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Environmental Management Systems and Reporting

A New Zealand Case

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Abstract: This paper provides details of the information system used by a New Zealand co-operative organisation to manage and report on their efforts toward environmental sustainability. Evidence was gained primarily through interviews with personnel at one of the three manufacturing sites. This evidence was corroborated and supplemented with observations and document analysis. The paper provides a historical background to the environmental management system implementation, demonstrating that this particular system was adopted to facilitate formal documentation, to provide formal recognition that the organisation is environmentally conscious, and to ensure legislative compliance. The reporting process facilitated by the environmental management system enables communication of environmental information upwards, downwards and between sites within the co-operative and to external parties. This example of the implementation and use of a new management information system illustrates how an organisation and its employees can maintain a focus on the effect their actions and decisions are having on the environment.

Keywords: Environmental Sustainability, Environmental Management System, ISO 14-001, Case Study, Co-operative, Communication, Information System

Introduction

FOLLOWING 'AGENDA 21', constructed at the 'Earth Summit' held in Rio de Janeiro in 1992, over 100 nations agreed to commit to working towards sustainable development, "development which meets the needs of the present without compromising the ability of future generations to meet their own needs" (United Nations World Commission, 1987, p. 8). However, Bebbington (2001) suggests that "accounting for sustainable development falls short of a comprehensive, coherent fully linked image of how an organisation interacts with social, environmental and economic arenas."

Environmental accounting comprises two distinct areas: external environmental accounting and reporting; and environmental management accounting and information systems. The following section will provide a review of the relevant literature, focusing on environmental management accounting. It is noted that, in particular, there is little research exploring information systems which support an organisation's environmental management system.

An outline of the research methods utilised leads into an introduction of the research site, Ravensdown Fertiliser Co-operative Limited, providing an historical background to the environmental management system implementation and showing why this particular system has been adopted. A description of Ravensdown's environmental management system

is then offered, illustrating what takes place and how environmental performance is measured. An explanation of Ravensdown's organisational hierarchy is provided, demonstrating reporting responsibilities and how they are achieved. Furthermore, a description is given of how the co-operative uses environmental information.

The paper then turns to the employee focus to address the staff's role within the environmental management system. The discussion and conclusion evaluate the information infrastructure which supports Ravensdown's environmental management system, suggesting how and why the environmental information is communicated effectively.

Literature Review

There are various ways in which external accounting reports could include issues of sustainability. Bebbington and Gray (1990) suggest accounting for assets by classifying them as man made, critical natural or sustainable natural assets. This would enable an organisation to gauge whether or not it is destroying natural capital to create man-made capital. Gray (1990) advocates comparing organisational activity against sustainability standards developed by the law, industry or company codes. Miley and Read (2000) show how Australian financial reporting at the local state level incorporates a 'statement of green cash flows' and a 'state of the environment report'. Legal, educational or economic persuasion



also can induce organisations to add these environmental issues (Gray et al., 1995; Gilkison, 1999).

This research will look at internal environmental management accounting, which Rikhardsson (1998, p. 51) defines as “the process of identifying, measuring, accumulating, preparing, interpreting and communicating financial and non-financial information that helps managers fulfil corporate environmental objectives.” Environmental management accounting includes: the monitoring of environmental performance (Wilmshurst and Frost, 1998); the provision and interpretation of information which assists management in decision making; the communication of environmental information across all levels (Birkin, 1996; Wilmshurst and Frost, 1998); the achieving of optimal efficiency of a company’s resource conversion process “to achieve cost savings, greater efficiency and oversight, and streamlined regulatory compliance” (Pawar and Risetto, 2001, p. 10); environmental budgetary planning and control; and short-term decision-making (Birkin, 1996).

Knowledge about environmental management accounting is growing as research is being undertaken on different aspects of environmental management systems (Birkin, 1996). Prior research has concentrated on a number of areas, including: evaluating the implementation of environmental management systems (Burns et al., 1997; Füßel and Georg, 2000; Lehman, 1999; Lamberton, 2000; Smith, 2002); environmental capital investment appraisals (Bennett and James, 1998; Miles, 1987; Clarke et al., 1994; Walley and Whitehead, 1994; Dunk, 1999; Klassen, 2001); environmental cost accounting (Baker, 1996; Boer et al., 1998; Wilmshurst and Frost, 1998; Bennett and James, 1998; Lally, 1998; Rimer, 2000); and environmental performance measures (Bennett and James, 1994; Epstein, 1995; Schaltegger et al., 1996; Welford and Starkey, 1996; Young and Rikhardsson, 1996; Deloitte and Touche, 1996; International Standards Organisation, 1997; Loeber, 1997; Lanen, 1999). One area of environmental management accounting which has largely been ignored by previous research is the development of environmental management information systems to support environmental management accounting. This paper will focus on this area.

