

Portfolio Submitted for the Degree of  
Engineering Doctorate (EngD) in  
Environmental Technology

The UK Packaging Regulations and Performance  
Measures in Environmental Management Systems

by

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## ABSTRACT

The measurement of industries' environmental performance is evolving as society strives towards the ideal of sustainability. Environmental performance indicators within different industries are being developed in order that industry can measure and evaluate performance and report on their level of environmental protection to different stakeholders. Although there are many studies of environmental performance measures, they have tended to focus on those that apply to manufacturing or 'dirtier' industries. This is mainly because environmental legislation, a major driver of environmental programmes in companies, has targeted these industries. Recent legislation on packaging has focused, for the first time, on environmental impacts that are pertinent to all industry sectors alike. This has given rise to an industry-wide set of environmental performance measures for packaging and packaging waste. This 'producer responsibility' legislation has marked the turning point as more legislation is formulated at the European and national level to holistically tackle the environmental impacts of product life-cycles.

Current research has concentrated on the development of performance measures for a service-orientated business that is subject to legislation concerning packaging waste, using ICL (International Computers Limited) plc. as a case study example. Particular attention has been given, in this research, to the identification of EPIs and their integration into an ISO 14001 certifiable environmental management system for the purposes of demonstrating continuous improvement. A risk assessment methodology is applied to demonstrate the effects of business constraints in the decision-making process regarding environmental programmes. The impacts of the UK Producer Responsibility Obligations (Packaging Waste) Regulations 1997 on the organisation and the necessary steps that the company has had to take in order to comply with the legislation have been examined. From this study a compliance methodology has been developed and it has been demonstrated how an organisation can achieve compliance and conserve valuable resources for improving its environmental performance. Finally, a survey has been carried out in order to assess the impacts of the UK Packaging Regulations on the environmental performance of industry. From this study a model has been developed for the application of EPIs to guide policy makers in the formulation of environmental legislation and the implications for future producer responsibility legislation.

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### **Annex 1: Publications**

Appendix 1: Developing environmental performance indicators for an information technology systems and services company

Appendix 2: The UK Producer Responsibility (Packaging Waste) Regulations 1997 – A Methodology for Compliance

Appendix 3: A Survey of the Effects of the UK Packaging Regulations on the Environmental Performance of Companies.

### **Annex 2: ISO 14001 Documentation for Performance Measures**

Appendix 1: Environmental Performance Indicators Manual

Appendix 2: Environmental Performance Measurement Procedures

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### **Annex 3: Survey Data**

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Appendix 2: Table of Survey Response Data, Analysis Calculations and Sample Formulae

Appendix 3: Graphical Representations of Survey Results and Non-parametric Test Data

### **Annex 4: Modules**

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## **GLOSSARY**

(Taken from a number of sources indicative of author's interpretation of the terms used and applied in this thesis)

### **Acid rain**

Sulphur dioxide SO<sub>2</sub> and nitrogen oxides NO<sub>x</sub> are the main pollutants which cause acid rain. Both are emitted principally by the burning of coal, oil and petroleum in power stations and motor vehicles

### **Climate Change**

A change in climate resulting primarily from human activities, and their direct or indirect effects on the climate system, which comprises the atmosphere, biosphere, oceans, water resources, soils and geological processes. Human activities affect these components and their interactions through releases of gases such as carbon dioxide, CFCs, nitrogen oxides, sulphur dioxide and water vapour directly into the atmosphere; through changes to ecosystems within the biosphere such as deforestation, desertification, or the draining of wetlands; and through the knock-on effects that these and similar changes cause to other components

### **Environment**

Surroundings in which an organisation operates, including air, water, land natural resources, flora, fauna, humans and their interrelation



<b>Environmental aspect</b>	<b>Element of an organisation's activities, products or services that can interact with the environment</b>
<b>Environmental audit</b>	<b>An inspection system that assesses the environmental effects of an organisation's activities, products and suppliers. It covers specific audits of waste prevention and other matters and focuses on environmental issues of key concern, for example, the organisation's impact on ozone depletion, pollution control, contaminated land or water, noise and odour pollution and waste minimisation.</b>
<b>Environmental condition indicator</b>	<b>Specific expression that provides information about the local, regional, national or global condition of the environment</b>
<b>Environmental impact</b>	<b>Any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organisation's activities, products or services</b>
<b>Environmental management system</b>	<b>The part of the overall management system that included organisational structure, planning activities, responsibilities, practices, procedures, processes and resources for developing, implementing, achieving, reviewing and maintaining the environmental policy</b>

**Environmental policy**

**Statement by the organisation of its intentions and principles in relation to its overall environmental performance which provides a framework for action and for the setting of its environmental objectives and targets**

**Environmental performance**

**Results of an organisation's management of its environmental aspects**

**Environmental performance indicator**

**Specific expression that provides information about an organisation's environmental performance**

**Environmental programme**

**Project or plan for achieving an organisation's environmental objectives and targets. It should include: (a) designation of responsibility for achieving objectives and targets at each relevant function and level of the organisation; and (b) the means and time-frame by which they are to be achieved**

**Environmental target**

**Detailed performance requirement, quantified where practicable, applicable to the organisation or parts thereof, that arises from the environmental objectives and that needs to be set and met in order to achieve those objectives.**

**Global warming**

**The term used to describe the rise in the Earth's overall temperature caused by human activities. Fossil fuel burning and other practices have combined to produce more and more greenhouse gases, which absorb infra-**

red radiation emitted from the Earth's surface and heat up the atmosphere in the process.

As a result, average temperatures around the world have risen by about 0.5°C since the beginning of the century.

Carbon dioxide (CO<sub>2</sub>) emissions from human activity are estimated to have caused around 50 per cent of this increase; a further 25 per cent is contributed by CFCs, and another 15 per cent by methane

Management performance indicator

Environmental performance indicator that provides information about the management efforts to influence an organisation's environmental performance

Non-renewable resources

Resources which, once used, can never be renewed. Fossil fuel energy such as coal, oil or minerals are examples

Operational performance indicator

Environmental performance indicator that provides information about the environmental performance of an organisation's operations

Organisation

Company, corporation, firm, enterprise, authority or institution, or part or combination thereof, whether incorporated or not, public or private, that has its own functions and administration

Packaging Regulations

The UK Producer Responsibility (Packaging and Packaging Waste) Regulations 1997

**Polluter pays principle**

The principle that those who cause pollution should bear the costs not only of damage caused by pollution, but also of measures necessary to reduce pollution.

**Recycling**

The process by which waste or used materials are put back into productive use. Efficiently operated recycling systems can reduce pollution problems caused by waste disposal. In addition, some recycling schemes may provide alternative sources of energy, and all aim to conserve energy and natural resources.

## **Sustainability**

**Economic, environmental, and social performance that is in conformance with the requirements of sustainable development**

## **Sustainable development**

**Sustainable development is defined in the Bruntland Report as ‘development that meets the needs of the present without compromising the ability of future generations to meet their own needs’. The aim of sustainable development is ‘improving the quality of human life within the carrying capacity of supporting ecosystems’ – a definition used in the joint IUCN, UNEP and WWF report entitled ‘Caring for the Earth: A Strategy for Sustainable Living’. Sustainable development emphasises the need for a balanced relationship between environmental, social and economic factors. Any industrial or other development will only be sustainable when it sustains the communities and environments on which it depends both now and in the future.**

## **Training**

**The Manpower Services Commission has defined training as:**

**‘a planned process to modify attitude, knowledge or skill behaviour through a learning experience to achieve effective performance in any activity or range of activities. Its purpose, in the work situation, is to develop the abilities of the individual and to satisfy current and future manpower needs of the organisation.**

## ABBREVIATIONS

(All acronyms used in this thesis and listed below are either cited in literature or accepted in industry)

CCL	Climate Change Levy
CEA	Corporate Environmental Affairs
CEFIC	European Chemical Industry Council
CER	Corporate Environmental Report
DETR	Department of the Environment, Transport and the Regions
DfE	Design for the Environment
EA	Environment Agency
EC	European Commission
ECI	Environmental Condition Indicator
EEB	European Environmental Bureau
EIM	Environmental Information Management
EMS	Environmental Management System
EMAS	European Eco-Management and Audit Scheme
ENDs	Environmental Data Services
EPE	Environmental Performance Evaluation
EPI	Environmental Performance Indicator
EPMF	Environmental Performance Management Framework
EPS	Expanded Polystyrene
ERN	Electronic and Electrical Equipment Recovery Note
EU	European Union
GRI	Global Reporting Initiative
ICL	International Computers Limited
IPP	Integrated Product Policy
ISO	International Organisation for Standardisation

IT	Information Technology
ITT	Invitation To Tender
MO	Material Organisation
MPI	Management Performance Indicator
MSWG	Multi-State Working Group
OPI	Operational Performance Indicator
Pb	Lead
PERN	Packaging Exporters Recovery Note
Polyprop	Polypropylene
PRN	Packaging Waste Recovery Note/ Producer Responsibility Note
Regs	Regulations
SEPA	Scottish Environmental Protection Agency
TRI	Toxic Release Inventory
TQEM	Total Quality and Environment Management
UKEN	United Kingdom Environment News
UNEP	United Nations Environment Programme
WEEE	Waste from Electrical and Electronic Equipment
WML	Workplace Management Limited

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## PORTFOLIO STRUCTURE

This portfolio is compiled in two volumes. This, the first volume contains the abstract, executive summary and the thesis which presents the intellectual contribution to environmental technology arising from this work. The second volume contains the six-month progress reports, numbered sequentially, and each with its own independent set of annexes and/or appendices.

The abstract and executive summary should be read first before reading the thesis, which offers comprehensive coverage of the entire research project. Where appropriate, in the thesis, references are made to relevant sections of the six monthly progress reports in volume two. The detail contained therein should be regarded as supplementary material.

The research work presented in this EngD portfolio is the author's own. Where the work of others has made a significant contribution to any aspect of this research project appropriate credit is given. Where the work of other researchers is quoted their comments are italicised.

The author would like to point out that between the time of writing and the publication of this document their surname changed from Collins to Collins-Webb.

# Executive Summary

## EXECUTIVE SUMMARY

### Project Background

The project was set up in 1996 to look at the environmental information requirements of a multinational computers company, ICL plc. At that time, ICL was a manufacturing organisation but the company's manufacturing arm was sold to Celestica, a Canadian company, in March 1997. Over the duration of the project, the company progressed from a systems and services organisation through to an e-business. When Celestica purchased the manufacturing arm (Design to Distribution, D2D) its decision was influenced by the fact that D2D had a high profile environmentally, being the first electronics manufacturer to achieve BS7750, EMAS and ISO 14001 accreditation. With the sale of its manufacturing arm, ICL lost its ISO 14001 and EMAS certification. In 1997, ICL set up new projects working towards the achievement of ISO 14001 but due to organisational changes the focus of this project had to change in order to take a global perspective. ICL's parent company, Fujitsu, has been undergoing an ISO 14001 implementation programme and as such this has exerted pressure on ICL to obtain certification. In addition, ICL is increasingly receiving questions on ISO 14001 within bid documents and Invitations to Tender (ITTs) on its compliance to environmental legislation, environmental performance measures and environmental programmes.

The research project aims over the four years have adapted to reflect these organisational changes. Environmental impacts differ from organisation to organisation and the research presented here has focused on an organisation that is service-oriented. Alongside the increasingly important environmental impacts arising from energy use and transport for such organisations are the impacts associated with waste for which there is an increasing amount of legislation. An example of this is the UK Government's Producer Responsibility Obligations (Packaging Waste) Regulations 1997. These regulations are extensive and demand the development of environmental measures for packaging and subsequently, information systems that have not previously held this type of data. The processes that have been set up in order for ICL to comply with the legislation have paved the way for meeting future, similarly information intensive environmental regulations which are expected to follow. Such regulations will be transposed from legislation produced by the European Commission and

will include the Waste Electronics and Electrical Equipment (WEEE) Directive and the Integrated Product Policy (IPP).

This research has concentrated on three main areas. Firstly, the development of environmental performance indicators, utilising the ISO 14031 environmental performance evaluation standard, for service-orientated organisations like ICL. The outcome of this has been the development of a risk assessment methodology and a model for integrating EPIs into an ISO 14001 compliant environmental management system. The second area has been to assess the effectiveness of the Producer Responsibility Obligations (Packaging Waste) Regulations 1997 on driving environmental performance within the company and the outcome has been a detailed policy analysis of the legislation and the formulation of a methodology for compliance. The third and final section is an assessment, via a national survey, of the effects of the Regulations on the environmental performance and programmes of companies across the UK.

## **Aim**

To understand and assess the relationship between the legislative drivers of environmental performance, and develop a system for the development of a set of environmental performance indicators and integration into an ISO 14001 compliant environmental management system, within a service-orientated business, using ICL plc. as the case study organisation and the UK Producer Responsibility (Packaging Waste) Regulations 1997 as the driver of universal performance measures.

## **Overall Goals and Objectives**

At the end of the second year of the project, the overall goals and objectives were outlined (see Volume 2, Report 4) and these were refined and developed during the remainder of the project. Each objective is outlined here and the progress over the duration of the project is summarised.

**I To review the environmental information requirements and flows within a multinational information technology business.**

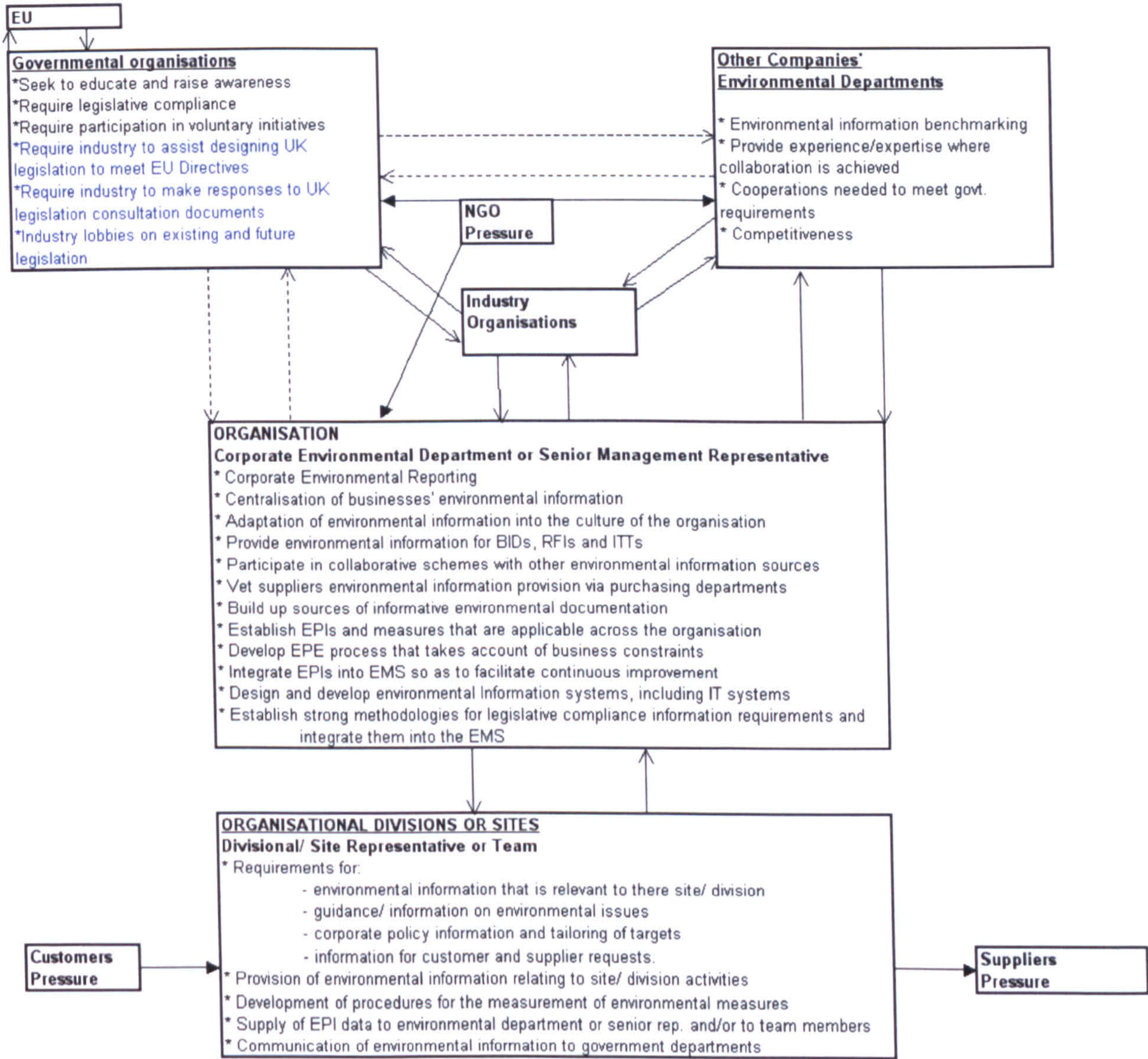
- **Develop model of information flows within the company and industry**

This model was developed for Environmental Information Management (EIM) and was completed early on in the project. It was extended in the final two years of the project through the investigation of environmental performance measures and their integration into an ISO 14001 compliant Environmental Management System (EMS) to provide a model which is generic for application across all industry sectors. This generic EIM model illustrated overleaf shows the flow of environmental information both within and external to an organisation.

