────────────┘
        ┌───────────────┬──────┴──────┬───────────────┐
        ▼               ▼             ▼               ▼
┌───────────────┐ ┌───────────┐ ┌───────────┐ ┌───────────┐
│ Corporate and │ │   Farm    │ │ Emergency │ │ Terminal  │
│  Facilities   │ │ Holdings  │ │ Response  │ │ Buildings │
│  Operations   │ │           │ │           │ │           │
└───────────────┘ └───────────┘ └───────────┘ └───────────┘
```

Step 2: Identify emission sources

By implementing the carboNZero programme, which complies with the GHG Protocol, XYZ categorised its emissions into three scopes. Scope one is emissions produced directly from the company's controlled sources, such as office wastes. Scope 2 is emissions produced indirectly by the company, such as electricity and fuel purchased from energy suppliers. Scope 3 is emissions produced as a result of the company's activities but with sources of the emission not controlled by the company. After the emissions are categorised, the company can then identify the emission sources and determine opportunities for emission reduction. XYZ's most recent (2009) Emission Reduction Plan shows that Scope one and Scope 2 emissions make up 91 % of the company's total emissions. In addition, 44 % of the total is from electricity use; the high usage of electricity being due to the heating/cooling of the terminal building.

Step 3: Collect data

The XYZ administration team is responsible for keeping records of most of the related data such as travel information and invoices. These data are always available to the environment manager, who can either collect the hard copy from the administration team or collect them through the company intranet.

Step 4: Calculate emission

The calculation is currently being done by Landcare Research NZ's carboNZero team. After the data are collected, the environment manager of XYZ sends these data to Landcare Research NZ to translate into emission information.

Step 5: Manage and reduce

Once translated, the emission information is sent back to XYZ. Based on this information, the environment team then work in conjunction with the other departments and Landcare Research to gain a better understanding of their emissions. By comparison with industrial norms or previous results, emission weak-points and opportunities that can lead to emission reduction are identified. These improvements are used to alter the environmental strategies and goals included in the Emission Reduction Plan for the following period. As identified in the 2009 Emission Reduction Plan, XYZ will focus on reducing Scope One and Scope Two emissions. Scope One emission is directly related to and controlled by XYZ, where the company can have stronger influence on improvement than on other scopes. Emissions from electricity use form a large proportion of Scope Two and the overall carbon footprint, so managing and reducing both Scope One and Scope Two emissions would significantly decrease the total emissions of the organisation.

Step 6: Apply and assess

To offset the emissions, XYZ buys emission credits from carboNZero approved sources. The required credits can be purchased from the EBEX21 programme, where carbon credits are generated by forest regeneration sites in New Zealand. Credits can also be purchased from other Kyoto-compliant or Kyoto-consistent projects. XYZ engaged Landcare Research to purchase credits on their behalf and once the emission is offset, XYZ applies to Landcare Research for carboNZero certification. The application will be audited by a third party to ensure that the relative data and financial records used by the company are accurate. This process is now referred to as "Verification'. One of the "Big Four" accounting firms, PricewaterhouseCoopers, is currently employed to verify this part of the process.

Step 7: Review annually

The certification of carboNZero is on a yearly basis. Therefore, to become certified, the company needs to review its GHG emission and go through the whole process of

implementation every year, using the seven-step process followed by XYZ during initial implementation as a guideline.

4.2.2 The implementation of carboNZero programme in XYZ

To ensure a smooth implementation of the carboNZero programme, XYZ employees were given some training and a launch event was also held soon after its adoption. The environment team gave several presentations to most of the XYZ employees to explain the programme, while copies of the movie, "The Inconvenient Truth", were bought and made available for loan to employees of the company. Flyers with energy saving tips were circulated, and energy efficient light bulbs were given to all employees. The environment team also developed an induction programme, used by the environment manager to help new employees understand the carboNZero programme and other environmental issues. An environmental awareness training DVD was also produced, in conjunction with other related departments, recorded around the airport campus, with a large number of staff participating in the recording process. The DVD emphasises stormwater management and groundwater protection, and covers the following environmentally related issues:

- Why protection of stormwater and groundwater is important;
- How stormwater is managed at the airport;
- Environmental best management practices; and
- Spill management.

The DVD is part of the XYZ's Environmental Compliance and Monitoring Programme. Field Staff are given training and consult on a regular basis. Experts of the carboNZero programme from Landcare Research were invited to the company to generally assess the implementation process and make recommendations.

XYZ's goal of implementing the carboNZero programme is to progressively reduce GHG emissions and offset any unavoidable emission to finally become a true carbon-neutral organisation. Therefore, the company also made a three-stage carbon-neutral development plan based on the carboNZero programme:

Stage 1: XYZ is committed to achieving carbon neutrality and will engage Landcare Research to assist in becoming carbon-neutral[5] certified.

The company first achieved carboNZero certification in January 2008. This achievement made XYZ the first carbon-neutral airport in the southern hemisphere. In early 2010, XYZ met the requirements of the carboNZero programme and obtained certification for being carbon neutral for the period 2008-2009. This is the third year in a row since it first achieved this certification in 2007, the GHG emission has been further reduced. In comparison with the base year, the total emission has been reduced by 16%. All unavoidable emissions have been offset during the last three certified periods and plans for further reduction of emissions have been made and included in the 2009 Emission Reduction Plan. As examples, energy usage is planned to be reduced by five % on 2007/08 level in the 2010/11 period, the proportion of recycled Asphalt Pavement will be increased to 30% in the runway maintenance programme, and the amount of material being diverted from landfill will be increased from 15% to 40% in the near future. By now, XYZ believes that the company has achieved the targets of Stage 1, and has started to work on Stage 2.

Stage 2: XYZ will establish a working group with tenants to develop an airport campus-wide carbon-neutral programme.