The International Federation of Accountants (1998) claims that the effectiveness of an organisation’s corporate environmental management strategy relies upon appropriate and reliable environmental-related accounting information. However, Gray (1992) suggests that certain aspects of accounting, such as the concept of money, will become obsolete when evaluating the environment. Therefore a different information system is required to record environmental inputs, outputs and processes. Rikhardsson (1998) defines environmental information systems

as consisting of a combination of hardware, software, people, procedures and tasks that manage environmental information and provide support to managers for achieving the company’s environmental objectives.

There has been some research on the role of employees in implementing environmental information systems. The employees of an organisation can influence the effectiveness of an environmental management system, as they provide the basis for its implementation at the operational level. Smith (2002, p. 37) concludes that employees are the key to success, by showing that environmentally sensitive companies “do not want big, honking binders on a shelf. We want living, working documents. We want employees to own it”. Pawar and Risetto (2001) found that it is essential that employees participate in the earlier stages of environmental management system implementation so that it is integrated into the overall organisational culture. Wilson (1998b) explains that an organisation can have the best environmental management system available, yet if employees are unaware of their responsibilities, the system will fail. Employee training programmes, which provide job-specific training and assessment of employees, should increase employees’ overall awareness of the environment and how to prevent environmental impacts resulting from employees’ actions or inactions. Wilson (1998a) stresses that environmental communication with employees is essential. Employees need to have an overall awareness of environmental happenings in the organisation so participation in and contribution to environmental systems can occur (Birkin, 1996).

There has been little research conducted in New Zealand on environmental management accounting. In particular, there are no empirical case studies considering the development of an enhanced information infrastructure which supports an effective environmental management system (International Federation of Accountants, 1998). This paper fills this gap by studying the environmental management information system at a supplier co-operative, Ravensdown Fertiliser Co-operative Ltd.

This study has three research objectives:

1. To provide an historical background of the company’s implementation of the ISO-14-001 environmental management system;
2. To describe the internal non-financial environmental performance system being implemented, including details about how the organisation developed its environmental performance measures in order to ensure compliance with legislation and regulations; and
3. To explore how environmental information travels between levels in the organisation and how it is used at each level.

Research Methods

A single case study approach has been adopted as it allows multiple sources of evidence to be utilised (Smith et al., 1988) and provides a holistic understanding of a single organisation, Ravensdown Fertiliser Co-operative, which cannot be provided by multiple designs (Yin, 1994).

In analysing Ravensdown four sources of evidence have been utilised. These multiple sources of evidence ensure the validity and reliability of the qualitative research presented (McKinnon, 1989).

Firstly, interviews provided the primary source of evidence. Open-ended interviews were conducted, using a semi-structured questionnaire as a guide. This allowed a flow of rich information to be obtained (Strauss and Corbin, 1990). Interviewees at Ravensdown included: the strategic planner, an environmental, health and safety manager, a plant manager, the chief financial officer and a number of general manufacturing staff at Ravensdown's Hornby plant. Interviewees external to Ravensdown were: a resource consent manager from Environment Canterbury¹ and a Ravensdown shareholder. Multiple respondents were used to guard against any single respondent's view being treated as representing the whole organisation and also to reduce the likelihood of a distorted reconstruction of events (Strauss and Corbin, 1990).

Secondly, historiography is used to describe Ravensdown's environmental activities from its origins to the present day, placing an emphasis on why the environmental management system was implemented. The historical context provided the basis of the study and formed a natural link to the interview-based research (Goodman and Kruger, 1988; Yin, 1994).

Thirdly, four independent observations at Ravensdown's Hornby manufacturing site took place. One of the authors had access to the whole site to observe a number of areas including: dispatch A and B; manufacture; acid plant; urea dispatch; administration block; and water storage. The observations undertaken allowed the researcher a practical perspective of the environmental management system.