- **Review CEA activities and the status of environmental data collection**

Quantitative environmental data collection and their analysis have formed part of the project since the start of the research programme (Volume 2, Report 3). The collection of hard-core data enabled the environmental performance measures to be developed later on in the project. Quantitative environmental information was gathered and from this a waste manual was produced for the company (Volume 2, Report 3, Annex 3). This demonstrates the breadth of information required by, and communicated within, such an organisation. By the end of the first year, the researcher had supervised an MSc project which led to the production of a report on plastics packaging waste and strategies for minimisation, reuse and recycling within an organisation (Volume 2, Report 2).

### The Role of Environmental Information Management (EIM)



- Key**
- Pressure →
  - Information Flow →
  - Possible Information Flows - - - - ->

**II To review the impacts of current and future environmental legislation on the information requirements and environmental performance of the company.**

- Review environmental legislation directly relating to ICL's operations.

All environmental legislation relating to an IT systems and services organisation was continually reviewed and developments in contaminated land, waste electrical and electronic equipment, packaging, special waste and batteries legislation reported in Volume 2. Reps. 1-2 & 6.

- Review packaging legislative information requirements.

Specifically packaging legislation in the UK and its impact on the industry has been key to this study. A compliance methodology, which is now operational within the company, has been developed. The methodology can be applied to other organisations in any sector that have to comply with the UK Producer Responsibility (Packaging Waste) Regulations 1997 (Volume 2, Reps. 1, 5 & 6). A detailed analysis of the Regulations, along with the compliance methodology developed, is presented in Chapter 3 of this thesis.

- Packaging legislation's impact on ICL's environmental performance.

This research was completed by the end of year two and a waste audit methodology was developed in order to assess the strategy that the organisation should employ. Waste measurement audits were carried out at one of ICL's largest sites in Stevenage and formed the basis of study for three MSc dissertations under the direct guidance of the researcher. Waste audits were continued at another of ICL's major sites in Warrington and these audits resulted in the formation of various packaging waste recycling programmes now applied across the organisation. This is described in Volume 2, Report 3. In addition to these recycling projects, other projects initiated within the company were tracked and recorded during the duration of the project. These results have been written up in ICL's compliance plans recorded in Volume 2, Reps. 5 & 7. This work also contributed to the packaging legislation compliance methodology developed and presented in Chapter 3.



**III To design, develop and implement a system for ICL to meet the environmental information requirements reviewed with particular emphasis on company policy and legislative demands.**

- Produce packaging legislation information requirements logic model

The logic model developed in consultation with an IT systems expert, is presented in Volume 2, Report 3.

- Application of the logic model to the information needs and flows throughout the supply chain, and integration of that information into an IT solution.

At the time of writing this work is still ongoing within the organisation but the research achieved its main objective in providing an IT solution for the compliance calculations and in re-creating a system for target data collection in response to the organisation shifting away from Unix systems to a Microsoft office email system. An example of the packaging regulations application within ICL is in Volume 2, Report 2. This is incorporated into the compliance methodology reported on in Chapter 3 of this thesis.

**IV To apply the current knowledge on environment-related performance measurement to ICL's information needs to ensure the organisation has practical tools with which to meet its corporate policy and targets.**

- Review of current literature on environmental performance measures

This is reported on in Chapter 2 of this thesis and is based on work carried out in the second year of the research (Volume 2, Report 4).

- Assess the applications of performance indicators by case study analysis
- Application of this assessment to ICL's performance evaluation requirements

These objectives were reached at the end of the third year and are reported on in Volume 2, Report 7. The outcome was used to formulate performance measures for service-based organisations and an example of applying it, used in the case of ICL. The results of this are described in detail in Chapter 2 of this thesis.

- **Development of performance measures and application of techniques**

These techniques have been formulated during the last year of the project and are described in Chapter 2 of this thesis. They include the use of video-conferencing and business mileage data to assess transport performance and the analysis of energy consumption performance per square footage building space and per personnel number by site.

**V To integrate such environmental performance measurement into the process of ISO14001 implementation within the company. To ensure that such measures facilitate continuous improvement programs within ISO 14001.**

- **Production of generic literature to support ISO 14001 incorporating performance measures**

This work progressed from the third year to the end of the project (Volume 2, Repts. 6 & 7). The summarised data are described in Chapter 2 of this thesis.

**VI To assess packaging as a universal environmental performance indicator and to ascertain the impact of the UK Producer Responsibility Obligations (Packaging and Packaging Waste) Regulations 1997 on the environmental performance of firms**

- **A survey was conducted via questionnaires on the effects of the UK Packaging Regulations on the environmental performance of companies across all industry sectors. One thousand companies were surveyed, having been stratified according to those that were members of compliance schemes and those that were registered individually. The methodology, results and analysis of this survey are described in Chapter 4 of this thesis.**

**VII Publish papers relevant to research focus in academically reviewed journals within four months of completed research**

- 1) **Paper I: Developing environmental performance indicators for an information technology systems and services company**

This paper has been submitted for publication to The International Journal of Risk Assessment and Management (IJRAM). A copy is at the back of this thesis (Volume 1, Annex 1, Appendix 1)

**2) Paper II: The UK Producer Responsibility Obligations (Packaging Waste) Regulations 1997 - A Methodology for Compliance.**

This paper has been submitted for publication to Environmental Management. A copy is at the back of this thesis (Volume 1, Annex 1, Appendix 2)

**3) Paper III: A Survey of the Effects of the UK Packaging Regulations on the Environmental Performance of Companies.**

This paper has been submitted for publication to The International Journal of Environmental Technology and Management. A copy is at the back of this thesis (Volume 1, Annex 1, Appendix 3)

**Summary of Key Contributions to Knowledge in the field of Environmental Technology**

- 1. The establishment of a set of environmental performance indicators, applying the ISO 14031 standard, measurement techniques and a risk assessment methodology for a service-orientated organisation.**
- 2. A practical model for the use of environmental performance measurement within ISO 14001 implementation that allows a multinational company to track and demonstrate year on year continuous improvement.**
- 3. A critical evaluation of the impacts of environmental legislation, particularly the UK Producer Responsibility Obligations (Packaging Waste) Regulations 1997, on environmental information management and environmental performance within a multinational information technology business.**
- 4. A critical evaluation of the UK Producer Responsibility Obligations (Packaging Waste) Regulations 1997.**
- 5. The development of a methodology for compliance to the UK Producer Responsibility Obligations (Packaging Waste) Regulations 1997.**

6. Assessment of the effects of the UK Producer Responsibility Obligations (Packaging Waste) Regulations 1997 on the environmental performance of companies and the use of packaging measures.
7. A model for the application of EPIs to guide policy makers in the formulation of environmental legislation.

In summary, a model has been devised for the development and risk assessment of environmental performance indicators in a service-orientated business and the integration of such measures into an ISO 14001 compliant environmental management system. Furthermore, it has been demonstrated that environmental performance indicators are not only useful for an organisation that is driven to implement such measures by legislative pressure, but that they can serve the understanding of policy makers as to which types of regulations are effective and why.

# Chapter 1

## Introduction

## INTRODUCTION

The main thesis behind this project is that a model can be devised for the development and risk assessment of environmental performance indicators in a service-orientated business and the integration of such measures into an ISO 14001 compliant environmental management system. Furthermore, it can be demonstrated that environmental performance measures are not only useful for an organisation, that is driven to implement such measures by legislative pressure, but that they can serve the understanding of policy makers as to which types of regulations are effective and why.

The overall aim, therefore, has been to develop an understanding of, and assess the relationship between, the legislative drivers of environmental performance, and to establish a set of key environmental performance indicators and integrate them into an ISO 14001 compliant environmental management system, within a service-orientated business. The author has used the sponsor organisation, ICL plc., as the case study and has studied the UK Producer Responsibility (Packaging Waste) Regulations 1997 as the driver of universal performance measures for packaging.

The following three chapters cover the main areas of research. In order to maintain ISO 14001 certification year on year, and thereby protect the investment involved, a company needs to be able to demonstrate continuous improvement. A major part of the project, therefore, has been to develop environmental performance indicators that will support continuous improvement programmes within an Environmental Management System (EMS). The development of environmental performance indicators, utilising the ISO 14031 environmental performance evaluation standard, for service-orientated organisations like ICL is the subject of the study reported in Chapter 2. The outcomes of this study has been the development of a risk assessment methodology for prioritising environmental performance indicators and a model for integrating the measures into an ISO 14001 compliant environmental management system.

There are many reasons why companies might wish to measure their environmental performance and make continual improvements. Environmental performance measures can enable a company to assess its environmentally related costs and the effectiveness of its

environmental programmes on reducing its environmental impacts. In addition, environmental measures enable a company to communicate its efforts to various stakeholders. The increasing amount of environmental legislation is another driver for companies to control and measure their environmental impacts and their management efforts to reduce such impacts.

The US Toxic Release Inventory (TRI), which requires companies to report the quantities of 300 listed chemicals emitted into the air or water on a facility basis, demonstrates the positive outcomes that can result from reporting data (Environmental Protection Agency, 2000). Many companies feared adverse public reactions and although some of these fears were subsequently shown to be justified, for the majority of companies, the process of gathering data encouraged cooperation, communication, and the sharing of best practice between companies. The data collected are estimates and are low in accuracy because release monitoring is not required. Different methodologies for making estimates exacerbate these inaccuracies. In addition, there are those companies that are failing to report or are reporting only some of the required releases. Despite the inherent inaccuracies of the data, the simple act of collecting and reporting data has still had a marked beneficial effect on the behaviour of most reporting companies representing a success for the TRI in stark contrast to the more traditional command and control type regulations (Fung and O'Rourke, 2000).

The demand for information-rich decision-making on environmental impacts is echoed in the 1997 regulations on packaging waste in the UK. The comparative similarity with this legislation is in the fact that public reporting is required, however, government departments are enforcing standards in the form of recycling targets rather than relying on incentives for voluntary activities. The benefits of reporting publicly on environmental information have been demonstrated through the extensive initiatives to reduce TRI chemicals since the release of data to the public (VCEMS, 2000). Chapter three focuses on an assessment of the effectiveness of the Producer Responsibility Obligations (Packaging Waste) Regulations 1997 on driving environmental performance using ICL plc. as a case study example. It seeks to outline the regulatory requirements concerned with packaging; the impact of the Regulations on ICL plc; and the current status implications for future policy formation and the producer responsibility approach to environmental legislation. It further proposes a compliance methodology that can be employed by any organisation that is faced with the onerous task of

with the onerous task of compliance with the Regulations. The proposed methodology shows how an organisation can achieve compliance and conserve valuable resources for improving its environmental performance.

Prior to packaging legislation being introduced, environmental legislation had focused on manufacturers who were perceived to be the heaviest polluters in industry. The packaging legislation, however, has been the first type of environmental legislation to affect all producers of product and services alike and has provided data on performance measures of a universal nature. The UK Packaging Waste Regulations has been the first producer responsibility legislation to be implemented in the UK. It is in this context that a national survey of companies, registered under the UK Packaging Waste Regulations, was carried out in order to gain insight into the effects of the Regulations on their environmental performance. Chapter four presents the key findings from this survey and the key factors that could determine the effects of the recent packaging legislation on UK companies' environmental performance. Furthermore, the study examines environmental performance measures with respect to packaging and the impact of the regulations on the introduction of packaging-related measures. A company can currently comply with the UK Packaging Waste Regulations by registering with the appropriate agency, either the Environment Agency (EA) or the Scottish Environmental Protection Agency (SEPA), or it can join a compliance scheme. The study has looked at the possible relationship between a company's choice of registration route and its environmental performance. The main outcome measures were: the perceptions of respondents on the Regulation's effects; the packaging measures employed; waste produced; packaging consumed/ handled, recycled, and reused; non-packaging recycled; energy consumed; and environmental policy and management status.

Chapter five provides a summary of the conclusions drawn from this research work, and recommendations for future research are included in Chapter six.



## Chapter 2

# Environmental Performance Indicators (EPIS) for a Service-Orientated Business

## CHAPTER 2

### ENVIRONMENTAL PERFORMANCE INDICATORS FOR A SERVICE-ORIENTATED BUSINESS

#### *Summary*

*EPs have been established by the author, based on the company's environmental policy and targets, and a framework for their measurement outlined. ISO 14001 certification requires that certified companies demonstrate continuous improvement in their environmental performance and EPs have been developed in order that the company can demonstrate such improvements year on year. The results show that a simple and logical methodology can be applied to identify EPs, utilising the ISO 14031 standard, and that a model can be developed for integrating them into an ISO 14001 compliant EMS. Finally, a risk assessment methodology is applied to demonstrate the effects of business constraints in the decision-making process regarding environmental programmes.*

## **2.1 Introduction**

Improved measurement of environmental performance should be part of the regular business activities of any organisation. However, it requires a set of environmental performance indicators (EPIs) that can be applied to the particular organisation's unique functions and culture. This chapter presents the establishment of EPIs within an information technology systems and services organisation, ICL plc. (International Computers Limited).

## **2.2 Background**

The drivers of implementing ISO 14001 are summarised followed by a critique of the ISO standard in industry which highlights the place for EPIs as a means to making ISO 14001 more effective.

### ***2.2.1 ISO 14001 and Environmental Performance***

The number of companies certified to the International Organisation for Standardisation's ISO14001 is increasing rapidly (ENDs,1998a). The drivers for implementing ISO14001, in brief, are as follows:

1. Achievement of cost savings through reduction in resource consumption and waste reduction through direct action or via process alterations.
2. Application of cleaner technologies in manufacturing
3. Improvement in regulatory compliance and reduction of associated costs
4. Raising the profile of the organisation as a potential source for ethical/ environmental investment funding and internal corporate funding.
5. Improved access to investment finance for infrastructure projects (both the European Bank for Reconstruction and Development and the World Bank now recognise ISO 14001);

6. Achievement of competitive edge by meeting supply chain requirements for ISO 14001.
7. Opportunity to minimise exposure to environmental liabilities, to achieve reduced insurance premiums.

ISO 14001's concept of an EMS has resulted in changes in business and management principles. Top management commitment to the environment, a systematic integration of environmental issues into the decision-making process of an organisation, and the re-engineering of governmental and business systems, taken together, are the factors which will drive future organisations and governments (Watson, 1996).

However, despite these very clear drivers for organisations to achieve ISO 14001 certifications, there have been many critiques of the standard; most notably the misinterpretation of the purpose of "standardisation" as opposed to "standard". ISO 14001, is a management framework that is intended to harmonise existing EMSs, not to provide a minimum standard of environmental performance:

*"measurable results of the environmental management system, relating to an organisation's control of the environmental aspects of its activities, products, or services, based on its environmental policy, objectives and targets." (Gleckman and Krut, 1996)*

A company must therefore take responsibility for improving its environmental performance as the certification bodies will be obligated to assess only the performance of the system and not the actual level of environmental performance against any baseline standards. It is arguable that the ISO 14000 series will reverse the trend of industry leaders exploring new ways to create global environmental performance standards because it will grant an 'easy A' to companies with the certification even if they have low environmental performance. There is much scepticism within industry that many companies have gained certification whilst overtly abusing the environment. As long as an organisation can show that it has continually improved in any environmental area it can maintain its certification even if the 'improvement' is miniscule or has little significance in comparison with the organisation's other environmental impacts. To date, there have been no studies carried out on whether this is in

fact happening but companies should perhaps be wary of relying on ISO 14001 certification as representing their own, or their suppliers, quality of environmental performance.

Glekman and Krut also argue in this article that the issues of Agenda 21, supposedly the basis of the standard's ideology, are so diluted as to be unrecognisable and quote (from the standard):

*"It should be noted that this standard does not establish absolute requirements for environmental performance beyond commitment, in the policy, to compliance with applicable legislation and regulations and to continual improvement."*

There is an apparent lack of environmental performance standards within the certification criteria and it is unfortunate that there is nothing that the accreditation bodies can use to reject an organisation's application for certification on the basis of environmental exploitation or inability to meet any basic criteria.

They also state that, unlike the European Union's eco-management and audit scheme (EMAS) or Agenda 21 which established a public 'right to know' and recommends public environmental reporting, the standard does not require any public reporting to be made, a factor which would place increased pressure on the organisation to improve its environmental performance.

The article goes on to emphasise the business argument for performance-oriented management systems. This basically states that effectiveness should be the focus rather than efficiency where efficiency focuses on the means rather than the ends. Effectiveness, however, focuses on the aim of the organisation, such as sustainable business practice, to which the efficiency of how to achieve it is complementary:

*"...becoming more effective will lead an organisation to become more efficient, but that the reverse is not true. Although ISO 14001 requires companies to state an environmental policy giving its environmental intentions and principle, it offers no mandate to incorporate sustainable development aims - or, for that matter - any other environmental limit values, into the policy."*

It can be argued that although EMAS is more effective in the sense that it drives the improvement of environmental performance the standard is being undermined by the

international standard. Evidence of this was apparent by the reduction in the implementation of EMAS by organisations during 1998, only one year after the introduction of the ISO 14001 standard (ENDS, 1998a). It seems likely that this has been due to the perception that it is easier to achieve an ISO 14001 rather than an EMAS certification, in addition to the international standard being more globally recognised.