The other tenants on the campus were encouraged to be part of the carbon-neutral programme. The XYZ environment team held workshops and talked about XYZ's experience as a carbon-neutral organisation. Experts from Landcare Research were invited to talk on the carboNZero programme. Either directly or indirectly influenced by XYZ, some businesses on the airport campus started to undertake environmental measures. For example, Company A is a leading global provider of integrated logistics solutions, and is the first independent tenant to receive carboNZero certification. Company B is another that may have been influenced by the implementation of carboNZero at XYZ. Although caring for the environment is one of Company B's core values, it is currently in the process of calculating its carbon budget and sought help on carbon emission issues from XYZ departments.

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[5] Carbon-neutrality in this research means that the company bought enough carbon credits to offset the GHG emissions included in its boundaries (Figure 4).

Furthermore, other businesses on the airport campus support XYZ's carbon-neutral position. The XYZ environment team is confident that it will get more businesses on board and eventually achieve the vision of becoming a sustainable airport campus. This stage is still in progress.

Stage 3: XYZ will work with airline partners to develop a programme for aviation operations.

By this stage, XYZ should have reduced its emission to the minimal level and all possible initiatives to reduce emissions would have been carried out. Tenants on the airport campus should either have achieved or be in the process of becoming carbon neutral.

Through Stage 1 and Stage 2, XYZ will have accumulated extensive knowledge and experience of such a programme, and will be able to help airlines to make improvement on their carbon-neutral status in Stage 3. XYZ claimed that it has achieved Stage 1, and is currently working on Stage 2. The company has yet to start on Stage 3.

4.3. The motivation

This section relates to the first two groups of data mentioned in Section 3.6. The first part of this section presents the findings as to why XYZ adopted the carboNZero programme and the second part describes what happened after its implementation at XYZ.

In 2006, Landcare Research offered XYZ the carboNZero programme. After several meetings with the Landcare specialist, the environment team of XYZ carefully considered and compared the programme with other systems available during that time. The XYZ team believed that the carboNZero programme was a robust system that could help the company to achieve its environmental goals. As such, the team presented the programme, alongside the current environmental issues, to the Board, and the adoption of carboNZero programme was approved in mid 2007.

The motivation for implementing the carboNZero programme came from both outside and inside the organisation.

Externally, the aeronautical industry, particularly the airlines, was facing criticism of its negative impact on climate change, and the airport is closely related to the airlines. Some members of the XYZ management team believed that the carbon footprint issue is becoming a decisive factor for tourists when planning their overseas holiday, and 30 % of passengers are from the international market. To keep the image of "100% Pure New Zealand", XYZ recognised the importance of including climate change issues into the management decision making process, and of taking ownership as a responsible corporate citizen. In order to obtain a long-term competitive advantage in the international tourism market and to assist tourists in their decision making when considering New Zealand as their next holiday destination, XYZ would like to make contributions to sustainability and environmental management. Thus, XYZ hoped that the implementation of the carboNZero programme would help the company to achieve its goal of running a sustainable airport operation.

Internally, the company had already considered environmental issues, and initiatives had been introduced to help reduce negative impacts on the environment. There were efficiency programmes in place for the energy system before the implementation of the carboNZero programme. The engineering department looked at reducing pressures and improving operation of pumps and controls and were also looking at using better controls on the air handling unit to minimise the heating and cooling energy consumption. Although these initiatives were not specifically introduced as carbon-neutral initiatives, they followed the philosophy of minimising the carbon footprint and being a "green" organisation. Some employees in the company believe that the carboNZero programme is a robust system, and that most of XYZ's environmental strategies can be placed under the carboNZero umbrella. As a result, it is easier for people to see that the company is taking carbon-neutral initiatives and it is easier for the company to manage all these initiatives as a combined system.

4.4. The changes

During the study, it was found that, as a result of the implementation of the carboNZero programme, changes occurred at XYZ.

Firstly, the key objectives of XYZ changed after the implementation of the carboNZero programme. The company decided to adopt carboNZero in the middle of 2007, and first achieved the certification in January 2008. Prior to 2008, one of XYZ's key objectives (extracted from the Statement of Intent) that relates to environmental issues is to:

Utilise land resource for development opportunities.

In the 2008 Statement of Intent, the above objective was replaced by a new comprehensive objective that covers more environmental issues. The new objective is to:

Operate in a sustainable manner and be recognised as a positive contributor to the community.

As a result, the company strategies used to achieve these goals have also changed. Before the implementation of the carboNZero programme, one of the company strategies included in the 2007 Statement of Intent was to:

Pursue the sustainable management and development of all aspects of the company's operations.

This strategy was enriched in the 2008 Statement of Intent after the implementation of the carboNZero programme (p.2) to:

Pursue the sustainable management and development of all aspects of the company's operations, being socially responsible through having regard to the interests of the community in which we operate.

Moreover, the environmental and social performance targets were further developed to accompany the changes of objectives and strategies. Two new targets were added, encompassing continued support for a famous local event, improved noise control and bird strike risk reduction. Five out of the six key objectives are now related in some way to these environmental and social performance targets.

The weight given to environmental and social responsibility disclosures in the company annual reports were increased after the implementation of the carboNZero programme. In the 2007 Annual Report, the sustainability section consisted of four pages that mainly included waste management and stormwater management information. This was changed in the 2008 Annual Report where the sustainability section was broadened to ten pages including information about emission reduction, runway maintenance using recycled materials, energy conservation, and waste management. All these components were disclosed with detailed case studies and full explanations. This has been further improved in the 2009 Annual Report, which contains a 22-page section on sustainable growth.

As a result of the implementation of the carboNZero programme, an emission reduction plan is made every year according to the carboNZero programme requirements. The emission reduction plan helps the company set targets for managing and reducing GHG emissions in the coming periods. It is used as a benchmark, with results compared with the set targets. The purpose of the emission reduction plan is to encourage XYZ to continue to improve. The more GHG emission the company can manage and reduce, the less the cost of buying verified carbon credits to offset its carbon footprint. The plan should ultimately lead to XYZ becoming carbon neutral. The figures extracted from the emission reduction plan show that the GHG emission for the latest period, between 01/07/2008 and 30/06/2009, was 4401.24 tCO_2e (ton of carbon dioxide equivalent). Compared with the base year when 5236.18 tCO_2e was emitted, the company has reduced its emission by 16%. Furthermore, the emission reduction plan also includes progress reports on specific emission reduction projects, clearly stating the objectives, actions, responsibilities, completion dates and current status of each project. The readers can easily get the information they need.