Finally, document analysis was employed to corroborate information gathered from interviews (Yin, 1994). Documents examined include: Ravensdown's annual financial reports from 1976 to 2004; Environment Canterbury consent forms; publications issued by Ravensdown, such as *The Gumboot Takeover*, brochures, *Code of Practice for Fertiliser Use*; Governmental regulations; and relevant documents internal to the co-operative, for example, a systems

improvement report and *Growing Today* (an internal newsletter written for staff).

Findings

Research Site

Ravensdown came into existence in 1978 as a result of dissatisfaction by farmers with the performance of existing fertiliser companies: the availability of fertiliser was unreliable; the quality of mineral specifications was low; and, due to inefficient plant and management, the price was high. The supply co-operative is fully owned by New Zealand farmers and has the sole purpose of purchasing, manufacturing and supplying over 24,000 shareholders' fertiliser needs (Ravensdown, 1992).

Ravensdown's activities have a direct impact on the environment, during both manufacture and use. Ravensdown's strategic planner comments: "We need to ensure that the way we produce and handle fertilisers and how we recommend they be used is consistent with best environmental practices protecting land, air, water, plants, animals and people" (Ravensdown Annual Report, 2001, p. 17).

Ravensdown has always been aware that if it wants to operate long term it needs to actively participate in environmental issues. For example, in 1993 windbreak structures were erected at Ravensdown's manufacturing sites in order to help control dust emissions, and a substantial proportion of research and development expenditure was invested in an effort to find better ways of reducing emissions (Ravensdown Annual Report, 1993).

Management, who are strongly committed to environmental issues, felt that a formal environmental policy needed to become visible not only within Ravensdown, but also to the general public dealing with the co-operative (Ravensdown Annual Report, 1997). Ravensdown's Board of Directors and Chief Executive Officer jointly produced the following environmental policy: "The environment is an integral part of our business and we acknowledge the relationship between the environment and our products and activities. Our commitment to the environment will be a guiding principle in our business and planning and development" (Ravensdown Annual Environmental Report, 2001, p. 2). With this commitment, Ravensdown continues to actively improve its environmental performance, moving towards a long term objective of gaining zero pollutant emissions at their three manufacturing plants: Ravensbourne, Hornby and Awatoto.

Each year Quality Assurance Services (QAS) undertakes external audits on Ravensdown's environ-

¹ Environment Canterbury is an elected body of local government, responsible for "the promotion of sustainable management of natural and physical resources" (Environment Canterbury, 2005).

mental management system. Dr G. S. Williams, Ravensdown's external environmental auditor, states: "Ravensdown has recognised that their activities have an impact on air, water and soil quality and are proactive in the management, monitoring and minimising of these impacts. Ravensdown management and directors are to be congratulated on this corporate social responsibility" (Ravensdown Annual Environmental Report, 2001, p. 8).

Ravensdown takes an active role in both internal and external education on environmentally related activities, through staff training and publications relevant to the environment.

Ravensdown's environmental policy has enabled the organisation to set a number of environmental goals to be achieved, including:

taking account of environmental issues in all commercial decision-making; complying with relevant environmental legislation; ensuring emissions are at the lowest level possible; working to improve environmental performance; being a good neighbour, concerned about the impact of the co-operative's activities on the surroundings; furthering awareness among staff of the interaction between activities and the environment; encouraging staff to respect the environment in their activities; developing an appreciation of the positive impacts of fertiliser on the environment among staff and the community; and, supporting research into the best use of products made maximising their benefits and minimising any negative environmental impacts (Ravensdown Annual Report, 1998, p. 13).

To achieve these environmental goals and supplement the organisation's environmental policy, an ISO-14-001 accredited environmental management system was adopted in 1997 (www.Ravensdown.co.nz). This system consists of international environmental management standards allowing organisations around the world to have an accepted common framework to document environmental activities (International Federation of Accountants, 1998). Ravensdown's manufacturing site at Ravensbourne began implementing an environmental management system in June 1996, working towards ISO-14-001 certification. The reporting system put in place was verified and accredited in March 1997 (Ravensdown, 1997a). The Hornby and Awatoto manufacturing plants followed Ravensbourne's lead, being certified in May 1999 and October 1999 respectively (Ravensdown Annual Report, 1999).