It has been noted that the EU's proposed changes to EMAS, to address its apparently decreasing popularity, could weaken the scheme. The proposals include a 'relaxation of environmental controls' by member states on businesses that sign up (since EMAS requires compliance to all relevant legislation). The EMAS revision proposals have been criticised for failing to create incentives for improving performance by the European Environmental Bureau (EEB). The EEB argued that EMAS would only survive if it were "*ecologically more demanding*" than the international standards and that the requirements for participation in the scheme should include the benchmarking of environmental performance and the application of clean technology. The scheme is moving closer to ISO 14001 in that it will be expanded to cover service and public sector organisations instead of being limited to industrial companies. It will still maintain the requirement for organisations to commit to continual improvement in their environmental performance, to comply with environmental legislation and to publish an annual environmental statement on their environmental impact and performance. The improvements to EMAS proposed are that the statement will have to be produced annually instead of every three years, organisations will have to involve employees in implementation, and that the significant environmental impacts associated with procurement policies should be addressed (Business and the Environment 1998c & d, ENDS 1998b).

So what drives an organisation to improve its environmental performance and go beyond the ISO 14001 certification stamp? The answer to this seems to lie in the fact that the leaders in the field of environmental best practise companies have realised that environmental protection is a key issue that will affect more and more their competitive edge and ultimately their bottom line. Other drivers include: attracting investment; the pressure of environmental regulation expansion to cover products as well as production processes; the pressure from consumers and the supply chain to provide goods and services at decreasing environmental cost; and the pressure from environmental groups' and associated media's influence on regulators (Steger, U., 1996).

Meeting these demands is not just about improving environmental performance, as an article in *Environment Business Magazine* (1997) argues, but about being seen to do so:

*“...sites used to logging and publishing the minutiae of environmental information are under no particular pressure from their well informed customers.”*

Therefore, environmental reporting capability is a crucial part of meeting the demands for improved communication of environmental performance. Although the article states that ISO 14001 certification is a mechanism which unequivocally achieves the communication of improved environmental performance, as argued earlier, it is possible that this is not always the case. In fact, this is highlighted within the article from Baxter’s Renal Division facilities:

*“Baxter is seeking certification against both the standard and its own corporate requirements, an approach which not only helps to keep environmental costs under control but also highlights any disparities between internal and external priorities. The ultimate aim is that in merging the standards we go one step beyond the existing system and demonstrate this to our external audiences.”*

Implicit in its statement is the expression of a need to go beyond the standard and to communicate this to the company’s stakeholders. Another even stronger example of a company recognising the need to go beyond ISO 14001 is that of Ontario Hydro:

*“... it was also recognised that the ISO 14001 standard did not include all the components that were part of the corporate environmental management system. To address this concern, Ontario Hydro enhanced its corporate environmental management system by following the ISO 14001 standard format while at the same time extending the standard by changing terminology and adding new sub-elements.”*  
(Stoesser, 1996)

The sub-elements the article describes address the company’s main aim towards sustainable business practice and the mechanisms in place to achieve this. It goes on to list certain drivers of environmental performance improvement including:

- environmental reporting
- continued senior management commitment
- the focus on environmental impacts

- accountability (such as performance contracts e.g. service level agreements)
- funding for environmental decision-making
- rewards and recognition
- auditing for the purposes of environmental issues management, carrying out corrective actions

Recent developments imply that the limitations of ISO 14001 are going to be addressed. The Multi-State Working Group (MSWG) on environmental management systems has prepared a draft “statement of consideration” that addresses the perceived weaknesses of ISO14001. These weaknesses are said to arise from the language used, in the areas of communications and reporting, compliance and pollution prevention. It has been recognised that under the existing standard, organisations can certify to ISO 14001 without necessarily improving their environmental performance and argues that:

*“the inclusion of a specification requiring an environmental statement relating to setting goals and reporting performance within the context of an organisation’s EMS would strengthen links with interested parties and benefit all users of the standard.”*

It also addresses the credibility problem of the standard only requiring “commitment to compliance” by proposing that compliance with the law be regularly recorded. The group argues that these revisions would improve an external auditor’s understanding of the organisation’s EMS and change the relationships between organisations and regulators (Business and the Environment, 1998d).

### ***2.2.2 Performance Indicators for Continuous Improvement***

In order for a company to manage its environmental performance it needs to be able to identify and measure its environmental impacts. Such measures enable an organisation to meet the increasing demands on them to provide information on their environmental performance. As a result, environmental performance indicators (EPIs) are increasingly being used by organisations and research is focusing on them.

The European Green Table report (1997) defines the benefits of environmental performance measurement as follows:



- Provides the management with concise and quantifiable environmental information
- Improves the basis for companies' environmental policy objective and targets
- Improves the basis for companies' internal and external environmental reporting as well as communication regarding environmental issues
- Enables companies to define their significant environmental aspects and describe and measure their environmental performance.
- Enables companies to focus on and demonstrate continual improvement of environmental performance
- Serves as a useful tool for those aiming at certification to ISO 14001 and EMAS
- Enables companies to complement existing environmental performance scopes by including developments of indicators for Health and Safety
- Improves the basis for internal and external benchmarking

The guidelines on Environmental Performance Evaluation (EPE), ISO 14031 have now been published for organisations that are "seeking ways to understand, improve and demonstrate sound environmental performance"(ISO 14031, 1999). The standard is especially complementary to ISO14001 in its description of the beneficial applications of EPE:

- achieve continual improvement of environmental performance;
- report and communicate its environmental performance
- identify opportunities for prevention of pollution
- increase efficiency and effectiveness; and
- identify strategic business opportunities

Within an EMS, the continuous improvement cycle is dependent on the commitment of the organisation's staff. A recent study, carried out by James and Bennett who have written extensively on the subject of environmental performance measurement, identified that the main audiences, as a driver for performance measurement, are internal ones (James and Bennett, 1998a). It makes sense that a company wishing to strengthen internal commitment to environmental improvement looks to influence its managers and employees generally and to provide them with the necessary tools.

EPIs can be used to demonstrate continuous improvement for the purposes of ISO 14001 certification. The value of EPIs in protecting a company's investment in ISO 14001 year on year is clear. The method by which a company achieves this is not so clear or so well documented. An environmental performance measurement framework (EPMF) has been described (Azzone et al., 1996) and been refined more recently by Young and Welford (1998). The framework is based on environmental performance measurement within the organisation and covers the three main areas of environmental policy, environmental management system, and processes, products and services. It does not, however, address the specific impacts unique to a particular organisation but takes the approach of selecting indicators according to type.

The literature has many different categorisations of performance indicators, but ISO 14031 separates them into three basic categories:

- Environmental condition indicators - includes sustainability, receptor and proxy/ risk
- Operational environmental performance indicators - includes facilities and equipment, resource consumption of processes, and logistics
- Management environmental performance indicators - includes stakeholders/ financial, implementation and conformity

The standard defines five kinds of quantitative measures for EPIs:

- Direct measures - basic data or information
- Relative data - data or information related to another parameter
- Normalised data - data or information converted to units or to a form which relates the information to a given standard or baseline
- Aggregated data - data or information of the same type, from different sources, collected and expressed as a combined value
- Weighted data - data or information modified by applying a factor relating to its significance

The manipulation of data in different ways requires caution. Relative indicators are complementary to absolute data and not a substitute. Aggregate indicators can show apparent progress over time, and a lot of time can be spent explaining (irrelevant) fluctuations.

Weighted indicators require discussions on value judgements which can be productive in raising awareness but a consensus is difficult to reach. Normalised indicators relate absolute or relative measures to a defined baseline. Dow Europe has developed a normalised methodology - known as an 'eco-compass' with which to compare different products (Fussler and James, 1996). This is unusual because normalised indicators are normally used to express changes in emission levels against a baseline year. The basic structure is designed on a life cycle basis and is shaped as a hexagon. The six poles of the hexagon represent different elements two of which are environmental elements: health and environmental potential risk, and resource conservation. The other four poles of the hexagon are of business as well as environmental significance and include: energy intensity; materials intensity; revalorisation (remanufacturing, reuse and recycling); and service extension. The latter measures the ability to deliver greater service from given inputs, for example improving durability. The eco-compass can be used for comparisons between products. The scoring is on a 1-5 scale and is based on the environmental impact to deliver a standard unit of service. The base case, usually an existing product, is scored as 2. New products only receive a score of 5 if the environmental impacts of one of the product's six attributes improves by >300%. This is based on the four-fold level believed by a number of environmental thinkers to be the minimum required for true sustainability (von Weizsacker, Lovins and Lovins, 1997). Dow uses the tool to identify and evaluate improvement projects and identify innovations towards sustainable business practice.

### ***2.2.3 Performance Measures and the Stakeholder***

Although corporate environmental reporting is not yet mandatory, there is an increasing amount of legislation that requires companies to provide environmental information relating to their business and often to their environmental performance. There are strong arguments for mandatory reporting, as most people accept that society has the right to know about industries' impact on the environment and that some companies will not report on a voluntary basis because they feel that it may have a negative impact on them. Many companies, especially those that are producing environmental reports, expect that reporting will become mandatory (Brophy and Starkey, 1996). It is certainly on the current government's agenda to make corporate environmental reporting mandatory and there are increasing demands from investors for companies to provide environmental information.

James and Bennett (1998a), however, do caution against mandatory reporting:

*“Government and regulators have been key to the development of environment-related performance measurement and will remain so. However, there is an emerging consensus that traditional ‘command and control’ approaches need to be supplemented by more flexible, incentive-based mechanisms. Disclosure of environment-related data is one such mechanism.”*

They go on to suggest that mandatory reporting could use what they call a ‘laser’ as opposed to a ‘light bulb’ approach, where a smaller amount of information would be selected and looked at more intensely, because it might be a more effective way to drive improvement. The main argument commonly used by supporters of voluntary environmental reporting is that businesses do not need government intervention because they will meet the requirements of their stakeholders (Maltby, 1997). Currently then, the main driver for environmental reporting is generally considered to be the improvement of stakeholder relations. The term stakeholder has been extended, through TQEM (Total Quality and Environment Management), beyond customers as purchasers of goods and services to include users of business outputs in the wider sense, such as staff, shareholders, regulators, communities, environmental groups and the general public. Two beneficial effects of environmental reporting are advances in environmental management strategy and internal commitment to improving environmental performance (ENDS 1998).

In a study, reported in ENDS (1998a), carried out by the UN Environment Programme (UNEP) and the think tank and business consultancy organisation SustainAbility, based in London, the barriers to producing environmental reports were explored. The four main areas identified were gathering data, absence of a standard set of indicators, lack of resources, and a lack of management interest. The lack of confidence in these areas in non-reporting organisations when compared to reporting organisations is discussed in the article and it is suggested to be unfounded. It could be argued that the lack of comprehensive guidance on the development of performance measures might be the reason.

In addition, the article emphasises the pressure placed on companies by the financial sector to provide environmental information and quotes an analyst’s comment from the report:

*“When financial analysts look at the environmental record of companies they tend to downgrade those that don’t keep up with the pack - lack of disclosure could be read as*

*a dinosaur indicator. This doesn't say much for a company's management" (ENDS, 1998a)*

It is now well accepted that there is a relationship between environmental and financial performance within a company and that investors are incorporating environmental considerations into their decision-making processes. Baxter International Inc. produces environmental financial statements as part of its drive to create '*a common language between business managers and environmental managers*' (Business and the Environment, 1998). The ability of some organisations like Baxter to measure environmental considerations in a financial way is reflective of how well advanced the organisation is in terms of environmental management. Both financial indicators and measures of sustainability are usually implemented by a company at a more advanced stage of environmental performance measurement than the average company because the metrics are much more difficult to develop (Business and the Environment 1998a). James and Bennett (1998a) categorise the developmental stages of organisations as "first, second and third generation approaches". By their definition financial measures are developed in the second-approach and sustainability ones by the third-generation approach. It could be argued that financial indicators should be separated out into those that directly affect business operational costs, and those that do not, and for these areas to be second and third-generation approaches respectively.

In a section written on the measurement and reporting of sustainability Welford and Jones (1996) stated that one of the important principles of the measurement process was:

*"The judgement as to how far a company is attaining any particular measure of sustainability must be made by a wide range of stakeholders."*

Various methods have been employed for the measurement of EPIs relating to stakeholders. IBM UK employed a consultancy, Ecotec, to approach their stakeholders directly to ascertain what they thought were key environmental performance areas and how they prioritised them (IBM 1995, ten Brink et al., 1996). The consultancy then assessed IBM against these parameters using their developed model of best practice. IBM was then able to prioritise those areas that were of high priority to the stakeholder but of low performance compared to best practice. IBM then proposed that their stakeholders benchmark themselves against the same parameters and against best practice. This was unsuccessful because the stakeholders

had dissimilar lists of parameters and associated priorities due to the differences in their own businesses. This tension between the individuality of businesses and the comparability of measures across industry sectors is a difficult issue. The chemical industry, being well advanced in measuring environmental performance, has been struggling since 1993, at the European level, to introduce reporting guidelines. The European Chemical Industry Council (CEFIC) introduced such reporting guidelines in 1998 that set 16 parameters to be reported against by its 22 member federations by 2002 as part of its responsible care programme (Business and the Environment, 1998b and European Chemical Industry Council (CEFIC), 2000). Three of the parameters are health and safety related, one is dedicated to distribution incidents and the remaining fourteen are all environmental parameters and include:

- Hazardous waste for disposal
- Non-Hazardous waste for disposal
- Sulphur dioxide
- Nitrogen oxides
- Carbon dioxide and other global warming gases
- Volatile organic compounds
- Phosphorus compounds
- Nitrogen compounds
- Chemical oxygen demand
- Heavy metals
- Other substances that potentially impact human health or the environment
- Energy consumption and energy efficiency

It has been on the UK Government's agenda for a few years not only to make corporate environmental reporting mandatory but also to improve the quality of environmental information available by addressing the large variation in the standard of corporate environmental reports and the absence of any comparison criteria (UKEN, 1998). In addition, the Government proposed a set of 13 headline sustainability indicators, designed to extend the more traditional economic indicators of performance (Environment Watch, 1998). These have been extended to include around 150 indicators with a subset of fourteen headline indicators as shown in Table 2.1.

**Table 2.1 UK Governments Sustainability Indicators**

<b>Maintaining high and stable levels of economic growth and employment</b>		
· our economy must continue to grow (3.12)	-	total output of the economy (GDP) H
· investment (in modern plant, machinery as well as research and development) is vital to our future prosperity (3.14)	-	investment in public, business and private assets H
· maintain high and stable levels of employment so everyone can share greater job opportunities (Box after 1.8)	-	proportion of people of working age who are in work H
<b>Social progress which recognises the needs of everyone</b>		
· equip people with the skills to fulfil their potential (3.16)	-	qualifications at age 19 H
· improve the health of the population overall (3.17)	-	expected years of healthy life H
· reduce the proportion of unfit (housing) stock (3.18)	-	homes judged unfit to live in H
· reduce both crime and fear of crime (3.19)	-	level of crime H
<b>Effective protection of the environment</b>		
· continue to reduce our emissions (of greenhouse gases) now, and plan for greater reductions in longer term (3.20)	-	emissions of greenhouse gases H
· reduce air pollution and ensure air quality continues to improve through the longer term (3.21)	-	days when air pollution is moderate or high H
· reduce the need to travel and improve choice in transport (7.29)	-	road traffic H
· improving river quality (8.30)	-	rivers of good or fair quality H
· reverse the long-term decline in populations of farmland and woodland birds (3.24)	-	populations of wild birds H
· re-using previously developed land, in order to protect the countryside and encourage urban regeneration (3.25)	-	new homes built on previously developed land H
<b>Prudent use of natural resources</b>		
· moving away from disposal of waste towards waste minimisation, reuse, recycling and recovery (Box after 6.11)	-	waste arisings and management H
<b>Improving quality of life</b>		
· achieving a better quality of life for everyone (3.4)	-	satisfaction with quality of life D

Source: Excerpt from DETR website:  
<http://www.environment.detr.gov.uk/sustainable/index.htm>

A study of the development of environmental reports showed that no overall framework had been created, nor was being used by managers on the production of environmental reports (Azzone et al., 1996a). It identified important issues to be:

*“ (i) the low level of standardization of the reported information; and (ii) the limited extent of the presented data ”*

They address the individuality of firms by saying that standardisation should not mean that all companies report on the same information but that the overall structure of the documents should be harmonised and the main classes of indicators defined. The paper goes on to say that these processes should be driven by the information needs of the main stakeholders.

Since this paper was written the issue of developing a framework for environmental reporting has been addressed by the launch of the Global Reporting Initiative (GRI). The GRI introduced guidelines on sustainability reporting in June 2000 (GRI, 2000). The report includes a requirement for the organisation to report on key sets of sustainability performance indicators and lists the following:

- *The specified generally applicable environmental performance indicators;*
- *Selected organisation-specific environmental performance indicators;*
- *Selected economic performance indicators*
- *Selected social performance indicators; and*
- *Selected integrated performance indicators.*

The GRI guidelines report goes on to describe in more detail the parameters required in terms of environmental impacts and units of measure.