The implementation of the carboNZero programme also encouraged the company to more actively participate in public environmental programmes. In April 2008, three months after its first achievement of carboNZero certification, XYZ joined ABC and over 300 other airports in Geneva, Switzerland, in signing the declaration on climate change. The former CEO of XYZ believed that carbon-neutral growth is a step towards a future carbon-free aviation industry. In September 2008, 25 recycling bins were installed in the airport as part of the government's "Recycling in Public Places" programme. It was the first time a recycling programme had been introduced into the public areas of the city. The former CEO said:

> We are pleased to be able to now provide a comprehensive recycling facility at the airport in accordance with our sustainability policy to ensure that we are meeting these expectations and protecting our environment…

New initiatives for reducing emissions were developed, or being investigated, in XYZ after the implementation of the carboNZero programme. As energy consumption is the main emission source of XYZ, the company is researching ways to reduce its energy usage and employ sustainable energy resources. For example, Interviewee G suggested the possibility of using some of the land owned by XYZ as a wind generation farm. Although this idea was not actioned due to the long payback period (about 30 years), it shows that XYZ is actively

seeking opportunities to reduce its impact on the environment. Some initiatives have already brought benefits to XYZ and reduced its emissions. A new terminal under construction will use more efficient heat pumps and chillers. The air control unit will be upgraded, with the new system using ground-sourced water as the energy exchange medium. As a result, 1 KW of energy input can generate four KW of heating or cooling, meaning the cost of energy usage will be reduced along with carbon emission. Further, new initiatives to reduce emissions were identified in the runway maintenance programme. By working with specialist contractors, emission generated from the runway maintenance project was reduced. Over 200 tonnes of Recycled Asphalt Pavement (RAP) were used in the project; the first time RAP was used on an airfield in New Zealand. The "COOlPave" technology was adopted which allows the asphalt mix to be produced and compacted at a temperature that is about 60 degree Celsius lower than the traditional asphalt mix. It reduced the fuel used for heating the asphalt mix, reduced emissions and increased the safety for users. At the same time, solar-powered stand centreline lights were installed.

XYZ's implementation of the carboNZero programme has increased the awareness of environmental issues both internally (employees) and externally (companies associated with XYZ). Internally, employees are more aware of the environmental issues. To reduce the emissions associated with energy consumption, XYZ launched the Energy Conservation Campaign in which employees were encouraged to participate and rewarded for making concerted effort to save power. A "Green Exchange" newsletter communicates XYZ's energy initiatives to staff on a regular basis, containing:

- Energy conservation tips;
- Myth busters;
- Educational information about XYZ's energy conservation measures; and
- Staff competitions encouraging energy saving ideas.

Posters are displayed in offices to remind people to switch off lights and computers when they are not in use and most offices have recycling bins with most employees keeping landfill and recyclable wastes separated. This finding is supported by some figures disclosed in the 2009 Annual Report. There were a total of 104 cubic metres of paper recycled in 2007. This amount was increased to 256.8 cubic metres after implementation. Further improvement was made in 2009, when a total of 422.14 cubic metres of paper was recycled. The increased awareness of environmental issues is also evidenced by other findings from

the research. When interviewing several employees from the Airport campus Facilities Office, the warehouse facility where some of the airport's equipment is serviced and fixed was visited with a couple of recycling bins in the warehouse and a couple of oil tanks for waste oil observed. Very little oil spillage was found on the ground of the warehouse. An employee from the engineering department was interviewed, and gave an example of another change. The warehouse used to burn most of its flammable wastes, however, this activity was stopped after the implementation of the carboNZero programme, when it was realised that burning wastes produces carbon emissions and has a negative impact on XYZ's carbon-neutral position.

Several interviewees from the Corporate Office also claimed that the implementation of the carboNZero programme had increased their awareness of environmental issues with Interviewee D commenting:

> Having carboNZero certification it makes us think about before we do. For example, when we do events we now choose the paper that we use to print invitations and information packs.

Interviewee C, who holds a senior position at XYZ, said:

> It [carboNZero] certainly made me more aware of the environmental issues. I mean, for example, that I drive a vehicle to work when I can potentially bike. I'm aware it's something I can do, but I've not got there yet. But they are in my mind…I am sure it is part of the reason - because our company is involved in it, as I am hearing about it and reading about it everyday.

The implementation of the carboNZero programme has also increased the awareness of environmental issues externally. As mentioned above, at Stage two of the carbon-neutral development plan, XYZ will establish a working group with tenants to develop an airport campus-wide carbon-neutral programme. This working group will provide support and advice to airport tenants and other businesses on the airport to encourage them to become carbon neutral along with the airport. Interviewee F from the Airport Facilities Office said:

> The method we use and the plant that we use is always tending towards carbon neutral. The more we can show them as landlord or building owner that we are

moving towards that direction, then the more it will encourage the other businesses to be.

Furthermore, it encourages the contractors of XYZ to make positive changes to become carbon neutral. After the implementation of the carboNZero programme, GHG emission management criteria were included in contract tender documents. The following was added to the main contractor's tender documents:

> XYZ is a carbon neutral company. We do not directly control contractor emissions but would like information on whether or not the contractor does any of the following:
>
> - Measure greenhouse gas emissions
> - Manage greenhouse gas emissions
> - Has any commitment to reducing emissions

The added criteria clearly indicate that XYZ prefers contractors who have similar views as them on carbon neutral issues. During the study, the arrival terminal of the airport was traversed where posters of XYZ's carbon-neutral position were displayed on the wall all the way to the shopping area. They are very hard to miss, being the first thing the passengers see as they step out of the bridge. This may increase the passengers' awareness of environmental issues.