There are a number of reasons why Ravensdown's management chose to implement an environmental management system. The most important reason was to facilitate formal documentation. As top manage-

ment and the Board of Directors are at a distance from the individual manufacturing plants, the implementation of an environmental management system at each manufacturing site enables upper management to be more informed of activities occurring at lower levels of the organisation. The ISO-14-001 system was chosen due to its strength in requiring procedures to be documented (Ravensdown, 1997b). The environmental management system enables an environmental information reporting standard to be set across the organisation, providing a better standard of communication concerning environmental issues. The formal reporting process that has resulted from the environmental management system implementation has the added benefit of increasing staff awareness of Ravensdown's environmental focus.

Secondly, the implementation of an international standard management system provides formal recognition that Ravensdown is environmentally friendly and not neglecting the environment. This has the advantage of improving the co-operative's image within the community by demonstrating that an environmental management system has been implemented and is achieving its goals.

Thirdly, the co-operative needed to put in place structures to ensure adherence to relevant legislation. The *Resource Management Act 1991* classifies fertiliser as a contaminant; therefore production is subject to environmental conditions. Ravensdown operates within resource consents and discharge permit levels set out by governmental regulatory bodies having district authority. For example, the Hornby site needs to obtain resource consents from Environment Canterbury for environmental impacts of manufacturing activities, such as consumption of groundwater or discharge of contaminants into the air. These consents and permits are processed and granted by Environment Canterbury with Ravensdown having the responsibility to remain within the limits prescribed (Environment Canterbury, 1997). Independent audits of Ravensdown's environmental management system provide assurance to regulatory bodies and the Board of Directors that the organisation is operating within its resource consents.

ISO-14-001 Environmental Management System

As an example of one implementation of the environmental management system, this section will focus on the Hornby site. Hornby's environmental management system comprises nine work stations situated around the manufacturing plant which record and track all environmental activities affecting them. These workstations are paper-based, consisting of a large folder containing: the environmental management programme, a document listing all the current

environmental objectives and targets, system improvement reports, Ravensdown's environmental policy, and procedures to follow if an environmental issue arises. The system is updated regularly and fully reviewed each year after the environmental audit. Essentially the system consists of documentation of environmental activities at a plant level, with a flow of information to management level where it is assessed.

Management system records from the plant level are retained in the environmental management computer system. The records include those produced as a result of operating an environmental management system (for example, environmental management programmes, environmental aspect identification sheets, continuous audit sheet summaries) and also additional records which demonstrate compliance with ISO-14-001 (for example, Environment Canterbury discharge and water abstraction reports). The environmental management system provides a summary of Hornby's environmental objectives along with set targets to achieve these objectives (Ravensdown, 1999).

The environmental management system also documents all relevant legislation necessary for the manufacturing site to operate, such as the *Fertiliser Act 1982*, the *Transport Act 1962* and a number of regional plans. A register of operating permits is also part of the system. The register contains all of the consents that Ravensdown requires to carry out its operating activities, including discharge to air permits and storage of dangerous goods permits (Ravensdown, 1999).

The environmental management system comprises two forms of environmental performance measures: the first is the identification of environmental aspects to continually improve the site; the second is discharge levels to meet resource consents and for inclusion in the annual environmental report. All environmental aspects are identified, including their characteristics, emissions likely to occur, possible effects of those emissions and the legal requirements Ravensdown is subject to under each aspect (Ravensdown, 1999).

A significance test is carried out on each environmental aspect to gauge the priority of each activity. This is achieved in two ways. Firstly, the environmental aspect is evaluated based on likelihood of occurrence, magnitude of effect, etc. Secondly, the risk is quantified by listing every area of possible risk. Scales have also been developed for likelihood and consequences measures. The significance of an

environmental aspect is then given a numerical value (Ravensdown, 1999). Both significance tests are carried out with the hope of obtaining the 'true' priority of the environmental aspect. The environmental aspects are then recorded in the environmental aspect summary with information regarding their impact and controls that may be introduced to prevent any adverse impacts. If the controls do not prevent the problem then the aspect will appear on the environmental management programme.