ISO 14031 has been criticised for not meeting the need for standardisation and for not addressing implementation issues (James and Bennett, 1998b) and as such, it should be seen as only complementary to the EMS standard ISO 14001. In unison with ISO 14001 the standard does not reference environmental reporting even though it does mention that stakeholder requirements should define parameter identification.



#### **2.2.4 Drivers for Environmental Performance Measures**

As in a range of other industries, the need to measure environmental performance within the information technology sector has developed increasing importance in recent years. This is due to companies recognising the impact of their businesses on the environment. Increasingly, stakeholders are not only showing interest in the improvements a company is making in its environmental performance but are also demanding information that demonstrates environmental best practice and management. Such interest by stakeholders derives from the fact that those companies which successfully develop environmental performance evaluation methods will improve their competitiveness and indicate in a broader sense their management and business performance abilities. Associated with this demand for improved environmental performance is the need to report or communicate the levels of environmental performance being achieved. This is especially so for companies implementing ISO 14001 where continuous improvement in environmental performance is a requirement and can only be demonstrated via the evaluation and measurement of performance (ISO, 1999). It is often the case that an organisation's decision to produce an environmental report promotes the realisation that clear measures of environmental performance are required for environmental improvements to be demonstrable. The pressure on companies to produce environmental reports is increasing as shown by statements made over the last few years by Michael Meacher, the UK's Environment Minister, indicating the intention to make corporate environmental reporting mandatory. There is much interest and discussion about mandatory environmental reporting (DETR, 2000b). The requirement under ISO 14001 to demonstrate continuous improvement in environmental protection is adding to the pressure on companies to develop sound measures of environmental performance. This is because companies will need to maintain their certification year on year, thereby protecting the investment made. The environmental performance evaluation standard, ISO 14031, provides guidelines to companies that are developing their own set of EPIs (ISO, 1999).

The 1990s have been called by some '*the decade of the merger*' and this is reflective of the increasing rate of change in the size of many organisations. Companies are constantly changing both their shape and their business functions. For example, ICL has moved towards the provision of services, away from manufacturing and is now becoming an e-business. These organisational changes result in the need for environmental performance measures that

are related to business size and function and as such can reflect the real rate of environmental improvements.

The increasing pressure from legislation has led to many organisations having to measure previously unaccounted-for environmental impacts. A good example of this has been the UK Producer Responsibility Obligations (Packaging Waste) Regulations 1997 that has required extensive data provision on packaging-related material consumption by material type. There is the perception that packaging is benign and, therefore, not an environmental problem. It is arguable, therefore, that without such legislation, companies would not adopt an environmental performance indicator for packaging materials because of the lack of previously available data and the extensive resources that are required to implement the necessary measurement systems (Collins, 1998). Finally, drivers with a direct economic link or consequence that can be equated to demands for improved performance clearly exist across industry. An example of this is that by optimising logistics, a company can reduce its transportation impacts thereby minimising the associated costs and environmental impacts.

### **2.3 Environmental Indicator Selection**

Review of a range of other organisation's in different industrial sectors corporate environmental reports can assist a company in identifying EPIs. A company can then select from those indicators currently relevant to its own environmental impacts on the basis of which categories of indicators are in common usage (Peck, 1996/7 and Lawson, 1998). Nevertheless, indicator selection and the development of performance evaluation measures are complex processes requiring careful planning and a structured approach (Peck, 1996/7 and Lawson, 1998). However, if a company relies only on identifying indicators on the basis of those used by others, the initial process of identifying significant aspects may be inadequate. This could result in a lack of emphasis on the measurement of important aspects or worse still, an aspect being omitted entirely. The identification of significant aspects, therefore, demands an understanding of the following:

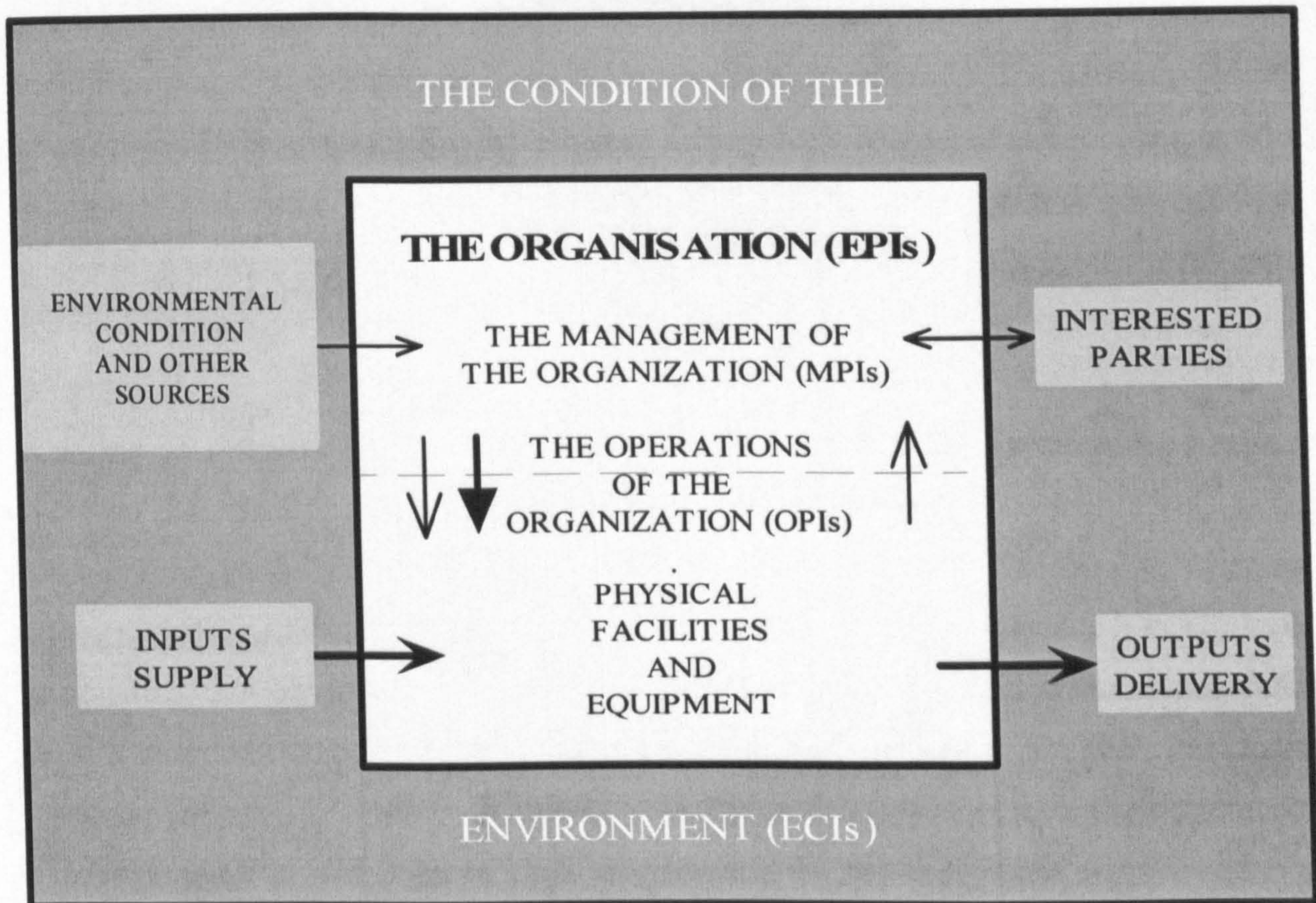
- Risk of environmental impacts on the surrounding areas
- Risk of environmental impacts evolving from products and processes
- Risk of environmental impacts of suppliers

- How the above are inter-related and the implications for collating/aggregating the significance of different business activities

In addition, not only do the environmental aspects need to be understood but also the measures have to be re-prioritised according to drivers such as legal or stakeholder pressures and resource limitations. In this context, consideration needs to be given as to how and where the data need to be gathered and how the data can be used internally to provide the necessary tools for enabling continuous improvement and its effective communication.

According to the ISO 14031 guidelines on environmental performance evaluation there should be three basic types of indicator, Environmental Condition Indicators (ECIs) and Environmental Performance Indicators (EPIs) that are then further divided into Operation Performance Indicators (OPIs) and Management Performance Indicators (MPIs). Figure 2.1 shows the relationship between the three major categories of indicator and their functionality within the sphere of the organisation, the environment and environmental performance evaluation (EPE). ISO 14031 additionally identifies five types of quantitative measure, defined in terms of the basis of their calculation. These are: direct, relative, indexed, aggregated and weighted. Direct data are basic data or information such as tonnes of waste produced. Relative measures are direct data that have been related to another parameter such as tonnes of waste produced per tonne of product manufactured. Indexed data are data that are converted into units or to a form that relates the information to a given baseline or standard. This indexed type of quantitative measure is often used to represent air emissions data. Aggregated data are data of the same type that have been collected from different sources and added together. Finally, weighted data are data that have been modified by applying a factor relating to their significance (ISO, 1999). These definitions should hopefully facilitate a common usage of terms as to date there has been a substantial number of differently defined and used terms for various EPIs.

Figure 2.1 EPE Evaluation Areas and their Interrelationships

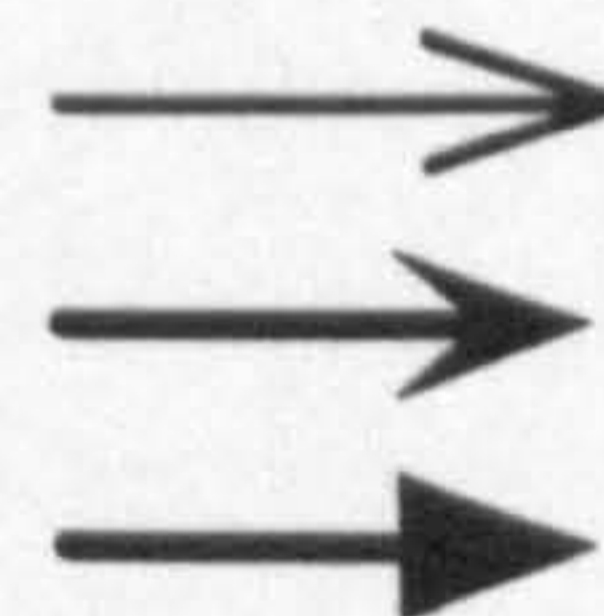


Key

Information flows:

Input and output flows related to the organization's operations:

Decision flows:



Source: ISO 14031 (1999)

A study carried out by James and Bennett (1998a) provides a good description of the relationship between the ISO 14031 model and current practice. The study showed that only a small majority of those companies surveyed used any kind of ECI, the most common being biological oxygen demand (BOD) and (COD) indicators of the impacts of effluents into watercourses. This is unsurprising as ECIs are, in most instances, the most difficult to measure because it involves obtaining data on ecological systems. The study also showed that most EPE activity is still focused on OPIs and particularly resource, emissions and wastes indicators. This is probably because the aspects that they measure are highly visible and the necessary data are usually readily available within the organisation. It is foreseeable that

there will be significant further developments in the types and applications of EPIs in future years. Standardisation of EPIs for the purposes of comparability is a complex issue to address. It is thought that standardisation should not mean that all companies report on the same information but that the overall structure of the documents should be harmonised and the main classes of indicators defined (Azzone et.al., 1996). ISO 14031 has been criticised for not meeting the need for this type of standardisation and for not addressing implementation issues, i.e. how key indicators might be measured (Bennett and James, 1998b). As such, although its intentions may be complementary to, it is lacking in its more functional support of the EMS standard ISO 14001.

Once EPIs have been identified and agreed within an organisation, standard methods for their measurement need to be determined and communicated across the organisation. As there is no description in the ISO 14031 standard of how various EPIs may be measured, individual companies may adopt their own methodologies and there are various studies showing different approaches used (Peck, 1996/7 and Lawson, 1998).

### ***2.3.1 Environmental Performance Indicators for a Service-based Organisation***

The author extracted those environmental performance indicators appropriate to a service based organisation from a wide range of industries and summarised them in Table 2.2. Most of the data have been gathered from corporate environmental reports and the particular organisations were chosen for various beneficial reasons. All the organisations are multinationals and were chosen by the author because they offered comprehensive indicators. LucasVarity and Mining Sector indicators were chosen because they were the results from in-depth EPI studies previously used in the academic literature. The Body Shop and Sainsbury's are both customers of ICL and Fujitsu is the company's full shareholder which, in addition, offered excellent environmental accounting measures. The Body Shop is widely recognised as a leader in the field of environmental and sustainability reporting. Wilkhahn is a company that bases its business activities on the principles of industrial ecology. In addition, Amerrada Hess Ltd offers equal leadership in terms of environmental best practice.

**Table 2.2 Environmental Performance Indicators for a Service-based Organisation**

<b>Measures</b>	<b>LucasVarity<sup>1</sup></b>	<b>Mining Sector<sup>2</sup></b>	<b>Amerrada Hess Ltd 1998 CER</b>	<b>Wilkhahn 1995 CER</b>	<b>Body Shop 1997 CER</b>	<b>Sainsbury's 1997 CER</b>	<b>Fujitsu 1998 CER Environmental Accounting</b>
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**Operational Performance Indicators**

<b>Energy Consumption</b>	mWh mWh/employee Cost				kWh % change kWh/ 1000 unit products distributed	kWh/ m <sup>2</sup>	
<b>Transport</b>					km covered Fuel consumption (litres) Fuel efficiency (km/ litre) t CO <sub>2</sub> emitted by UK fleet no. cars in fleet air miles no of flights car journeys by employees no. of deliveries/ collections from suppliers	gallons/ vehicle miles/ gallon	

<sup>1</sup> Source: Lawson, N., "Environmental Performance Indicators in Industrial Management Systems" EngD Dissertation, 1998

<sup>2</sup> Source: Peck, P., "Operational EPIs for the Mining and Metals Sector" IIE MSc Thesis, 1997.

**Table 2.2 Environmental Performance Indicators for a Service-based Organisation (Continued)**

Measures	LucasVarity <sup>1</sup>	Mining Sector <sup>2</sup>	Amerrada Hess Ltd 1998 CER	Wilkhahn 1995 CER	Body Shop 1997 CER	Sainsbury's 1997 CER	Fujitsu 1998 CER Environmental Accounting
<b>Global warming</b>	T CO <sub>2</sub> equivalents (VOC/ Ox/ CO <sub>2</sub> )	kg CO <sub>s</sub> equivalents/ t material moved	t CO <sub>2</sub>		t CO <sub>2</sub>	Kg CO <sub>2</sub> /m <sup>2</sup>	
<b>Acid Rain</b>	SO <sub>x</sub> t	SO <sub>x</sub> equivalents/ t material moved	t SO <sub>2</sub>				
<b>Smog</b>	NO <sub>x</sub> t	NO <sub>x</sub>	t NO <sub>x</sub>				
<b>Water</b>	t t/ employee Cost				m <sup>3</sup> used % change	m <sup>3</sup> Cost	
<b>Waste Disposal</b>	t t/ employee Cost		t	t municipal waste t building rubble t special waste (broken down)	t to landfill t obsolete stock t obsolete stock to landfill		
<b>VOCs lost</b>	t t/ employee Cost						
<b>Environmental incidents</b>		No. of incidents					

<sup>1</sup> Source: Lawson, N., "Environmental Performance Indicators in Industrial Management Systems" EngD Dissertation, 1998

<sup>2</sup> Source: Peck, P., "Operational EPIs for the Mining and Metals Sector" IIIIE MSc Thesis, 1997.

**Table 2.2 Environmental Performance Indicators for a Service-based Organisation (Continued)**

Measures	Lucas Varity <sup>1</sup>	Mining Sector <sup>2</sup>	Amerrada Hess Ltd 1998 CER	Wilkhahn 1995 CER	Body Shop 1997 CER	Sainsbury's 1997 CER	Fujitsu 1998 CER Environmental Accounting
Material input				kg materials			
Material output				kg materials			
Material consumption				kg consumables			
Recycling				kg thermal recycling kg recycling (broken down)	t waste incinerated t waste recycled	'000 t card plastic	
<b>Management Performance Indicators</b>							
		no. of fines or penalties	No. of Prosecutions Letters of warning				
Suppliers						% age supplies meeting certain criteria	

<sup>1</sup> Source: Lawson, N., "Environmental Performance Indicators in Industrial Management Systems" EngD Dissertation, 1998

<sup>2</sup> Source: Peck, P., "Operational EPIs for the Mining and Metals Sector" IIE MSc Thesis, 1997.



**Table 2.2 Environmental Performance Indicators for a Service-based Organisation (Continued)**

<b>Measures</b>	<b>LucasVarity<sup>1</sup></b>	<b>Mining Sector<sup>2</sup></b>	<b>Amerrada Hess Ltd 1998 CER</b>	<b>Wilkhahn 1995 CER</b>	<b>Body Shop 1997 CER</b>	<b>Sainsbury's 1997 CER</b>	<b>Fujitsu 1998 CER Environmental Accounting</b>
<b>Financial Costs</b>					Utility Costs (gas, electricity and water)		Direct and Indirect Costs Energy Conservation Costs Recycling Costs Information Costs Risk Prevention Costs
<b>Financial Benefits</b>							Energy conservation Recycling Risk Mgt. Environmental activities: Business efficiency education

<sup>1</sup> Source: Lawson, N., "Environmental Performance Indicators in Industrial Management Systems" EngD Dissertation, 1998

<sup>2</sup> Source: Peck, P., "Operational EPIs for the Mining and Metals Sector" IIIE MSc Thesis, 1997.