Internally, communication throughout XYZ has improved since the implementation of the carboNZero programme. The programme has established a shared vision through all different levels of XYZ, creating a need for company members to communicate and work closely to achieve this vision. Firstly, communication between departments was improved. Although the environment department was established to manage environmentally related issues, the carbon-neutral status of the company cannot be achieved by that department alone: it is an organisational-level decision that requires all departments to actively participate. The goal of being carbon neutral cannot be achieved without collaboration between departments. Interviewee A commented that after the implementation of the carboNZero programme, the employee needed to co-operate and communicate more often with other departments in order to get the job done. Interviewee A said:

So, when I write my plan, I need to talk to them [teams from other relative departments] and discuss the achievable targets for the coming period with them, and I put that into my plan.

Secondly, communication between employees has improved. The implementation of the carboNZero programme should involve everyone in the company, and, because everyone is working to achieve the same goal, it encourages them to talk with their colleagues as to how they can contribute. Interviewees D and E told the researcher that they would like to communicate with their managers, or other relevant members of XYZ, when they have suggestions about the carboNZero programme or can identify problems or inefficiencies within the programme.

Thirdly, communication with stakeholders outside the organisation has improved. It allows the experience of implementing the carboNZero programme to be shared, and the vision of XYZ to be passed to other parties outside the organisation. In addition, it enables XYZ to learn of new initiatives and innovations for reducing emissions from other businesses. Interviewee E said:

We also disclose our carboNZero status which we like to communicate with other organisations as much as possible. It is very important to communicate with companies who already have some environment initiatives in place, so we can learn from each other's experiences.

The statement made by interviewee B reinforces this finding:

We also have a maintenance engineer team who are in daily contact with the tenants around the airport. It is very important that they have a good understanding of carboNZero.

The findings presented above are analysed and discussed in the following chapter.

Chapter 5 Discussion

5.1 Motivation and changes

As mentioned in Section 2.2, Graetz (2000) claimed that the fast changing business environment forces organisations to make necessary organisational changes in order to survive. The adoption of carboNZero programme in XYZ is motivated by both external and internal environments' changes. Externally, stakeholders' criticism of the aeronautical sector's negative impact on climate change, together with the discovery that carbon footprint issues are becoming a decisive factor for tourists when planning their overseas holiday, motivated XYZ to make changes in the organisation to address these issues. Indeed, this motivation was mentioned by Interviewee A:

> If there is criticism about aeronautical sector polluting the environment, we better
> have a solution for this problem.

Internally, some of the XYZ's management team believed that the company needs a new management control system to combine its existing environmental initiatives for achieving better environmental performance. Therefore, it is clearly evident that there is a need for XYZ to make changes.

Evidence shows that a planned change approach was used by XYZ. A considerable amount of work had been done by the management team before the decision to adopt the carboNZero programme was made. This was made evident by interviewee A, who mentioned that people from Landcare approached XYZ initially then sat down with the management team of XYZ and talked about the advantages of adopting the carboNZero programme. Next, a team of XYZ's senior managers and experts from Landcare was formed to study the feasibility and consequences of implementing the programme. Detailed plans and strategies were then drafted and consultations with department managers conducted before the implementation. The planned change approach enables the management team of XYZ to establish a clear goal of reducing GHG emission and becoming a leader in the aeronautical sector addressing their negative impact on climate change by implementing the carboNZero programme. This finding supports Wilson's (1992) finding, reviewed in Chapter 2, that the planned change approach is a top-down process, highly dependent on senior managers. At the planning stage of the implementation project, there is minimal involvement

from lower and middle level employees of XYZ. Furthermore, according to Wilson (1992), senior managers may not clearly understand the changes in many instances, therefore, they may become biased. Burnes (2004) also argued that the assumption used by a planned change approach, that all stakeholders are willing to fully participate in the change project, and a common agreement can be reached in the organisation, does not always stand up. Both Wilson's (1992) and Burnes's (2004) arguments regarding to the planned change approach are evident, and discussed in the resistance to change section later in this chapter.

In addition, Lewin's (1951) three-step change model, introduced in Chapter 2, can be applied to the project of implementing carboNZero programme in XYZ. In this model, the first step is "unfreezing", during which time organisations discard or modify their old governing factors such as goals, structures and strategies. It is evident in Section 4.3, that right after the implementation of the carboNZero programme, XYZ changed its key objectives and strategies to include environmental issues in its governing factors. The second step of Lewin's model is "movement", when new approaches are developed to replace old ones. Again, the findings from the previous chapter show that changes were made in XYZ in various areas, such as communication and awareness of environmental issues, across all levels of the organisation in response to the new organisational key objectives and strategies. The last step of Lewin's model is "refreezing", where changes are incorporated into the organisation. According to interviewees A and B, after the implementation of the carboNZero programme, environmental issues have been incorporated into the decision making process. Furthermore, interviewees C and D stated that the changes, such as decreasing office landfill waste and power usage, brought by carboNZero programme have become part of their daily activities.

Learning was involved in all threes steps of the change project. Soon after the management team decided to look into the possibility of adopting carboNZero at XYZ, there is evidence that learning started. Books were bought for managers to study the idea of being carbon neutral, experts from Landcare were invited to XYZ to give presentations to the management team, and managers were encouraged to talk to each other and to share information about this project. After the initial learning phase, key organisational objectives and strategies were modified and became the foundation for future changes, which is the first step of Lewin's model. Changes made in the first step need to be executed by lower level employees in the

second step. An organisation itself cannot change, it is the members of the organisation that change. Learning is vital at this stage in order to help members of the organisation make their changes. Many methods were adopted by XYZ to stimulate learning. Interviewee A confirmed that XYZ bought many copies of the documentary film "An Inconvenient Truth" which talks about climate change and other environmental issues and made them available for all employees to borrow. Newsletters were printed and distributed to all employees, explaining why XYZ was adopting the carboNZero programme and how they could make changes as an employee of the organisation. Energy saving light bulbs were given to employees together with some tips for saving energy, both at work and home. The department in charge of the implementation of the carboNZero programme at XYZ was working closely with experts from Landcare, so workshops were held, designed to answer employees' questions and give them the knowledge to make changes in their daily jobs. Learning, in the last step of Lewin's model, is "informal" in nature which means it may happen when employees discuss the project or when they read the news or encounter articles on environmental issues in various media. In this step, the learning and the changes brought by carboNZero programme are incorporated in their everyday life.