Environmental aspects can be added by anyone on site – workers, managers, customers and visitors – by returning an environmental aspect identification form to the health and safety, quality and environmental manager (H&S,Q&E) (Ravensdown, 2002b). Environmental aspects can also be included in the environmental management programme for other reasons, such as health and safety. A review of the environmental management programme is completed every year before budget time to allow for the allocation of money to projects (Ravensdown, 1999).

The second environmental performance measure, discharge levels, provides data which is needed to observe resource consents. Air and water emissions are monitored on-site, by recording the results in a log sheet in the environmental management system. As the company states: "Ravensdown has a commitment to continuous environmental improvement and as a result of this we monitor our outputs to ensure we meet our resource consent" (Ravensdown, 2002d). The environmental performance indicators measuring air and water emissions are then included in Ravensdown's annual environmental report illustrating levels of fluoride, sulphur dioxide, and phosphorous. Another measure of discharge levels is that of complaints from neighbours and locals in the areas surrounding each manufacturing site (Ravensdown Annual Environment Report, 2001).

Environmental Information Flows

Figure 1 illustrates the organisational hierarchy of Ravensdown. Environmental information can travel in three directions within the organisation: upward, where environmental issues have been documented at a plant level and need to be communicated to senior management; downward, where managers need to inform staff on matters regarding the environment; and cross-site, where Ravensdown's three manufacturing sites discuss environmental issues. A fourth channel of environmental communication is to external entities, for example, through environmental publications.

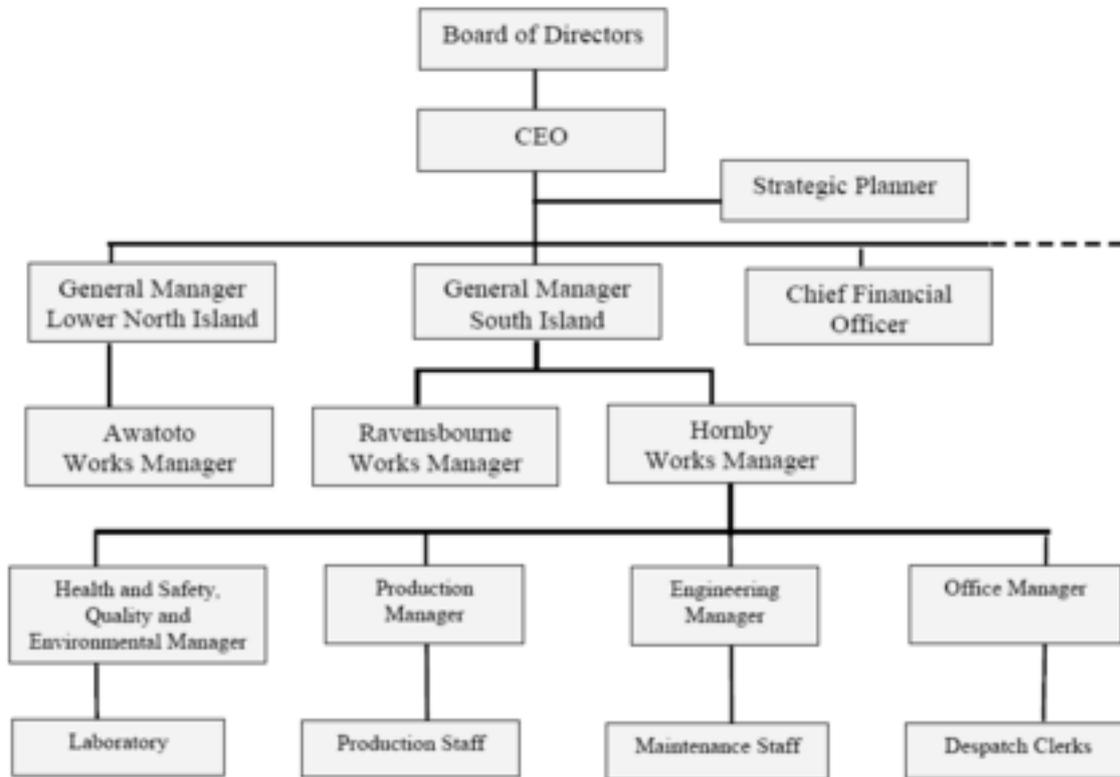


Figure 1
Ravensdown Fertiliser Co-operative Limited Organisational Chart. Extract from internal document.