### ***2.3.2 Environmental Performance Indicators for an IT Systems and Services Company***

In order for ICL to assess its environmental performance, EPIs have been identified in this work, based on the Corporate Environmental Policy and Targets (Collins, 1998), that are compatible with ISO 14031. On the basis of this the indicators were evaluated in terms of those currently measured and those for which a measurement system will need to be set up. Table 2.3 has been constructed to show the drivers behind different indicators and which measurement systems will, therefore, be feasible to implement.

A good example of stakeholder pressure and the driver for best practice is that one of ICL's customers requested a statement concerning ICL's readiness to comply with the EU Directive on Waste Electrical and Electronic Equipment (WEEE). ICL was able to respond knowledgeably giving information about the seriousness with which it took this issue, its lobbying and its presence in the industry. More importantly, ICL was able to demonstrate its advanced approach to this problem by giving information on the EPIs it had established through this research programme. ICL has set up a stringent environmental auditing programme of its recycling partners which includes a set of performance criteria against which ICL's own internal take-back and recycling operations are also measured. They have set up a certification scheme for recyclers who are appointed by ICL as ICL-approved recyclers or ICL-approved remanufacturers together with a programme of continuous improvement and re-auditing of recycling partners.

**Table 2.3 Table showing EPIs and Measurement Systems Feasibility**

Environmental Management Aspect	Environmental Performance Indicators	Drivers of Actual EPIs	Drivers of Potential EPIs	Units of Measure
Life Cycle of Product	<p>Design</p> <ul style="list-style-type: none"> <li>Number of new products with low energy consumption and increased processing power</li> <li>Number of products altered for design for disassembly</li> <li>Number of products utilising recycled plastics</li> <li>Number of hazardous components eliminated</li> </ul>		<p>R S</p> <p>R S (L)</p> <p>R S</p> <p>R S L</p>	
	<p>Distribution and Packaging</p> <ul style="list-style-type: none"> <li>Weights of packaging by material type recycled (paper/card, steel and plastics)</li> <li>Percentage packaging recycled of total waste produced</li> <li>Weights of recycled packaging used</li> <li>Weights of reusable pallets used</li> <li>Number of procurement partnerships for reuse</li> <li>Total weights of packaging used</li> <li>Number of CD-ROMs used for software and documentation.</li> </ul>	<p>L (R)</p> <p>R</p> <p>L</p> <p>L</p> <p>L Sk C</p> <p>L (R)</p>	R	<p>kg</p> <p>%</p> <p>kg</p> <p>kg</p> <p>kg</p>
	<p>End-of-Life</p> <ul style="list-style-type: none"> <li>Weights of equipment taken back for recycling, reuse and refurbishment</li> <li>Weights sent to landfill</li> <li>Weights of equipment recycled from ICL's operating companies across Europe</li> <li>Number of improvements to suppliers' recycling processes mandated</li> <li>Number and best practice rating of ICL Approved Recyclers</li> </ul>	<p>L (R)</p> <p>L (R)</p>	L (R)	<p>kg</p> <p>kg</p> <p>kg</p>
	<p>Batteries</p> <ul style="list-style-type: none"> <li>Number of batteries recycled</li> </ul>	<p>B Sk &amp; (L R)</p> <p>B Sk &amp; (L R)</p>	L (R)	kg

**Key to Drivers:**

- R: Corporate Environmental Reporting
- C: Cost Reduction
- S: Standards (actual or de facto)
- B: Best Practice
- L: Legal Requirements
- I: Specific to ISO 14001
- Sk: Stakeholders
- ( ): Indicates secondary driver

**Table 2.3 Table showing EPIs and Measurement Systems Feasibility (Continued)**

Environmental Management Aspect	Environmental Performance Indicators	Drivers of Actual EPIs	Drivers of Potential EPIs	Units of Measure
Accreditation and Auditing	Number of ICL sites and businesses ISO 14001 certified Number of sites internally and externally audited	R, C & I	I	
ICL's Suppliers	Number of suppliers ISO 14001/EMAS certified Number of suppliers with an Environmental Policy		R I R I	
Accreditation and Auditing	Number of ICL sites and businesses ISO 14001 certified Number of sites internally and externally audited	R, C & I	I	
ICL's Suppliers	Number of suppliers ISO 14001/EMAS certified Number of suppliers with an Environmental Policy		R I R I	
Energy Efficiency	Quantity of energy consumption (electricity, gas and oil) on office sites Quantity of energy consumption (electricity, gas and oil) on warehouse sites	C R (L) C R (L)		kg NO <sub>x</sub> kg SO <sub>x</sub> kg CO <sub>2</sub>
Transport	Numbers of vehicles with catalytic converters Number of air and road miles saved by video conferencing facilities Business miles travelled Logistics (of product) miles travelled	R B R (C) R Sk & (C)	R Sk C	kg CO <sub>2</sub> kg CO <sub>2</sub> kg CO <sub>2</sub>
Elimination of Waste	Weight of waste to landfill Quantities of water consumption at metered sites		R C R C	kg '000 m <sup>3</sup>

**Key to Drivers:**

- R: Corporate Environmental Reporting
- C: Cost Reduction
- S: Standards (actual or de facto)
- B: Best Practice
- L: Legal Requirements
- I: Specific to ISO 14001
- Sk: Stakeholders
- ( ): Indicates secondary driver

**Table 2.3 Table showing EPIs and Measurement Systems Feasibility (Continued)**

<b>Environmental Management Aspect</b>	<b>Environmental Performance Indicators</b>	<b>Drivers of Actual EPIs</b>	<b>Drivers of Potential EPIs</b>	<b>Units of Measure</b>
Recycling of Consumables	Weights of cardboard recycled	L (Sk)		Kg
	Weights of plastic recycled	L (Sk)		kg
	Weights of paper recycled	R (Sk)		kg
	Weights of plastic cups recycled	R (Sk)		kg
	Number of laser printer units recycled	R (Sk)		
Training and Awareness	Number of environmental training programmes across Europe		Sk (R)	
	Number of environmental action awards given		Sk (R)	
	Number of suppliers supported through EMS implementation		Sk (R)	
	Number of schemes involving community action for the environment		Sk (R)	
Costs	Environment Agency Fees	L		£
	Environmental Taxes (e.g. Climate change levy) Running of Environment Affairs Dept. Regulatory Compliance Programmes	L	L (Sk) R (Sk)	£ £ £ £

**Key to Drivers:**

- R: Corporate Environmental Reporting
- C: Cost Reduction
- S: Standards (actual or de facto)
- B: Best Practice
- L: Legal Requirements
- I: Specific to ISO 14001
- Sk: Stakeholders
- ( ): Indicates secondary driver

By integrating the service-based environmental indicators selected in Table 2.2 with the information from the feasibility study data shown in Table 2.3 the following Table 2.4 below has been constructed. The environmental indicators are comprehensive in nature and both OPIs and MPIs have been classified in Table 2.4. Environmental condition indicators (ECIs), however, have not been included because the data are not only difficult to obtain but are currently outwith the scope of environmental performance measurement of service-based organisations.

Once EPIs have been identified and agreed within ICL, a standard method for their measurement is determined and communicated across the organisation. This often involves the use of information systems to collate all the information but has to be assessed manually and recirculated back to the origin to gain validation of the data. The overall Environmental Performance Evaluation Process (EPE) used at ICL has been illustrated by the author in Figure 2.2 and highlights the drivers and barriers involved. The different sources of pressure imposed on the EPE process are denoted by block arrows. The drivers and barriers may be so intense that they may cause changes to the core business functions of an organisation which in turn would lead to a re-identification of environmental impacts and a new cycle of EPI identification and measurement systems implementation. One example of these effects might be the introduction of a levy on company parking spaces leading to a move towards hot-desking and home working. Another example might be that a company might change its core business as a result of a government regulation banning the use of lead. Electronic electrical goods producers and suppliers would have to ensure that their engineers were not using Pb solder and that no components contained Pb etc. The EPE process shown is a generic one and may well be applicable to any industry.

**Table 2.4 Application to ICL's Environmental Performance Evaluation Requirements**

Environmental Aspect	Environmental Impact	Environmental Performance Indicators		Measurement Status
		Operational Performance Indicators	Management Performance Indicators	
Energy Use	Natural Resource Depletion  Global Warming  Acidification Smog	KWh % change kWh/ employee kWh/ m <sup>2</sup>  tCO <sub>2</sub> tCO <sub>2</sub> / m <sup>2</sup> tCO <sub>2</sub> equivalents  t SOx t NOx, particulates	<b>Management Performance Indicators</b> cost (including climate change levy) cost of energy efficiency initiative surveys cost of energy efficiency technologies	All data available although currently only total kWh collected.
Transport	Natural Resource Depletion	business miles travelled (road and air) fuel consumption litres t CO <sub>2</sub> t NOx t SOx particulates no. videoconferences plus mileage and emissions saved fleet fuel efficiency miles/ litre no. of vehicles in fleet % age vehicles with catalytic converters no. of deliveries/ collections from suppliers		Currently collect business mileage and videoconferencing data - office locations of participants and no. of attendees translated into roadmiles saved (see section 2.5.2).  air mileage data could be collected  no. of vehicles in fleet and % with catalytic converters is available  fuel efficiency availability is unknown  deliveries and collections from suppliers unknown

**Table 2.4 Application to ICL's Environmental Performance Evaluation Requirements (Continued)**

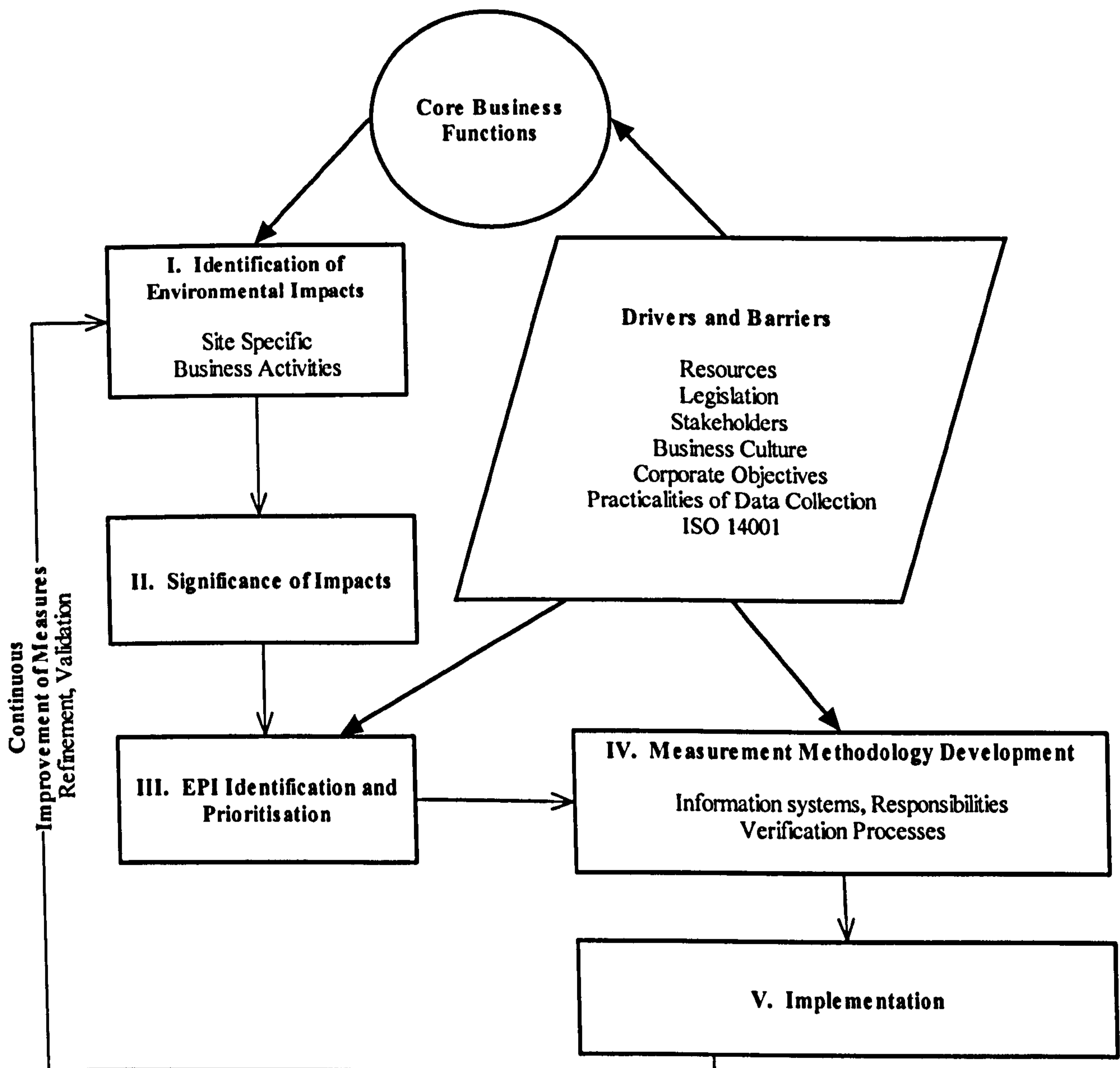
Environmental Aspect	Environmental Impact	Environmental Performance Indicators		Measurement Status
		Operational Performance Indicators	Management Performance Indicators	
Water	Natural Resource Use	m <sup>3</sup> m <sup>3</sup> /employee	cost cost of water conservation technologies	Inadequate metering on sites data availability unknown costs not collected
Waste	Landfill disposal	t t/ employee t electrical and electronic waste t/ Sales	cost (including landfill levy)	general waste data potentially available from sub-contractors but not currently collected electrical and electronic waste data availability unknown costs not collected
Virgin Material Use	Natural Resource Depletion	t paper purchased t plastic cups purchased no. laser printer consumables purchased	cost	purchasing data are currently collected but are inadequate costs not quantified
Indirect environmental aspects - suppliers	various	no. of consumables purchased containing recycle	no. of dfe products ee.g. ease of disassembly, hazardous substance elimination, low energy consumption, recycle content. no. of ICL Approved Recyclers no. of partnerships for asset recovery (product and consumables) no. of suppliers queried on environmental issues no. of suppliers that have (environmental policy EMS and/or certification)	data unavailable for dfe products and consumable recycle no. of ICL Approved Recyclers is known some data available on partnerships for asset recovery supplier environmental data unknown



**Table 2.4 Application to ICL's Environmental Performance Evaluation Requirements (Continued)**

Environmental Aspect	Environmental Impact	Environmental Performance Indicators		Measurement Status
		Operational Performance Indicators	Management Performance Indicators	
Recycling	Natural Resource Conservation	t packaging recycled (plastic card wood) t plastic cups recycled t paper recycled units laser printer consumables recycled t electrical and electronic equipment recovered for recycling, reuse and refurbishment (includes batteries) t CD ROMs recycled	cost of recycling cost of compactors/ bailers cost of waste audits cost of storage facilities	recycling data are collected for packaging, paper, plastic cups and laser printer consumables weee recycling data collected but not aggregated costs not collected
EMS			no. sites internally audited (until ISO 14001 group certification) no. internal auditors trained cost of EMS implementation	no. of sites audited and no. of internal auditors trained known
Environmental Incidents		no. environmental incidents	no. warnings/ fines/ penalties cost of compliance	no incidents yet cost of compliance known but not aggregated
Community Relations		commuter patterns (% by car, motorbike, on foot, bike, train or bus)	no. of commuter transport surveys no. of press releases on environment no. of CERs produced no. of enquiries cost of employee transport surveys and employee travel initiatives no. of environmental group/organisational memberships	commuter survey data collection has started recently

Figure 2.2 Approach to EPE Development



Key:

Process Flow →  
 Pressures →

## **2.4 EPI Risk Assessments and Decision-Making**

The final stage for an organisation to evaluate its environmental performance and to make decisions about its environmental improvement programmes is to carry out a risk assessment of the main categories of EPIs on the basis of legal, economic and environmental risk. Table 2.5 shows for ICL how each environmental impact is rated out of five for each of these three factors, with 0 being no associated risk and 5 being high risk. The fourth column of data represents the adjustments necessary for the constraints on, or barriers to, carrying out related environmental activities. The rating on this scale is from minus 15 to plus 15 and includes costs, manpower, longevity of projects, senior 'buy in', and the culture of the organisation that includes both the values of the organisation and its mode of operation. In the case of environmental incidents, the score relates to the level of uncertainty and/or lack of control. The EPI categories for suppliers are divided into three classifications for the purposes of risk assessment and include: Group A suppliers which are large in size and have, or have potential to have, large environmental impacts; Group B suppliers are either medium sized with medium environmental impacts or are large with insignificant environmental impacts or small with significant environmental impacts; and Group C suppliers are small suppliers with insignificant environmental impacts.