Finally, the findings indicate that the planned change approach and changes made by XYZ are consistent with Argyris's generative learning model. As introduced in Chapter 2, generative learning is a two way process which allows fundamental factors such as strategies and goals to be constantly questioned and modified. Adopting the planned change model, the first change XYZ made in the implementation of the carboNZero programme was to change key organisational objectives and strategies. Another important aspect of generative learning is its endless learning cycle like that of XYZ's seven-step implementation process described in Chapter 4. The carboNZero programme has an annual certification system. It requires XYZ to assess its GHG emission performance against the target set at the beginning of each year and give feedback to the management team in order to make necessary changes in the following year to further improve environmental performance. Therefore, the carboNZero programme is not a one off project, it encourages XYZ to continuously change and learn. From these findings the researcher concluded that the implementation of the carboNZero programme has contributed to building generative learning in XYZ.

5.2   XYZ's characteristics of learning organisations

It was mentioned previously that organisational learning and learning organisations are 'two sides of the same coin'. This section discusses some characteristics of learning organisations found in XYZ. The implementation of a carbon accounting system, namely the carboNZero programme, further exhibits some of these characteristics. This evidence will then be used to examine whether or not the case company was transformed into a learning organisation by implementing the carboNZero programme.

5.2.1   Communication

As shown in Table 2.1, 'inquiry and dialogue', which encourages employees to discuss and question their activities, is one of the characteristics of a learning organisation. The table also shows 'collaboration and team learning' as another characteristic. Communication is the foundation of both of these two characteristics. Watkins and Marsick (1993) described 'inquiry' as a dialogue that takes place through talk in which people mutually explore ideas, questions, and potential actions. It is the key to learning through interactions with others. An open communication environment means members of the organisation can express themselves and ask questions freely. It also means that mistakes are allowed, and that individuals are not accused or attacked. In an environment where making mistakes is risky and relates to severe punishments, people tend to follow orders rather than take initiatives. Such an environment is unlikely to encourage learning (Watkins & Marsick, 1993). In a learning organisation, members do not learn individually. Employees or working groups share their ideas with others, in both vertical and horizontal directions, in the organisation. Communication in both directions ensures that everyone in the organisation is speaking the same 'language'; they are aware of the same issues and try to solve the same problems. Knowledge is transferred and shared through the organisation's communication channels as 'collaboration' can only be built on 'communication'.

As is evident from the findings presented in the last paragraphs of Section 4.2.3., communication in XYZ improved after the carboNZero programme was implemented The programme requires frequent communication between departments, with associated plans made by several departments working collaboratively. It was also observed that most senior managers in the Corporate Office left their office doors open to encourage their staff to discuss relevant issues with them. No direct evidence was found to support a contention that the open environment was caused by the implementation of the carboNZero programme,

however, according to some interviewees, while some improvements may not be directly caused by the carboNZero programme it did reinforce their will to keep doing the right things. More importantly, the programme aligns the goals of the individuals with the organisation's goals. Through improved communication the interviewees agree that environmental issues are important, and that they are happy to learn more about them and to help the company achieve and maintain its carbon neutral status. Although some may not have a good understanding of the carboNZero programme, they still work towards the company's goals. As an example, Interviewee H is a field employee of XYZ, and does not know a lot about the carboNZero programme but, based on what was learnt, Interviewee H believes that it is a good thing to do, and is happy to do things that can reduce the carbon footprint.

Conversely, some inherent problems that hindered communication in XYZ were identified. Firstly, the structure of XYZ complicates communication between employees. There are two groups of employees in XYZ: the field employees and the office employees. The field employees are located at various locations around the airport facilities, and the office employees work at the Corporate Office. The field employees normally report to the Airport Facilities Office, which is located remotely from the Corporate Office. Communication between these two offices is mainly by email and phone calls. There are not many opportunities for face-to-face communication between employees from the two offices and, as most information is kept at the Corporate Office and on the company intranet, field employees have only limited access to this information in comparison with office employees. Although computers are available for field employees to use in the Airport Facilities Office, the usage is very low. Several interviews were conducted in the tearoom at the Airport Facilities Office, and it was observed that no one used the public computer during the lunch break.

The downward communication through the hierarchical structure of XYZ is another barrier to communication. Strategies and plans are usually assigned to lower level employees by the top management team based in the Corporate Office. The field employees have few opportunities to meet with senior managers to discuss the carboNZero programme. The lower level employees, especially the field employees, are not actively involved in the programme; they just passively follow instructions from their immediate managers. One field employee described the communication with managers from Corporate Office as "fly in

and go". If they wish to communicate with higher level managers, there is no efficient 'upwards' communication channel.

5.2.2   Continuous learning

Continuous learning means that learning becomes part of the everyday job, and is built into routine tasks. Generative learning, as described in Chapter 2, is an endless learning cycle. It means that a learning organisation is continuously and purposefully modifying its behaviour to reflect new knowledge and information obtained. As a learning organisation, members need to be proactive and learn continuously in formal and informal ways. In formal learning, the trainer sets the goals and objectives of learning, and in informal learning, the learner sets the goals and objectives (Cofer, 2000).

Some limited formal ways of learning associated with the carboNZero programme are evident in XYZ. Training given to the employees soon after the implementation of the carboNZero programme was in the form of formal learning. The programme was officially introduced to all members of the organisation and other related stakeholders by presenters from the environment department and experts from Landcare Research. The training sessions and presentations were designed to give a brief overview of the carboNZero programme, and how members could contribute to help the company achieve carbon-neutral status. The information pack provided and the loan DVDs about climate change are also ways of formal learning. In addition, the environment Department had training plans for further formal learning. According to Interviewee G, someone from the environment department was supposed to meet with them once a month to give them training with regards to the carboNZero programme and other related environmental issues. However, this arrangement has only been carried out occasionally. Informal learning is evident mainly from the office staff, who are learning unintentionally both at work and at home. The learning happens when they talk about the carboNZero programme, read about it from the newspapers and internet, and hear about it from the radio or television. Corporate Office is exposed to the programme more often than field staff. Although there may be some informal learning among field staff, there was no obvious evidence of this.