Upward Communication

Environmental information gathered through the environmental management system is reported to the Works Manager by the H&S,Q&E manager. This report contains any new environmental aspects that have been identified, emission levels, problems with the system and any other information concerning the environment.

After receiving this report the Works Manager will factor any issues of importance regarding the environment into a report prepared with a site-wide perspective, suitable for presentation to the General Manager, South Island, who reports directly to the CEO of the co-operative. The CEO then collates the information into a formal report for the Board of Directors.

Ravensdown rates the need to communicate with each of their twenty-four thousand shareholders very highly, and this is illustrated by their investments in a call centre, e-business and integration of geographic

information to enhance services to its shareholders (Aimer, 1998). Environmental information is also communicated to Ravensdown shareholders through the Annual Report, quarterly co-operative newsletters, an annual environmental report, and Ravensdown shareholder meetings which are held throughout the country on a regular basis. Additionally, information is communicated through informal means, for instance, holding field days for farmers and visiting rugby games (Ravensdown, 2002f).

Downward Communication

Environmental goals are reviewed and discussed at general management meetings. ISO-14-001 meetings are held to review any aspect of the environmental management system, such as assessing goals, and illustrating progress made. The meetings include both management and staff so that general feedback is obtained and a means of communication to staff is provided.

Environmental information from senior managers guiding lower level managers is seen as 'directional'; for example, having been on an operations conference, top management will address the manufacturing site personnel with a statement about the direction the company will now take. Most of the time information is filtered through the organisational hierarchy to reach the site managers.

Ravensdown's internal newsletter, *Growing Times*, provides information to employees on environmental developments that are occurring, outlining new initiatives and new processes and providing feedback on the effectiveness of the current system and process. This newsletter is distributed to all levels of the organisation (Ravensdown, 2002c). Also employees' payslips include reports on emission levels.

Cross-site Communication

Manufacturing site-based communication of environmental documentation consists of a less formal reporting mechanism; for example, an environmental issue may be discussed in an informal conversation. An open plan office space at the Hornby manufacturing site facilitates this style of communication, which often occurs between the H&S,Q&E manager and the plant manager.

Cross-functional communication also takes place where all three manufacturing sites communicate through video-conferencing about environmental operating issues. This is not a regular reporting device, but can be utilised when a problem occurs or a need becomes apparent. Operational conferences, held once a year by Ravensdown, allow informal environmental communication between sites. These conferences provide site managers with a means to 'catch up' and assess each other's progress.

External Communication

Each manufacturing site possesses a *Contractors Manual* constructed for contractors and sub-contractors employed by Ravensdown for term employment. This document informs casual workers of environmental risks, potential hazards and the environmental regulations within which Ravensdown operates (Ravensdown, 2002a). Each site also has a *Welcome to Ravensdown Fertiliser* pamphlet issued at the front desk of the administration department. This pamphlet introduces customers and visitors to the specific site, highlighting how important the environment is to Ravensdown and asking visitors to respect this by behaving in a responsible way (Ravensdown, 2002g).

There are numerous publications for interested parties external to Ravensdown including: shareholders, local government, iwi (Māori tribes/people groups), and local neighbours (Ravensdown, 1999).

Ravensdown feels it has a responsibility to educate end-users of their product to minimise the impact of fertiliser on the environment. As an example, Ravensdown was a 50% partner in the three year development of the *Code of Practice for Fertiliser Use*, a code designed to provide a framework for spreading fertiliser ensuring farmers avoid, remedy or mitigate any adverse environmental effects (Fertresearch, 1997). In an effort to promote the *Code*, Ravensdown trains and educates field staff, farm advisors, retailers and farmers. Ravensdown's strategic planner comments: "We need to ensure that the way we produce and handle fertiliser, and how we communicate they be used is consistent with best environmental practices protecting land, air, water, plants, animals and people."

Product education and understanding is also achieved through the use of external brochures which Ravensdown has available on all of its goods. These brochures provide a general level of information on the product with an explanation of any environmental effects the product is likely to have.

Ravensdown publishes a quarterly newsletter in each of its three manufacturing regions. The newsletter is publicly available, providing the reader with Ravensdown news and events. The newsletter contains environmental information; for example, Ravensdown's ISO-14-001 accreditation was summarised with an explanation of how this increase in environmental performance will aid the co-operative (Ravensdown, 1997a). The newsletter allows the interested public to remain informed of the co-operative's progress in environmental matters.