The scores given in the Table correspond with ICL's EPI risk assessment. For example, energy consumption has a high risk factor due to the company's high level of environmental impacts both in the building's energy use and in the use of IT. The constraints are relatively low which means that overall the risk factor is 1 and action should be taken to improve environmental performance relating to energy consumption. As a service-based organisation the risk factor attached to Group A suppliers is predictably high and emphasis should be given to this area when drawing up environmental programmes. A good example of how ICL has addressed this is through the auditing of its waste electrical and electronic equipment recyclers. The company ensures that the recyclers it uses meet certain environmental criteria through its Approved Recycler scheme. Both packaging and waste electronic and electrical equipment have high risk factors due to both high legislative and associated financial risks and high environmental impacts. Transport is particularly high in the various risk assessment categories but it is also extremely high in the level of constraints imposed. This is because ICL's business depends on business travel and to reduce business mileage directly may be

damaging to business activities. However, there are areas within the transport category, such as commuter travel which may be open to some indirect influence such as encouraging the use of public transport to get to work etc.

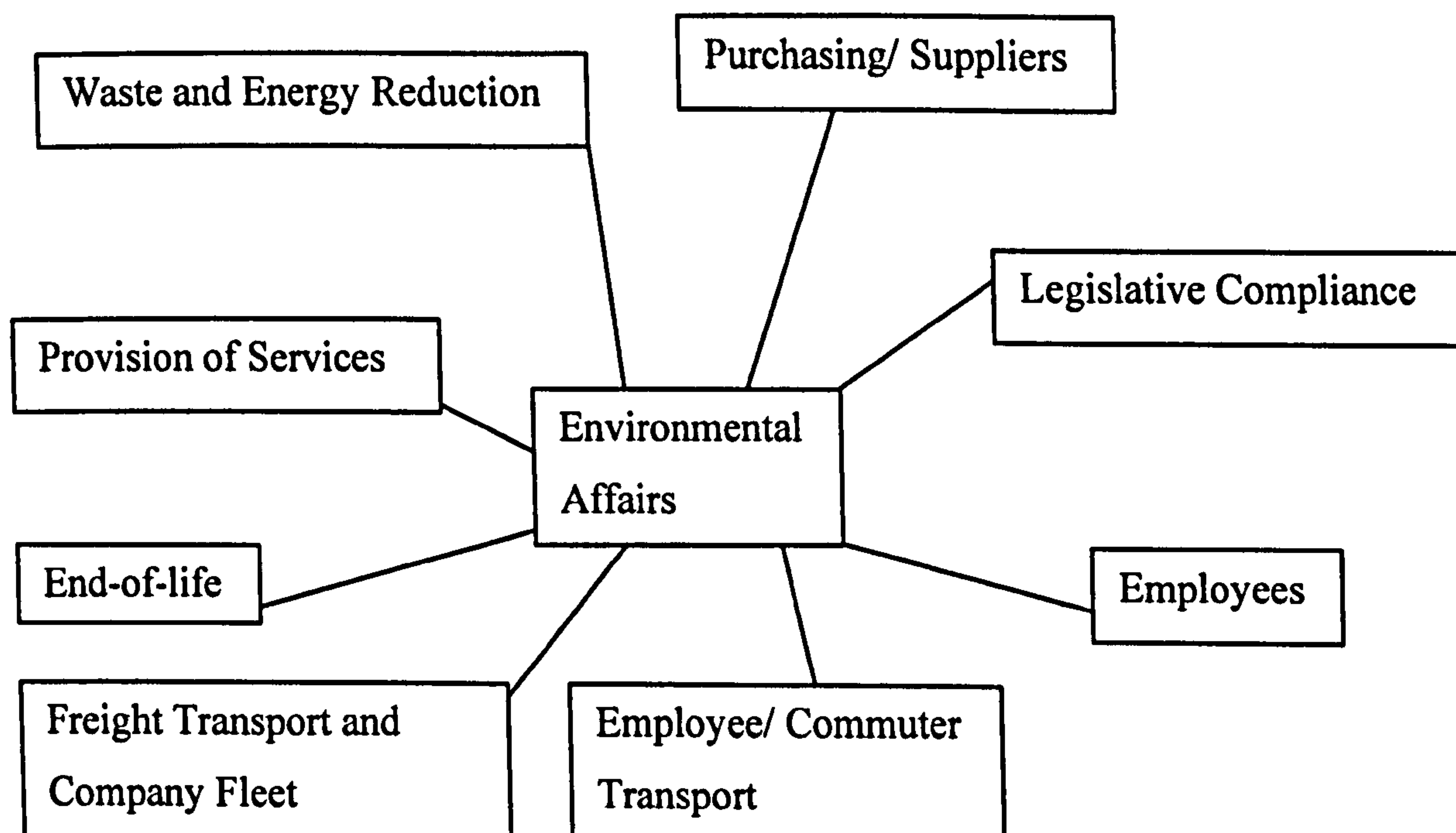
**Table 2.5 EPI Risk Assessments**

<b>EPI Category</b>	<b>Legal</b>	<b>Economic</b>	<b>Environmental</b>	<b>Constraints</b>	<b>Total</b>	<b>Percentage of Modulus Total</b>
Energy Consumption	1	3	4	-7	1	3%
Transport	2	2	4	-12	-4	-13%
Water	0	2	1	-5	-2	-7%
Waste	1	3	3	-7	0	0%
Packaging	4	3	3	-6	4	13%
Consumables	0	2	2	-5	-1	-3%
End-of-Life Equipment	5	5	4	-9	5	17%
<b>MPIs</b>						
EMS	4	4	4	-10	2	7%
Group A Suppliers	3	4	4	-7	4	13%
Group B Suppliers	2	3	3	-7	1	3%
Group C Suppliers	1	2	2	-7	-2	-7%
Environmental incidents	3	3	2	-8	0	0%
Community relations	0	3	3	-10	-4	-13%
<b>Modulus Totals</b>	<b>26</b>	<b>39</b>	<b>39</b>	<b>100</b>	<b>30</b>	

## 2.5 Integration of Environmental Performance Measures into ISO 14001

The difficulty with establishing environmental management systems for a service-based organisation is that it is at risk of producing what is essentially a facilities management-orientated system. This arises because the most obvious environmental impacts at first glance appear to be those associated within the buildings in which the organisation operates. The indirect impacts associated with the business activities of an organisation such as purchasing, provision of products and services, and transport are more difficult to identify and control. This is because they are more often controlled by other parties in the supply chain such as contractors, sub-contractors, suppliers and customers. To this end the flow of environmental information, environmental impacts and their measures have been tracked through the organisation. Figure 2.3 shows a model that has been produced in this work to illustrate the key elements involved in an ISO 14001 certifiable environmental management system within a service-based organisation. Each factor will now be considered in turn.

**Figure 2.3 Elements of a Service-based Organisation's ISO 14001 Certifiable Environmental Management System**



### **2.5.1 Purchasing**

Purchasing decisions should be made with the inclusion of environmental attributes as part of the specification. The most basic form of this is a simple question as to whether the supplier has an environmental policy statement and/or an environmental management system certification. A far more sophisticated approach is to assess the organisation's range of suppliers in terms of their size and level of supply (both quantity and frequency). Such an assessment could lead to a three-tier classification of high, medium and low risk in terms of the indirect environmental impacts of the organisation, and an approach can then be tailored for each one. An example of a tailored approach would be to simply communicate the company's environmental policy and programmes to low risk suppliers, request environmental information via questionnaires from medium risk suppliers and go so far as to carry out an environmental auditing programme on high risk suppliers. ICL plc carries out just such an environmental auditing programme on its recyclers of electronic and electrical equipment. The audits are carried out according to specific criteria as follows:

- Registered with the Environment Agency
- Holds relevant waste management and carrier licences
- Understands environmental effects
- Supplies method statements, mass balance and audit trail
- Tests equipment sold for re-use
- Environmental risk assurance

Only those that meet the criteria gain ICL Approved Recycler status and become suppliers to ICL. These audits are continually carried out and, therefore, the recyclers have to maintain their high environmental standards.

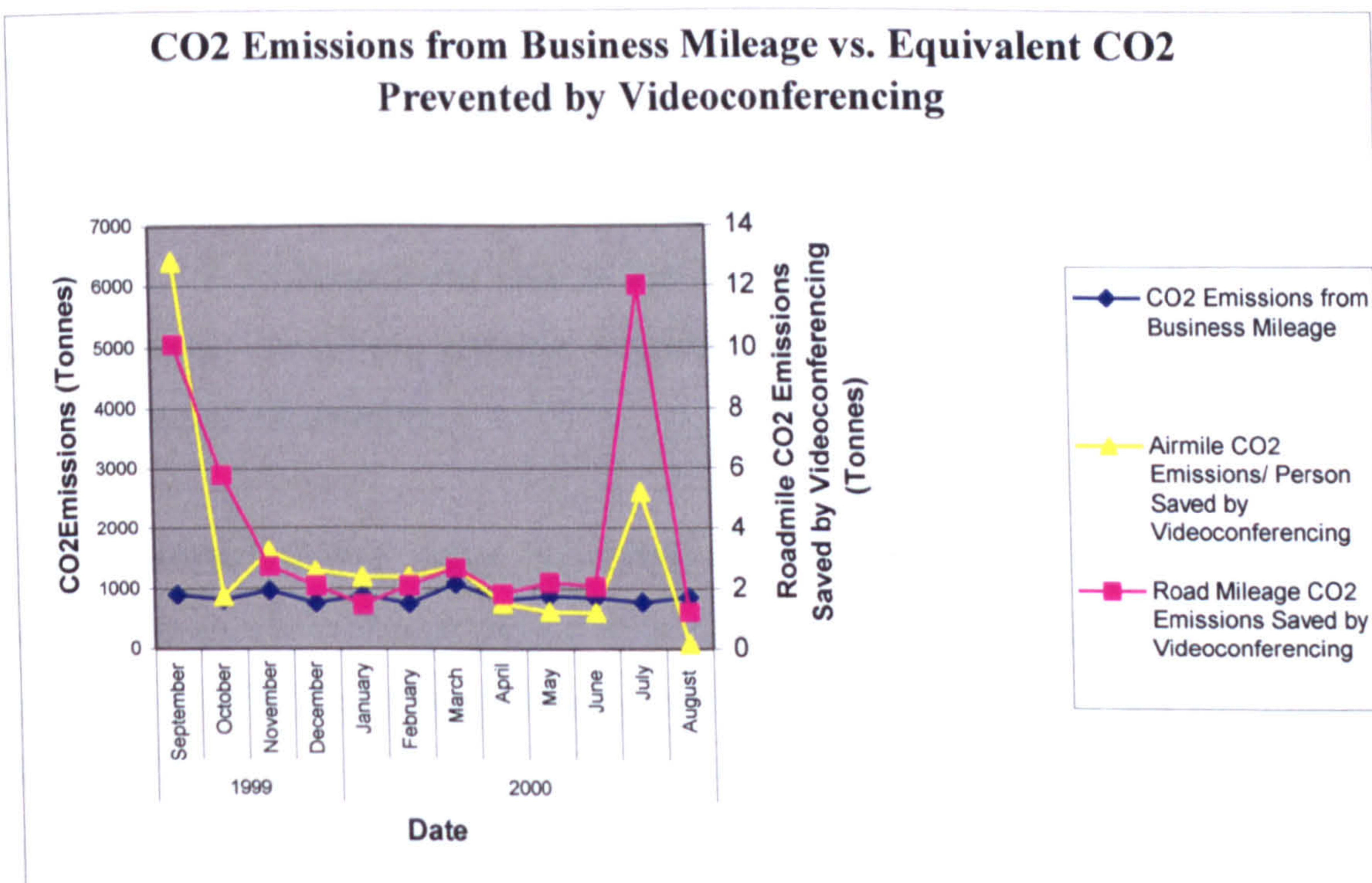
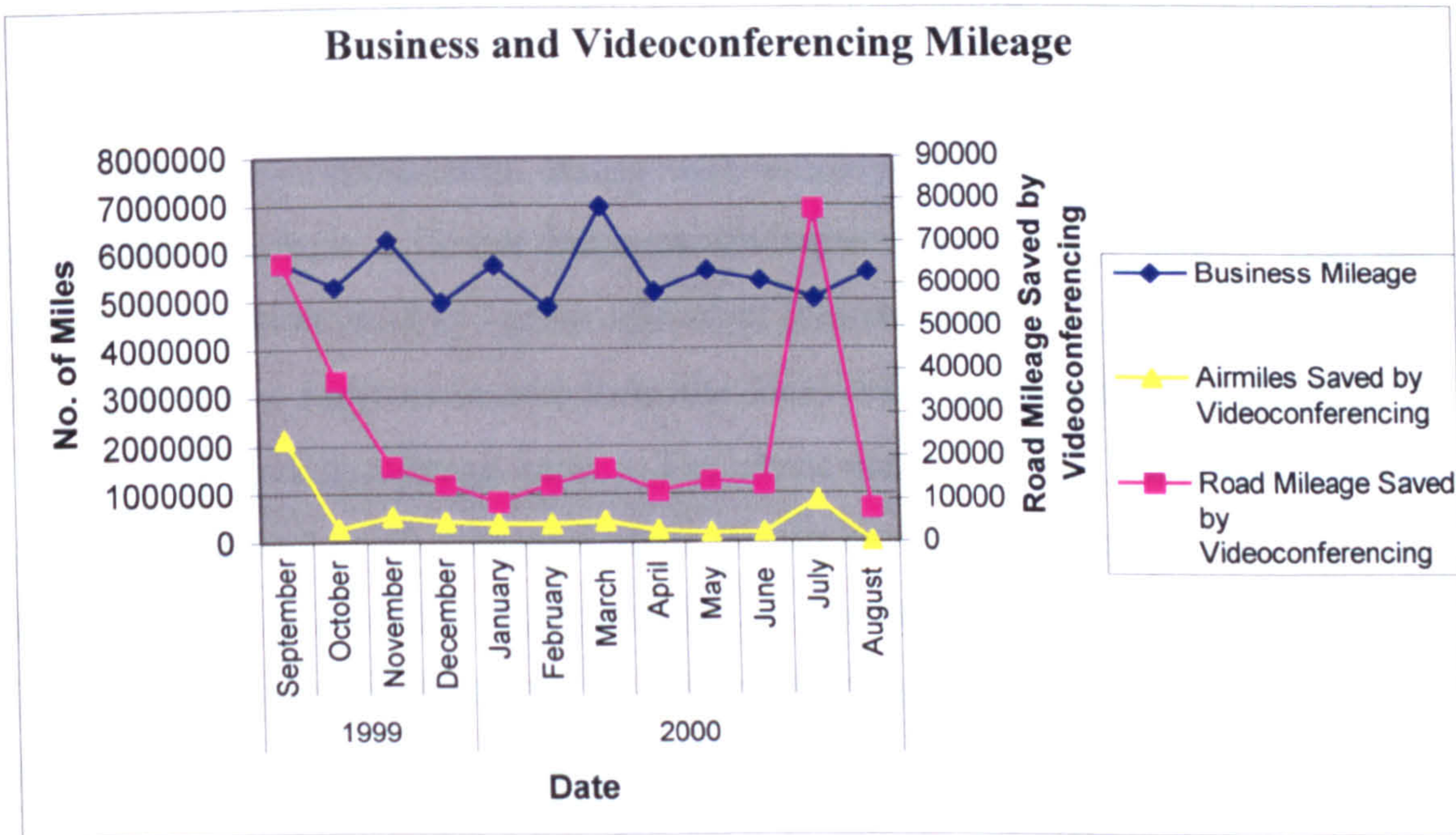
In terms of product procurement, the environmental attributes of products need to be assessed in terms of environmental criteria such as energy efficiency, hazardous substances, recyclates content, and end-of-life reusability/ recyclability options. In certain circumstances this has resulted in industry sectors designing environmental criteria for their products. Companies that supply these products as part of their service can work in partnership with their manufacturing suppliers to ensure that the products they are supplying meet the criteria. In the IT sector, increasingly, companies are using technical reports known as TR70 reports on their products. TR70s provide information on the environmental attributes of IT products and providing these for as many products as possible is the longer-term aim.

Another large area that falls within purchasing is the application of certain environmental requirements into and contractual agreement. An example of this would be where certain environmental legislation may require information, such as the UK Packaging Regulations, a company can put the onus on its suppliers to provide it with the primary data to which otherwise it would not have access (See section 3.4.2).

### ***2.5.2 Freight Transport and Company Fleet***

Issues to be dealt with in this area include the negotiation of contracts between the company, via purchasing and legal departments, and the freight providers. Road transport companies would need to be treated in the same way as other suppliers. The measures that can be used to assess environmental impacts and improvements have been listed in Table 2.3 and include the use and measurement of business mileage versus the application of videoconferencing. As part of this study the primary data have been extracted and represented in the following Figures (Annex 2 Appendix 3). The following graphs show how the measures can be used to assess improvements in environmental performance via the relationship between the two modes of communication, using ICL's data as an example (Figure 2.4). One of the limitations of these data is that it does not take into account the use of teleconferencing which is at present immeasurable and would otherwise account for large quantities of mileage saved. Overall, the fluctuations that can be observed relate to changes in the level of business activities and the increasing use of videoconferencing over summer months may be due to a resistance to travel during the holiday period.