The EMANAGEMENT system mentioned in section 3.3.1 has the potential to stimulate both formal and informal learning at XYZ. This system is designed to monitor and manage the company's daily emissions. Information collected by EMANAGEMENT may formally

encourage the employees to learn more about the carboNZero programme and XYZ's emission profiles. Informal learning could also be developed when employees used the system, which could enable them to gain a better understanding of the carboNZero programme. Unfortunately, it is not being used due to limited resources.

5.2.3   Employee empowerment and decentralised decision making

According to Senge (2006), it is the ability of individuals to articulate and pursue a personal vision that triggers the learning activities. Employees cannot be empowered by their managers, but rather they need to personally believe. They choose how they would like their jobs to be done, feel that their jobs are important, are confident about their abilities to get the job done, and know that they can make an impact on the organisation (Quinn & Spreitzer, 1999). Employee empowerment and decentralised decision making allow the employees to put their new ideas into action and test them in practice; this is part of the learning process. It also enables the employees to get involved in some critical decision making. Watkins and Marsick (1993) concluded that empowered employees are motivated to learn.

In XYZ, some employees are empowered by the implementation of the carboNZero programme while others are not. The researcher found that the field employees are less empowered than the office employees, who have more flexibility in their jobs. For example, Interviewees D and E advised that after the implementation of the carboNZero programme, they chose to refill, instead of replace, their printer cartridges and are allowed to use recycled paper and recyclable materials. The programme is commonly accepted at the Corporate Office of XYZ; the office employees believe that the programme is important and that they can make a difference by doing the right thing. Interviewee D said:

> It was a pleasant surprise when I first heard about it [carboNZero], and it is a very
> noble thing to do.

According to Interviewee E:

> We try to mitigate our emission as much as we can… We try to make sure that
> what we are doing has less impact on the environment.

In contrast, the field employees have a much lower level of empowerment. They do not usually make their own decisions, one possible cause being the differences in operational environments. Office employees work in an open operational environment, where

suggestions and changes to make improvements are encouraged. However, field employees work in a stricter operational environment which has clear rules and procedures that need to be followed, some, imposed by the government, have to be complied with due to the nature of the business. For example, the health and safety staff have to work according to the health and safety code, otherwise, they may endanger themselves and passengers and cause serious, if not fatal, injuries.

5.2.4   People's commitment

In the organisational change literature (Young & Jordan, 2008; Senge, 2006), both top management teams' support and high level participation among employees are considered essential factors for organisational change. Therefore, it is suggested that people's commitment be discussed in two parts, namely the management team support and the lower level employees' participation. Although mentioned only in the study by Sudharatna and Li (see Table 2.1), Young and Jordan's (2008) research provides empirical evidence that top management support is the most important factor for a project to be successful. It is not simply one of many factors, but rather, a decisive factor. The term "management team" in this research refers to the chief executive and the executive management team. The management team develops and facilitates the mission and vision of the organisation and, in XYZ's case, after the implementation of the carboNZero programme, replaced one of the company objectives with a more comprehensive one, covering more environmental issues. It is obvious that the management team tried to use the new objective to send a clear message to everyone in XYZ that the company is committed to making changes to protect the environment. The support of the management team is important because they are involved in the running of the company and ensure appropriate actions are taken for its long-term success. They make decisions regarding daily operations and shape the company structure. In XYZ, some rules and procedures were developed by the management team to ensure that all employees work towards the same goal of being carbon neutral. Performance indicators were assigned to departmental managers to assist them in measuring their progress in the emission reduction process. Incentives were given to employees who make special contributions in helping the company achieve its carbon-neutral goal. The actions of the management team are seen as models that influence the activities of members in the organisation. Their support shows a clear and strong desire for learning, and potentially encourages the lower level employees.

On the other hand, it was found that the participation of lower level employees, especially the field employees, is relatively low in comparison with those at management level. According to Hickey and Casner-Lotto (1998), employee participation has proven power in promoting continuous improvement. According to the information collected from interviews the implementation of the carboNZero programme in XYZ is supported by most employees, with those who do not support the programme being mostly inactive learners who have worked in the company for more than 20 years. They do not understand that their jobs can have an impact on the environment, and it is difficult for them to accept that, by slightly changing the ways they get their job done, they can contribute to the improvement of the company's carbon footprint and align their activities to the company's carbon-neutral goal.

5.3 Resistance to changes

This section discusses the last group of issues mentioned in Section 3.6. In XYZ, there is some resistance to the changes brought by the implementation of the carboNZero programme. According to Argyris (1999), resistance may be at either, or both, the organisational level or the personal level.

5.3.1 Organisational level

Initially, resistance may be caused by 'dynamic conservatism'. Agyris (1999) concluded that organisations may be so used to working under the old patterns that they ignore the information that would have helped them to change. The conventional goal of a company is to maximise shareholders' profit, thus gaining economic profit is more important than other goals.

It was mentioned by several XYZ interviewees that there always has to be an economic bottom line. The dominant position of making profit is reflected in the company's annual reports. Four annual reports for the period between 2006 and 2009were reviewed, and all have the goal to "deliver sustainable growth in revenue and earnings" at the top of the company's objective list. The implementation of the carboNZero programme coincided with some changes that have positive impacts on environmental issues, and some employees and managers are considering environmental issues in their decision making. However, the force for change does not appear to be strong enough to change the embedded thinking patterns and working activities of many employees of the company. The implementation of the

carboNZero programme is still based mainly on consideration of cost and benefit. Interviewee A advised:

> Not like Landcare, we are a business, we cannot commit to something that costs us too much money for no real return. We have to see there are some benefits to us as well.

The interviewee also mentioned that the carboNZero programme is not a priority, as there are other things going on in the company. However, people will pay more attention when GHG emission starts to cost more.

Interviewee B has a similar opinion. The interviewee emphasised that the implementation of the carboNZero programme has to have an economic bottom line.