Ravensdown developed its first annual environmental report in 2001, reporting to the general public on Ravensdown's environmental activities and emission levels for the year. Ravensdown's CEO believes that the "environmental report's objective is to provide the reader with an understanding of our business and environmental issues we address" (Ravensdown Annual Environmental Report 2001, p. 2).

Employees Knowledge of Environmental Activity

Wilson (1998a) recognises environmental communication with employees as being essential, as employees are responsible for the day-to-day operations of the organisation. If employees misunderstand their individual impact, the organisation's effort to increase its environmental performance may be unsuccessful.

Ravensdown provides environmental communication to staff in a broad sense through staff training programmes. Environmental training occurs both internal and external to Ravensdown. Internal

presentations are held by the H&S, Q&E manager in an effort to provide staff with an overall sense of the co-operative's environmental position and guidance specific to their position. Employees are also sent to external training courses on environmental impacts, which have provided an increased level of environmental awareness.

The co-operative's environmental position is reinforced to staff members through the organisation's environmental policy and environmental management system documents located throughout the site. Ravensdown managers have always regarded employee participation as important. Staff's identification of environmental aspects during their day-to-day activities begins the documentation process.

Overall the employees interviewed feel that participation is recognised by management: what they suggest does not go unnoticed and is entered into the environmental management system. They realise that management are unable to implement every idea suggested and only expect to receive a fair hearing which occurs frequently. Employees feel that the environmental management system has increased awareness of environmental issues at the plant. However, with this has come extra work in documenting environmental aspects.

Discussion and Conclusions

Environmental management information systems supporting environmental management accounting have largely been ignored in previous research. Rikhardsson (1998) comments that environmental information systems should manage environmental information, providing support to managers in achieving the company's environmental objectives.

Ravensdown's environmental management system has been implemented primarily as a tool for facilitating the documentation of environmental information, allowing the co-operative to control, plan and improve environmental performance, and thus to manage environmental information more efficiently. The detailed implementation of the system shows that Ravensdown makes a genuine effort to record and manage environmental activities. This case study has explored how the documentation of environmental issues in the environmental management system can be reported and communicated, not only upwards to senior management, directors and shareholders, but also downwards, within the organisation and outside the organisation.

The managerial commitment shown in this co-operative has resulted in the environmental policy permeating the entire organisation, appearing as far

down as individual departments at manufacturing sites. The policy has led to a number of environmental objectives being set in place, with managers reinforcing this with strong leadership, a structured reporting framework and a conscientious effort to educate both inside and outside users through environmental publications.

Employee commitment to Ravensdown's environmental management system is strong with training programmes providing a good overall level of knowledge regarding environmental issues. The documentation process has affected staff because of the time taken to complete activities, yet participation in identifying environmental aspects and including them in the reporting system is high.

Both managerial and employee commitment is intense in striving to achieve Ravensdown's environmental objectives, complying with relevant legislation and working towards a uniform goal illustrated in Ravensdown's environmental policy.

Environmental performance indicators could now be used in this organisation as a means of measuring managerial performance, thus creating a balanced scorecard type performance measure, where a manager is measured using financial and non-financial aspects (Kaplan and Norton, 1992).

Non-financial performance measures could be further enhanced through the use of external benchmarking. Simmons (1995, p. 3) defines benchmarking as "an ongoing activity of comparing one's own process, product, or service against the best known similar activity, so that challenging but attainable goals can be set and a realistic course of action implemented to efficiently become and remain best-of-the-best in a reasonable time." Ravensdown has two possibilities when considering benchmarking their environmental management system: the first is to compare all three sites to each other to promote competitiveness; the second is to obtain a market average that Ravensdown's overall position can be benchmarked against. Ravensdown has taken this initiative by joining the Core Leadership Group, which gives it access to external benchmark environmental information (Ravensdown, 2002e).

Opportunities for Future Research

There is scope for many more intensive case studies of environmental management systems and reporting. This paper has looked at only one manufacturing organisation. Future research could look at other industries and organisation types. Also, research could investigate the management accountant's role in the environmental management system.

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