**Figure 2.4 The Use of Videoconferencing and Business Mileage Data as Environmental Performance Measures**



**2.5.3 Employee/ Commuter Transport**

The legislative moves towards introducing fiscal instruments for combating global warming include the publication of The Transport Bill: Part III Road Charging and Workplace Parking in December 1999. This legislation provides Local Authorities with powers to introduce a tax on company car parking spaces. This pressure will mean that increasingly companies will



need to concentrate efforts on reducing the pressure on employees to travel to work by car and to provide incentives for using other means of transport. Increasingly companies are being asked to produce green travel plans in order to demonstrate their commitment to reducing car usage by employees. One way of reducing the amount of car transport used is to introduce car-sharing schemes and to use suitable IT software to facilitate this. A process for communicating environmental issues with employees can be via groups of volunteers or representatives from different business divisions on company sites. ICL has done this through the appointment of 'green teams' at selected key sites. Other initiatives include the provision of bus services to and from the local train stations and provision of facilities for cyclists and cyclist mileage rates. The main environmental measures for the successful implementation of green transport plans should be via regular surveys of commuter patterns in order to assess areas for improvement, the success of various initiatives and the necessary timing for awareness campaigns. A key performance measure should be the number of employees using the car as a percentage of the total number of employees.

#### ***2.5.4 Employees***

Performance measures can be sought via organisational 'green teams'. Measures of environmental performance can be fed back through green teams in order to stimulate new initiatives for problem areas and to increase awareness and motivation for achievements. Green teams, therefore, provide a useful communication route for various forms of environmental information.

Environmental training, under ISO 14001 also comes under this category and measures can include the numbers of staff trained in certain areas and the associated costs. This can include induction briefings to raise environmental awareness of new staff and environmental auditor training for selected members of staff who often include environmental, quality and health and safety staff. Training can involve EMS 'process' training, 'content' training or elements of both. EMS 'process' training involves training of people who are involved in the actual implementation of the system itself, for example, undertaking reviews, planning and delivering the system. EMS 'content' training involves training of people requiring specialist knowledge in such areas as energy efficiency, green purchasing, waste and recycling etc. and those who require a general awareness training of their responsibilities under the EMS (e.g. turning off lights, recycling office paper etc.). Specialist training for people directly

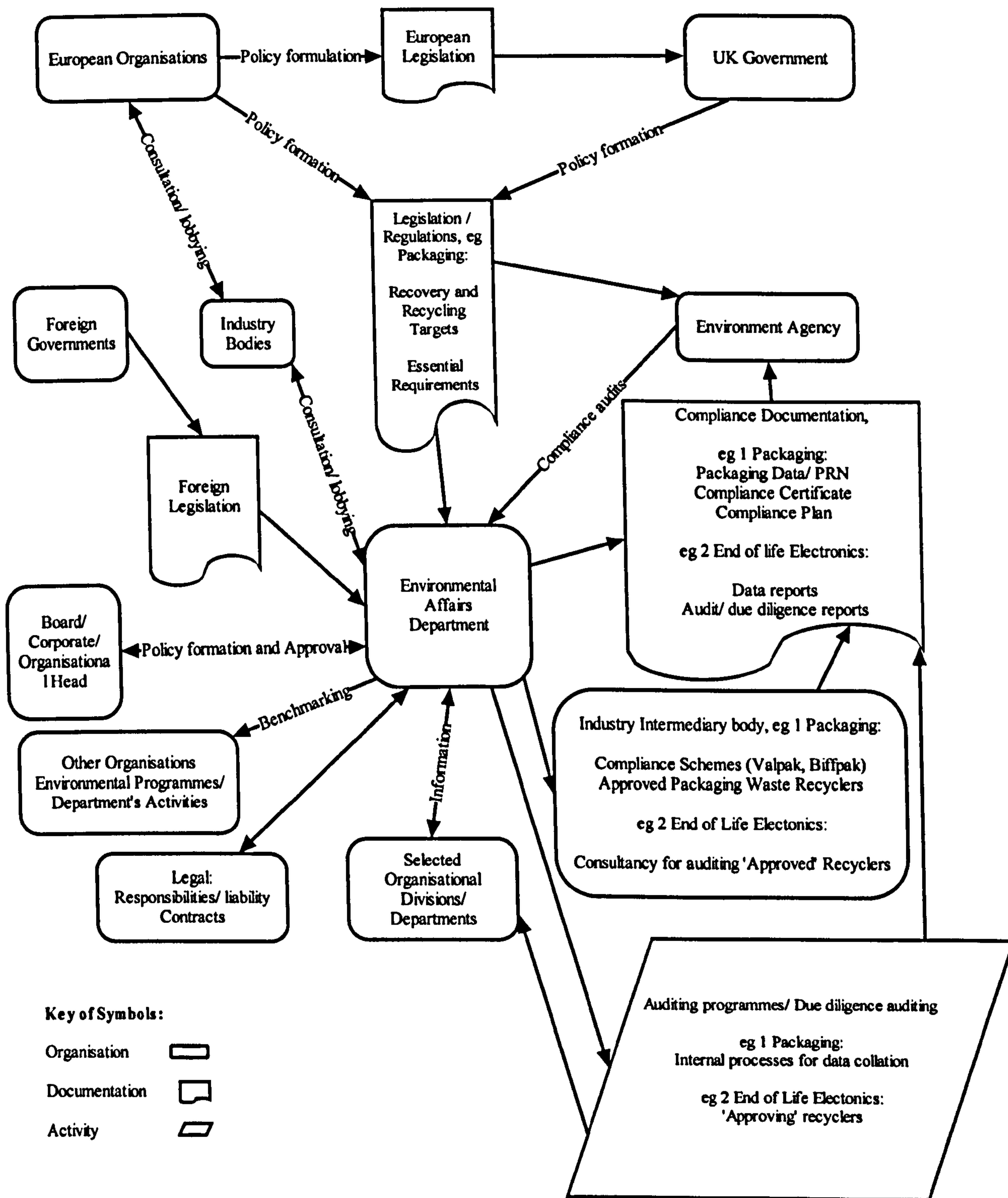
responsible for the EMS underpins process and content training. Training can be delivered through external specialist training courses, internal training with consultants or departmental trainers, or through one to one tuition in the workplace. Staff development and training can be included in staff appraisal systems and evaluation of training should be recorded under ISO 14001 (Improvement and Development Agency (I&DeA), 1999).

General awareness can be increased through the use of the organisation's various communication media such as newsletters, intranet sites and notice boards. An important measure that can be introduced here is the number of environmental awards that can be issued to staff who have contributed to the organisation achieving its environmental objectives.

### ***2.5.5 Legislative Compliance***

The legal compliance infrastructure within an organisation can become very complex indeed. An example of ICL's infrastructure for dealing with legislative compliance is shown in Figure 2.5. The pressure comes from legislation formulated at the European level and transposed into member state legislation, at the national level in Europe, or from other countries in the world. The environmental affairs department has to collect, interpret and assess such legislation for the requirements laid on the organisation. Responses may include external industry bodies that either orchestrate compliance or representation during consultative policy formation stages. ICL's compliance to the UK Packaging Regulations is the subject of in-depth study presented in Chapter 3. Performance measures for legislative compliance are largely expressed in terms of the number of non-compliances whether these are internal non-compliances with regards to legislative compliance processes or real external, high risk impact, non-compliance exposures which may result in fines etc. Easily and rapidly updated databases of environmental legislation, either electronic or paper-based documentation, should be kept as part of the awareness and communication measures. The frequency with which these are reassessed and acted upon could be a useful indicator of compliance performance.

Figure 2.5 Organisational Compliance with Legislation



### ***2.5.6 Waste and Energy Reduction***

Waste reduction measures are extremely difficult for organisations to implement at present. This is because many organisations sub-contract out site facilities management and often waste management companies do not provide them with data relating to the weight of the waste. If they do provide waste data it may only be in terms of the number of skips removed, nevertheless, this guide may be mis-representative as skips are often lifted on certain days, regardless of how full or empty a skip is and the fact that often skips hold 'non-conformance' waste which is unpredictable and often unidentifiable. Quantities of segregated waste for recycling purposes is much more controllable and the quantities taken for recycling are usually attainable from the majority of suppliers. Useful indicators can be derived from the quantities of particular types of waste recycled as a percentage of the quantities purchased.

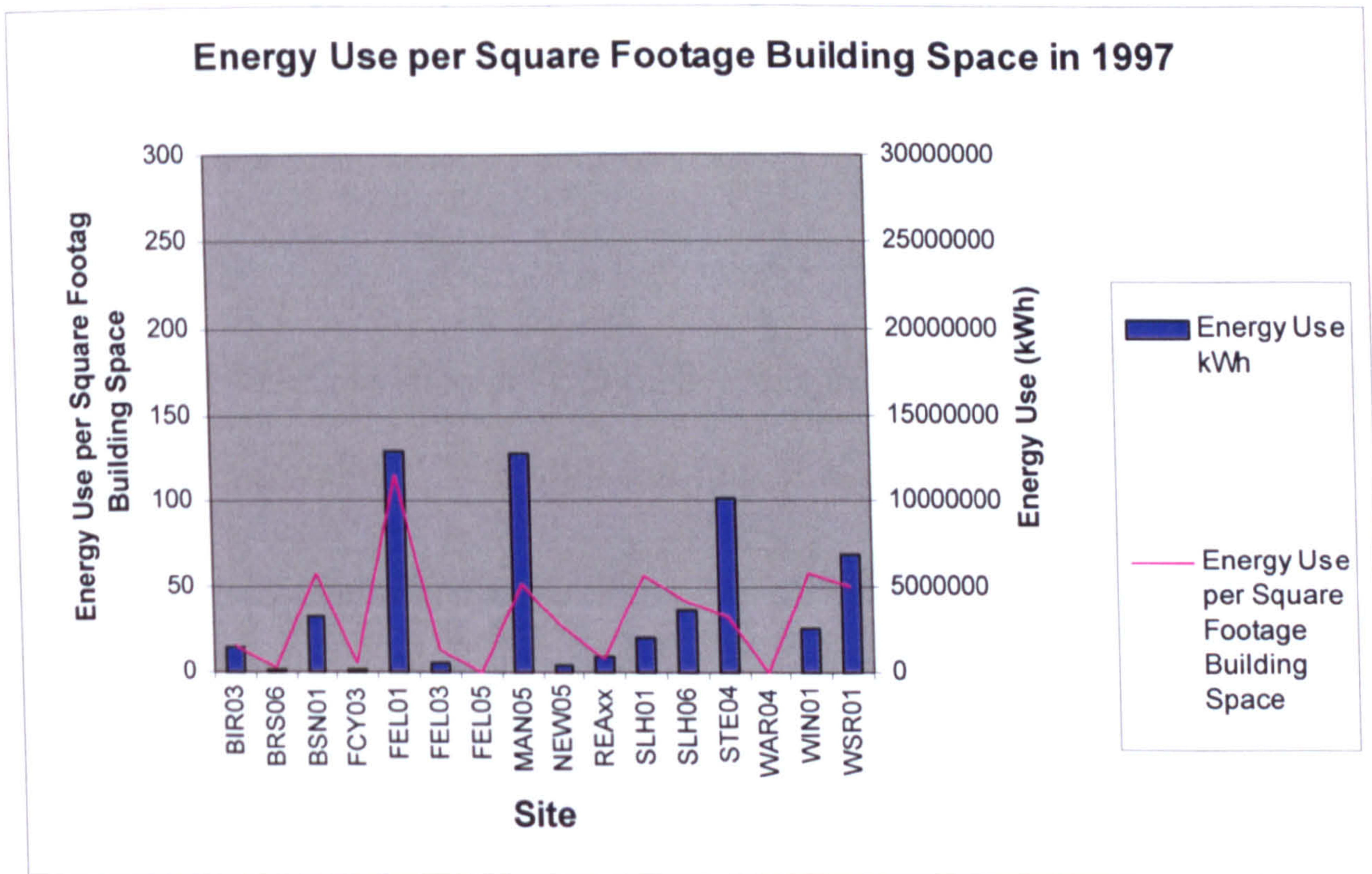
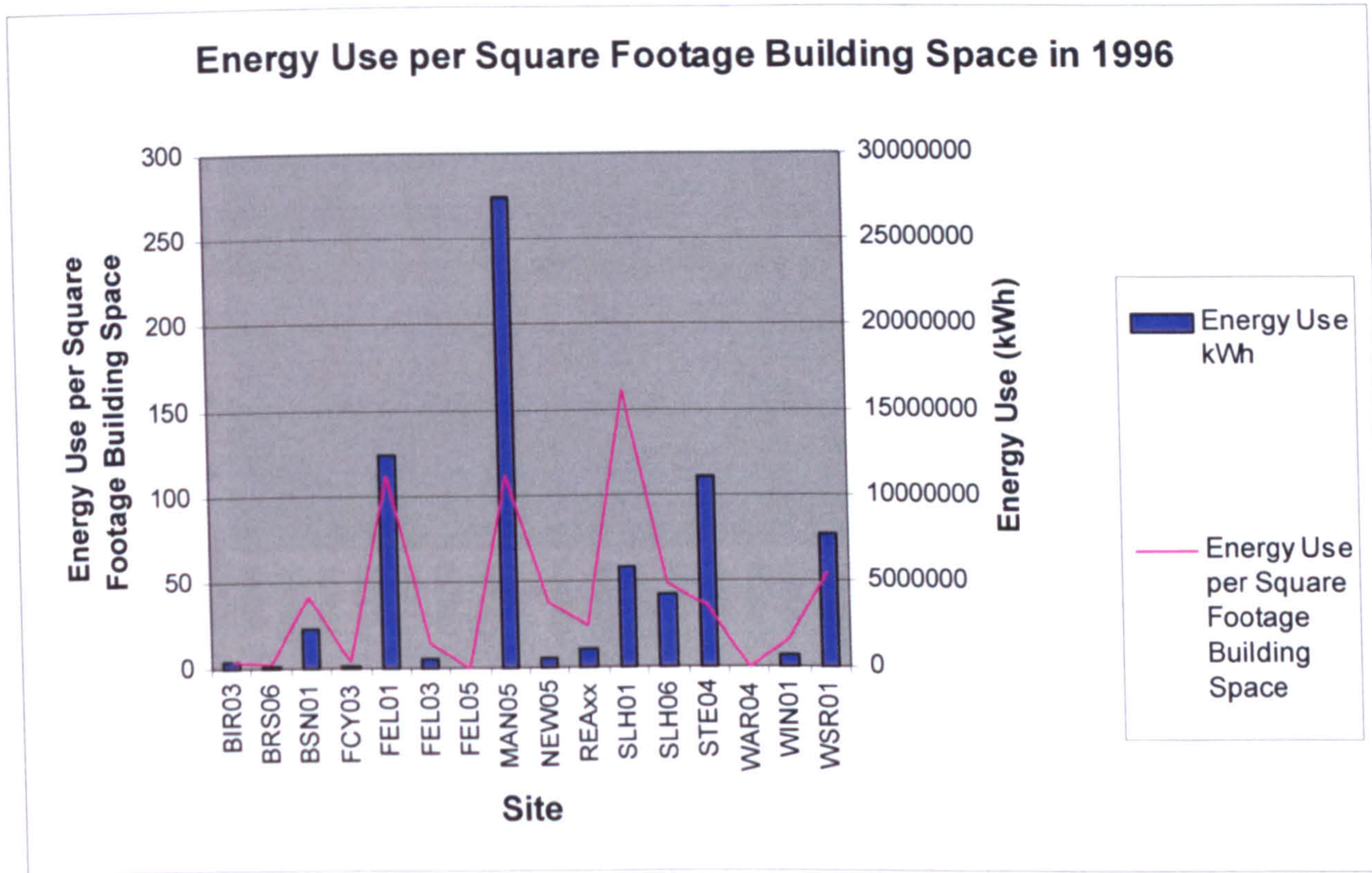
A survey carried out during the second year of the research demonstrates the difficulties in gathering this type of information. The survey, in the form of questionnaires, was carried out in order to gather information on waste and recycling at all the ICL sites. The questionnaires were sent to each of the company's site facilities departments. Although all the sites responded, the information given was low in quality and little was gained relative to the waste measurement reviews (Volume 2, Report 3, Annex 2) apart from providing an idea of the costs of waste management for ICL (Volume 2, Report 3, Annex 1). The waste measurement reviews, when combined with waste data from the waste management company, Cleanaway, gave good estimates on percentage composition of different materials in the waste stream and regular sampling would ensure the provision of good quality information to support recycling programmes.