In addition, the carboNZero programme is mainly used by some employees in XYZ to attract the attention of airline companies and to make more profit. Interviewee C said:

> We were trying to get airlines to look at us. So anything to get airlines to look at us is what we're trying to do as well… The programme is one of the many tools that we should use to make us stand out from the crowd.

In some parts of the organisation, the dynamic conservatism can be so strong as to cause regression in the change process, as in the following example.

Boilers in the terminal used to run on diesel but, after the implementation of the carboNZero programme, XYZ replaced the diesel with LPG, a cleaner substitute fuel. However, soon after the change, the LPG price increased significantly, while the diesel price decreased. The cost of burning diesel and buying credits to offset the additional emissions was lower than the cost of burning LPG and, as a result, XYZ switched back to diesel. Interviewee A remarked, sadly, that the positive change of cleaner fuel for boilers in the terminal was reversed due to the consideration of short-term economic benefit. Some new initiatives that originated from the implementation of the programme were delayed, or even given up, due to the importance of the economic bottom line. The idea of using some of the airport land for sustainable wind farm generation was dropped because the estimated payback period is 30 years. It was concluded that only initiatives which could bring obvious and immediate economic benefits to the company would be considered.

The company's structure may be another organisational-level resistance to change. The Corporate Office and Airport Facilities Office are located remotely from each other. As mentioned above, this structure causes difficulties with communication between the two offices. It hinders information flow and knowledge transfer, which are two important factors in learning organisations. No formal communication channel between these two offices was identified; the connection is mainly based on emails and phone calls. On one hand, the office employees, who are exposed more often to the carboNZero programme, know more details of and participate more in the programme. However, most of them lack operational knowledge. On the other hand, the field employees have more practical experience and knowledge of operational activities, but they do not understand the carboNZero programme as much as the office employees do. As a result, XYZ employees are at different levels when it comes to understanding the carboNZero programme. The resistance from employees who have lower level understanding of the programme is stronger. An interviewed field employee, who has little understanding of the programme, described XYZ's carbon-neutral status as "ironic". This employee does not understand how the airport can be carbon neutral when there are airplanes taking off and landing every day. Obviously, this employee neither fully understands the carboNZero programme nor the principles of the programme. Interestingly, this is the same person who described the communication with Corporate Office employees as *"they [office employees] just fly in and go"*. It is evident that field employees do not have sufficient information or knowledge of the carboNZero programme, and that communication between field employees and office employees is poor. It cannot be concluded that the inefficiency of communication is caused solely by the two offices being located remotely, but it is one of the factors in the communication problem.

5.3.2 Personal level

According to Atkinson (2005), resistance to change at personal level is common and unavoidable, even with foresight and pre-planning. This conclusion is supported by Kreitner (1992), who identified ten causes of resistance to change, including poor training. Poor training is directly related to an employee's inability to change. In order to change, employees need to have the skills of identifying inconsistency and correcting errors. In the case of XYZ, to develop these two skills, the employees first need to have a clear understanding of the carboNZero programme, then they can continuously compare their activities with the principles of the programme, and find the inconsistencies that they need to

fix in order to comply with the programme requirements, thus developing the requisite skills. However, the importance of training in the implementation process of the carboNZero programme was not realised by the management team of XYZ. As mentioned above, only limited training was conducted at the beginning stage of the implementation process, which was more than two years ago. Although continuous education plans and induction programmes for new employees were developed, they were not being properly implemented. The meetings on environmental issues were not held regularly, and there was no follow-up after the induction programme. Two senior managers were interviewed, who both believed that it was unnecessary for the lower level employees to know a great level of detail of the carboNZero programme. Obviously, they underestimated the importance of the lower level employees in this change process, and they underestimated the resistance at the personal level. As a result, it was found that the lower level employees have only limited understanding of the programme and, without proper training, employees are not able to change even when inconsistencies are identified between their activities and the principles and requirements of the carboNZero programme. As Interviewee G said:

> We know the company is trying to be carbon neutral. To achieve that goal they
> [the management team] need to give us the training and the tools.

In XYZ, employees (especially the lower level) may become a barrier to the organisation in the change process.

Personal level resistance may also be caused by the involvement of examining individual's governing factors in the change process. Agyris (1999) determined four common governing factors, generally used to direct one's actions to avoid embarrassment, threat or feeling incompetent, therefore, individuals are often defensive and have difficulties expressing their true feelings to others. Kreitner (1992) also claimed that emotional side effects and personality conflicts are possible causes of resistance to change at the personal level.

During the research, it was realised that some opinions given by the interviewees could not truthfully represent their true feelings. Some interviewees' answers to the interview questions appeared to be given based on what they thought the researcher wanted to hear and some on the management team believe that not everyone in the organisation fully supports the carboNZero programme, even though they have not received any negative feedback about it. This reveals that the management team, although it has a very 'open' approach, is

not getting 'the whole picture', and that the lower level employees are trying to avoid 'unnecessary trouble' by keeping their true feelings on this programme to themselves.

Some XYZ employees may be resistant to change because they are worried about the extra workload brought on by the implementation of the carboNZero programme. Interviewee A stated that there are things that can be done to improve the implementation, however, only a few things have been done so far, because these are extra work in addition to normal duties. No extra time or resources are allocated to them for the improvement. Another possible cause may be that the employees are unsure as to how the changes will impact their job security.

5.4 Conclusion

Based on the discussions presented above, the conclusion was reached that the implementation of the carboNZero programme is positively changing XYZ and transforming it to a learning organisation. However, due to some inherent problems, identified above, it cannot be concluded that XYZ is a learning organisation yet.

When using a carbon accounting system to trigger generative learning in an organisation, it is paramount to implement the system properly in order to avoid possible resistance. From the findings of this research, it can be concluded that in an ideal situation, the implementation of a carbon accounting system should be done in two steps.

The first step of implementation should be from a 'top-down' direction as the management team need to 'buy in' first, and set the direction for the company. As mentioned above, support from the management team is very important: it helps the company to establish formal learning among employees. Formal learning may include training, workshops and presentations given to employees to enable the employees to understand the system and gain sufficient knowledge to learn new ideas and make changes.

The second step of implementation should be from a 'bottom-up' direction. In this step, employees learn proactively and informally. They would have gained the knowledge on how to change in the first step, and they would now accept, and try to make, changes. The employees are now engaged in informal learning, as they will continue to learn from their discussions, from watching TV, and from reading the newspaper. At this stage, learning happens unconsciously, and is embedded in the employees' daily activities. This conclusion

is consistent with Burnes's (2004) research, mentioned in Chapter 2, where he suggested that the top-down approach (planned changes) and the bottom-up approach (emergent change) are allies rather than competitors, and can be used together to achieve the best result.

Chapter 6 Conclusions, contributions, and limitations

This research used the single case study approach to explore the relationship between carbon accounting systems and organisational learning. The proposition of this research is that Anthony's (1965) management control system can be applied to a carbon accounting system. Then the CAS becomes an integral part of the management control system and the implementation of the system stimulates organisational changes and generative learning in the organisation. Finally the organisation transforms to a learning organisation. From this research, it was found that the implementation of carbon accounting system triggered generative learning in XYZ Limited, however, it does not necessarily mean that XYZ Limited is a learning organisations. In order to truly become a learning organisation, inherent problems within the organisation have to be identified and solved to remove any resistance to change.

6.1. Conclusions

The implementation of the carboNZero programme in XYZ stimulated organisational changes and generative learning. Organisational changes were identified in many areas: (i) it changed the company's objectives, strategies and performance indicators; (ii) it encouraged XYZ to participate more often in community activities; (iii) it encouraged the development of initiatives to improve XYZ's environmental performance; (iv) it increased the awareness of environmental issues both internally and externally; and (v) it improved XYZ's communication between its employees.

Since some of these changes are closely related to the characteristics of a learning organisation, it can be concluded that the XYZ is in the transition process of becoming a learning organisation, but it is not a learning organisation yet due to the resistance to changes. The deviation between the original expectations and the findings may be explained by the various inherent problems of XYZ discussed in Section 5.3.

Finally, the resistance to change in XYZ is at both the organisational and personal levels. At the organisational level, the issue of 'dynamic conservatism' may be the cause, meaning that some XYZ staff are so used to working under the traditional company imperative , which is to gain economic benefits, that they ignore the information that would have helped them to

change. Another problem at the organisational level is the company structure. As the two offices of XYZ are located remotely, information flow and communication between the offices is hindered. Resistance to change at the personal level may be caused by poor training. Most lower level employees of XYZ did not receive comprehensive training or have sufficient knowledge of the carboNZero programme. This causes employees to have different understandings of the programme, with those who have limited understanding being resistant to the changes wrought. Personal level resistance to change may also be due to other issues, such as employees trying to avoid 'unnecessary trouble' (for example, extra workload and job security concerns).

6.2.   Contributions and suggestions for future research

Based on the experience gained from the case company, some recommendations are concluded which may be helpful in stimulating organisational learning when implementing carbon accounting systems:

- Educate all levels of employees, help them to understand the principles of the system, and provide reasonable amounts of information on the system.
- Before implementing, plan carefully, identify all possible bias against the implementation, and try to find solutions beforehand.
- Allocate sufficient resources to implement the system.
- Encourage everyone in the organisation to participate in the planning, implementation and evaluation process.
- Encourage communication and discussions regarding the system among employees.

This research is one of few attempts to study carbon accounting systems from management accounting's perspective. It focuses on the relationship between carbon accounting systems and organisational learning, and provides empirical evidence related to this research area. Although the implementation of carbon accounting systems should initiate organisational learning, the research found that it is difficult to achieve this in practice due to resistance at both the organisational and personal levels. This research should provide a basis and direction for future research on similar topics. According to Strauss and Corbin (1990), qualitative research is appropriate when first identifying variables of the phenomenon to be studied. Therefore, it could be rewarding to test the findings of this research quantitatively in future studies. Also, practitioners will find this research useful in their implementation of a carbon accounting system and in facilitating generative organisational learning.

6.3.   Limitations

There are some limitations to this research. Data access limitations meant that not all relevant documents were made available. Some documents were confidential, with limited time allowed to study others, consequently, the documents that were studied may not represent the whole picture of the phenomenon. McKinnon (1988) suggested that researchers use multiple methods of data collection to overcome this limitation. This is known as triangulation, which, as discussed in Chapter 3, was the method used in this research.

Another limitation is the observer-caused effect, which means that the presence of the researcher might affect the way that people behave. As a result, the data collected may not show the true characteristics of the research target. In interviews at XYZ, it sometimes appeared that the interviewees were trying to give the answers that they thought the researcher was looking for. In addition, no evidence of common causes for resistance at the personal level was found, as discussed in several relevant publications. It was suspected that some interviewees were uncomfortable with the interviews, and answered questions in such a way as to avoid "unnecessary troubles". To overcome this, interpersonal skills were revised to make the participants feel comfortable during the study. The researcher asked the interviewees to pick up the time and places for the interviews and the list of interview questions were given to each interviewee a couple of days in advance in order to make them feel comfortable and secure. The researcher always explains to the interviewees before the interviews start to make sure they understand that this research is an independent academic research, it has nothing to do with their performance evaluation and no disclosures of identity will be given in the research.

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Appendix

Interview Questions

- What motivated the company to adopt the carboNZero programme?

- How was the adoption decision made?

- What does the company try to achieve by implementing the carboNZero programme?

- Does everyone in your department support this programme?

- How often do you hear your colleagues talk about the carboNZero programme? How about environmental issues?

- Has anything changed by this programme?

- How is the programme implemented?

- What level of participation do you think is necessary?

- How much do you understand this programme? How about others in your department?

- Do you think it is necessary to let everyone in the organisation know a lot of details of the programme?

- How did you learn about this programme?

- How does the environmental performance get measured?

- How does this programme relate to your daily activities? Do you think the programme has any impact to your off-work life?

- Is there anything that you think you can do or something you have done to improve the environmental issues?