The UK Government has introduced the climate change levy which is a tax on gas and electricity usage and will be in force from April 2001. This fiscal measure was introduced in order to enable the UK to meet its reduction in carbon dioxide emissions targets under the Kyoto Protocol. The EU Member States collectively agreed to an 8 per cent reduction at Kyoto. The UK's contribution to this target has been set at a 12½ per cent reduction on 1990 levels in emissions of a group of six greenhouse gases. The UK has also set itself a domestic objective that goes beyond our legally-binding Kyoto target - to reduce emissions of carbon dioxide by 20 per cent on 1990 levels by 2010 (DETR, 2000a). Previously, the Government

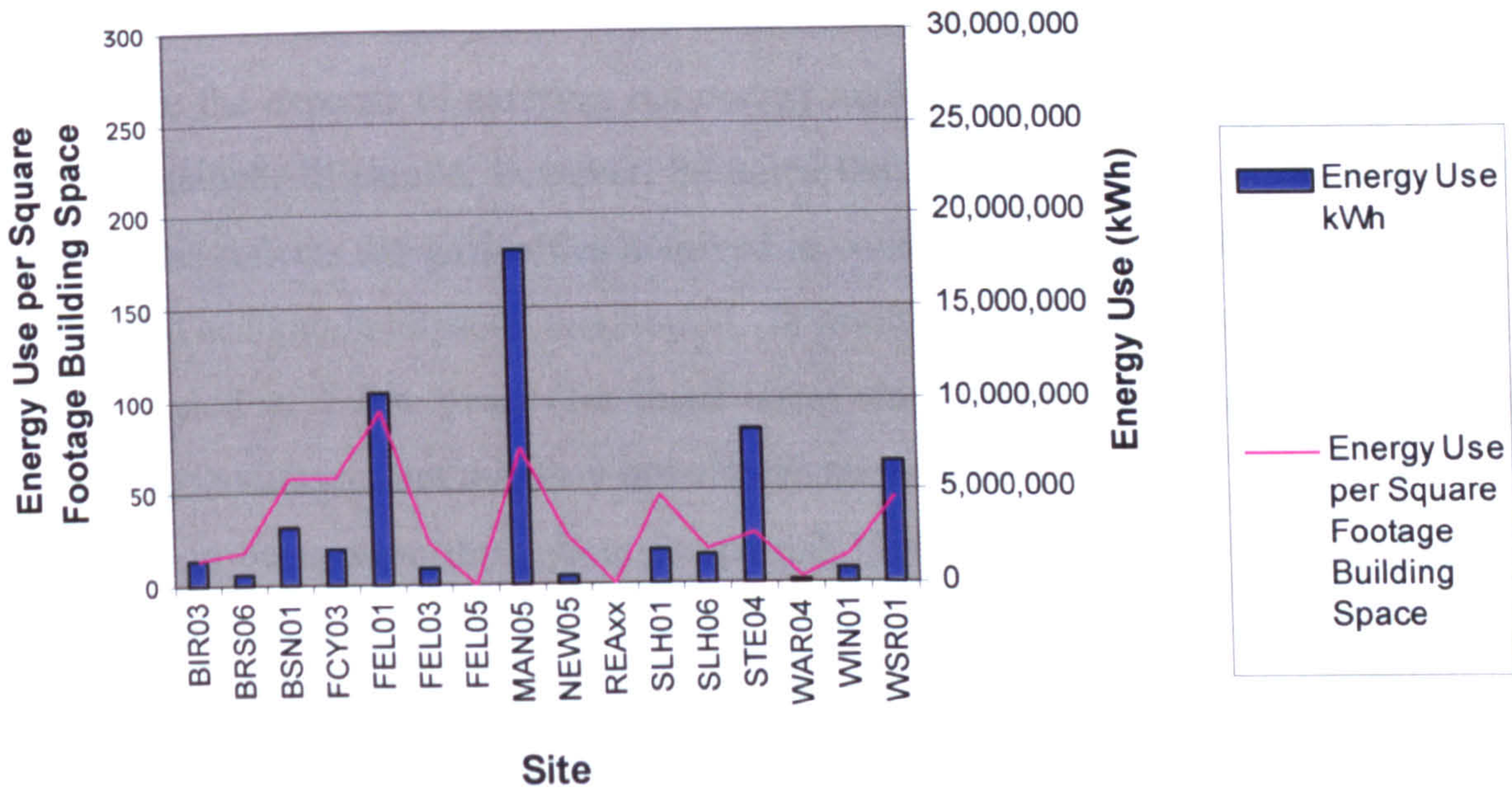
had relied on voluntary initiatives to drive energy consumption reduction such as its Making a Corporate Commitment Campaign (MACC).

Energy consumption is an indicator that most organisations can quantify with relative ease because it is invoiced according to units of consumption (e.g. kWh). The processes can be set up to collect this data electronically and performance assessment can be made on the basis of consumption per square footage building space, level of sales, or per number of personnel. Figure 2.6 demonstrates these performance measures using ICL's total energy consumption over its sixteen main sites and energy consumption per square footage building space by site over the period 1996 to 1999.

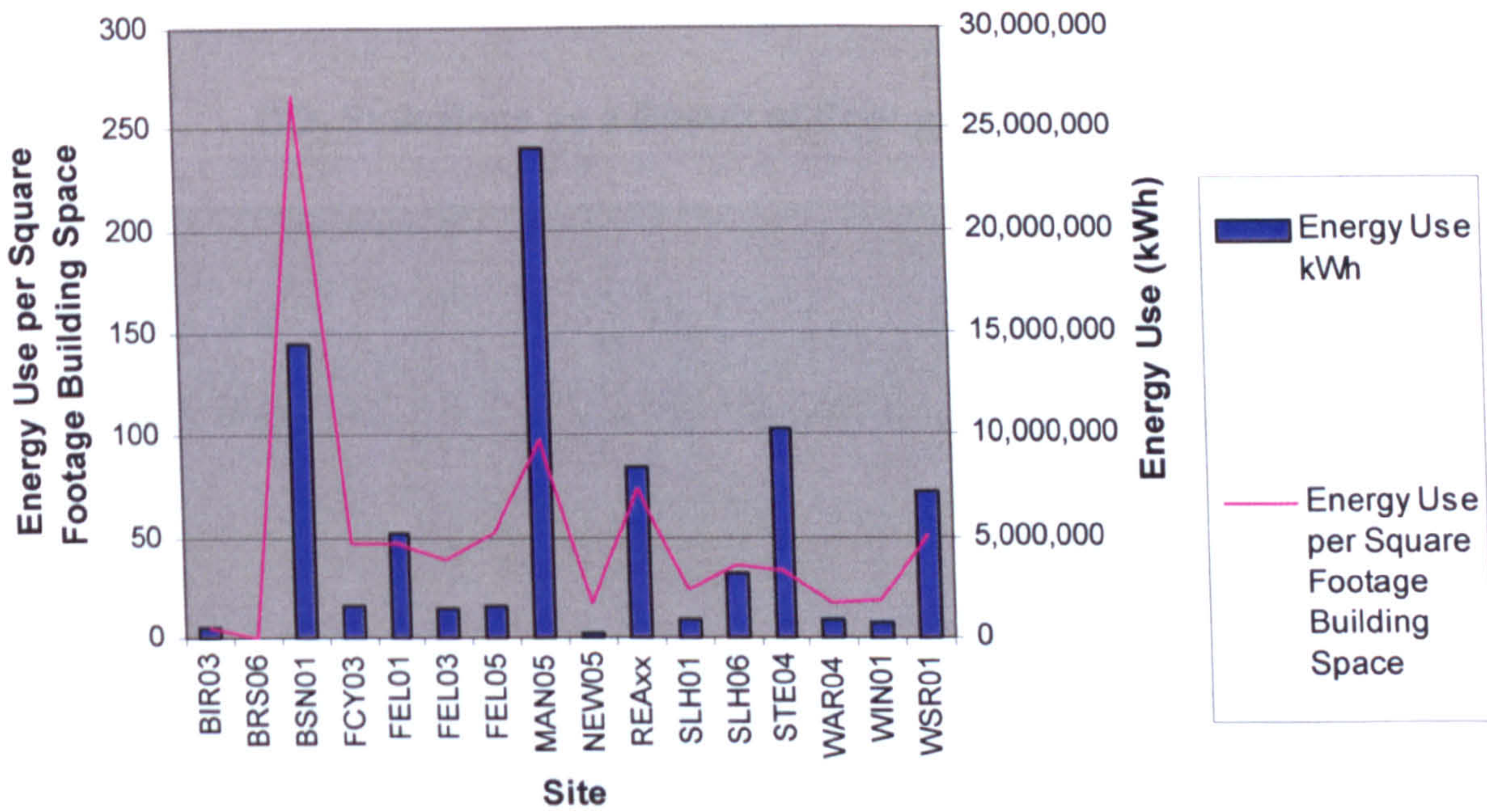
Figure 2.6 Energy Consumption Performance Measures



**Energy Use per Square Footage Building Space in 1998**



**Energy Use per Square Footage Building Space in 1999**

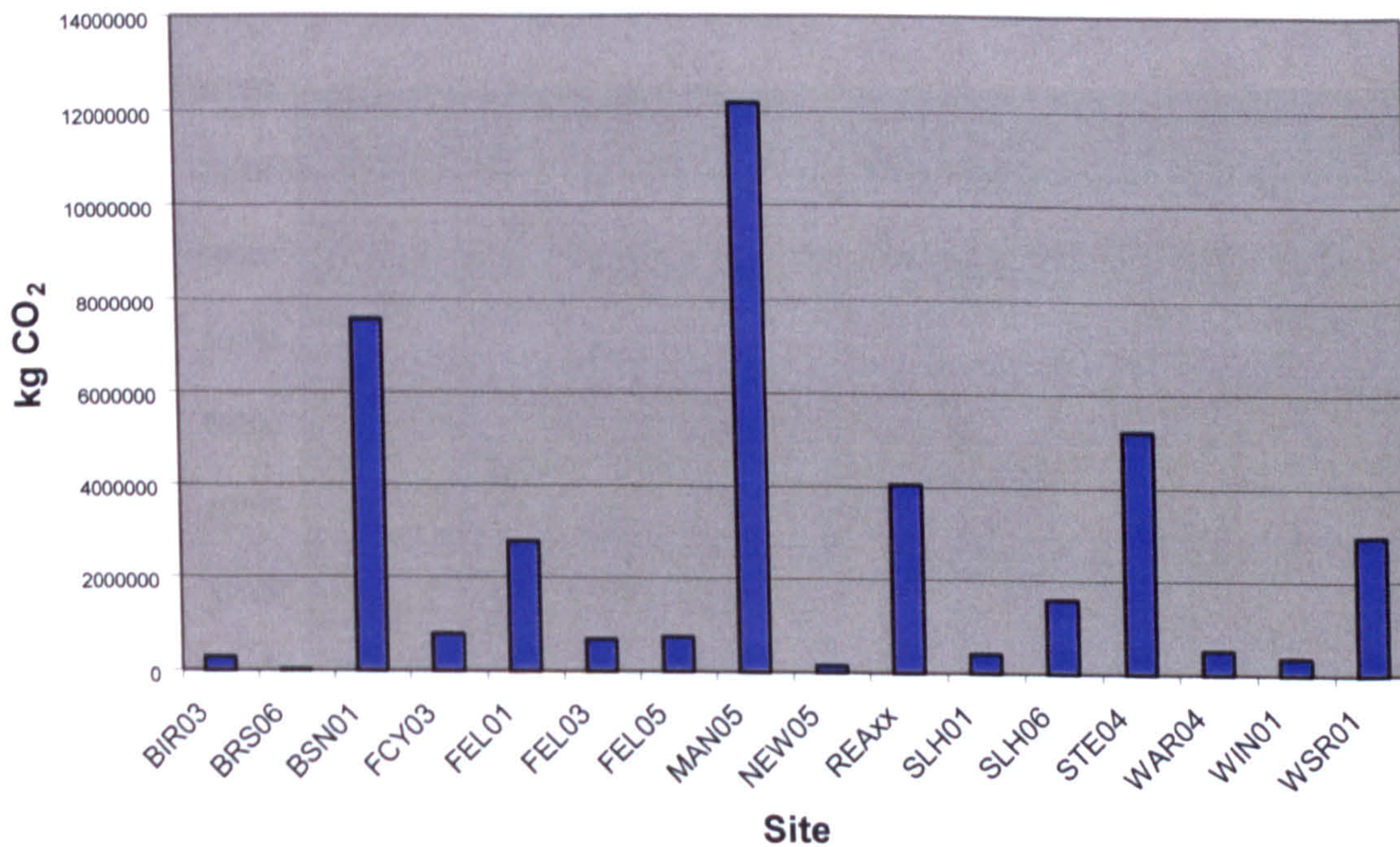


As can be seen from these graphs, the use of these environmental performance measures can achieve greater transparency with regard to which sites are using more energy and which sites are more energy-efficient. The progress can be traced over time and any improvements demonstrated within an environmental management system. It can be seen that over the four

year period both the Stevenage (STE04) and the Manchester (MAN05) sites are very energy efficient despite their high energy usage whereas Basingstoke (BSN01) is low in its energy efficiency relative to the other sites. This immediately highlights the problem areas and, therefore, where the expense of carrying out energy audits should be directed in terms of the benefits to be gained. It should, however, be noted that various data are missing for certain sites and that this reflects the difficulties involved in collating environmental data and making some useful and accurate interpretations from it. It would be pertinent to track the data for the sites over a period of a few years (for those sites which only have data for 1999) before planning energy audits etc. but this may not always be possible. The sites included have been based on those in occupation throughout the period 1996 to 1999, previous years have seen the use of different sites and these have been excluded for the sake of clarity. Whereas this is acceptable for making comparisons of sites, it is obviously not possible when comparing total energy consumption. The following graphs show the environmental impacts of energy consumption in 1999 in terms of global warming carbon dioxide, smog-forming nitrogen oxides, acid rain forming sulphur dioxide and global warming potential (Figure 2.7).

**Figure 2.7 Graphs to Show Environmental Impacts from 1999 Energy Consumption**

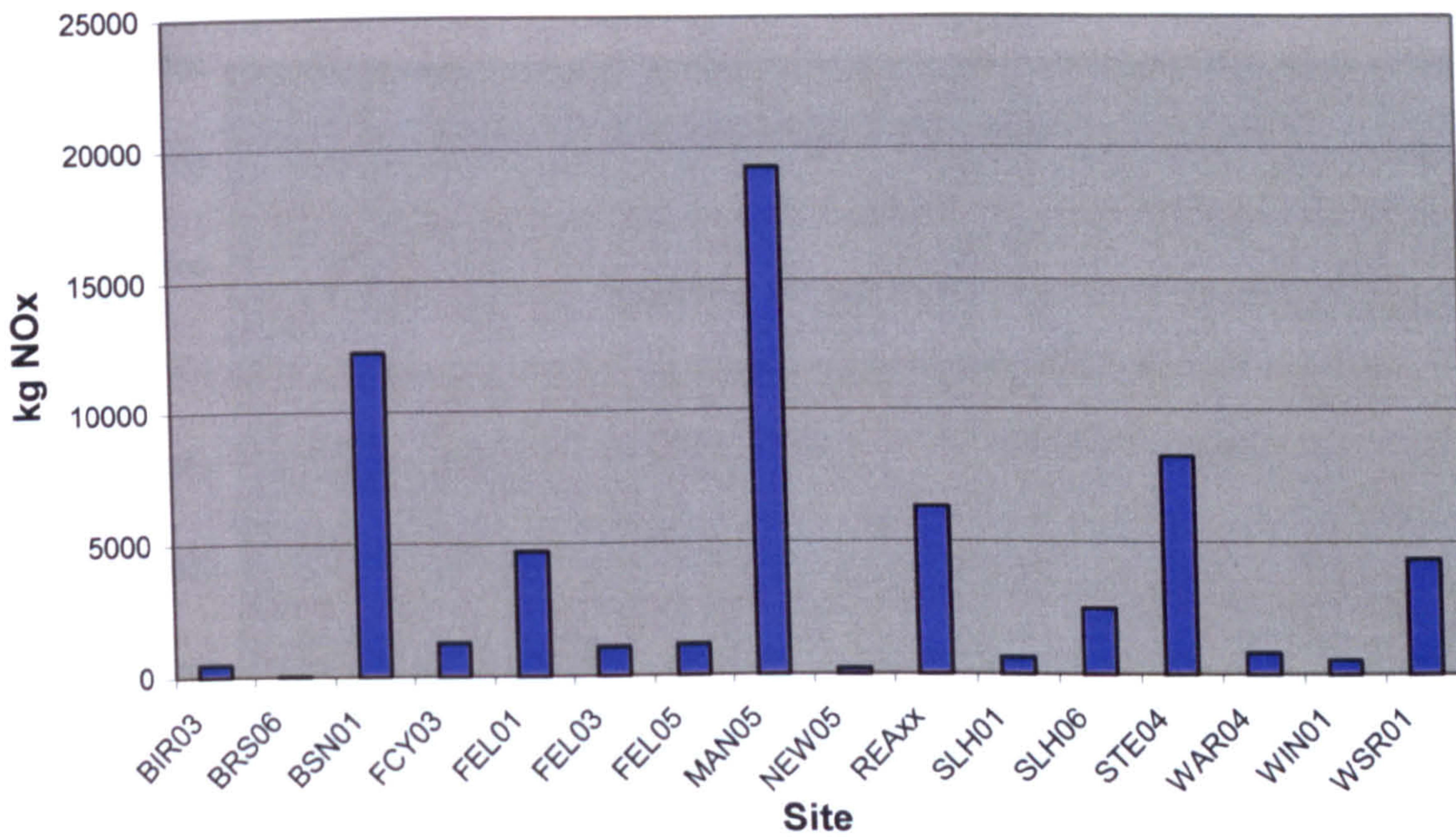
**CO<sub>2</sub> Emissions as a Result of Energy Use by Site**



Note: 1 kWh from Gas ≡ 0.185kg CO<sub>2</sub> Assumed 60% boiler efficiency  
 1 kWh from Electricity ≡ 0.55kg CO<sub>2</sub> UK Fuel Mix 97  
 1 kWh from Oil ≡ 0.25kg CO<sub>2</sub> Assumed 60% boiler efficiency

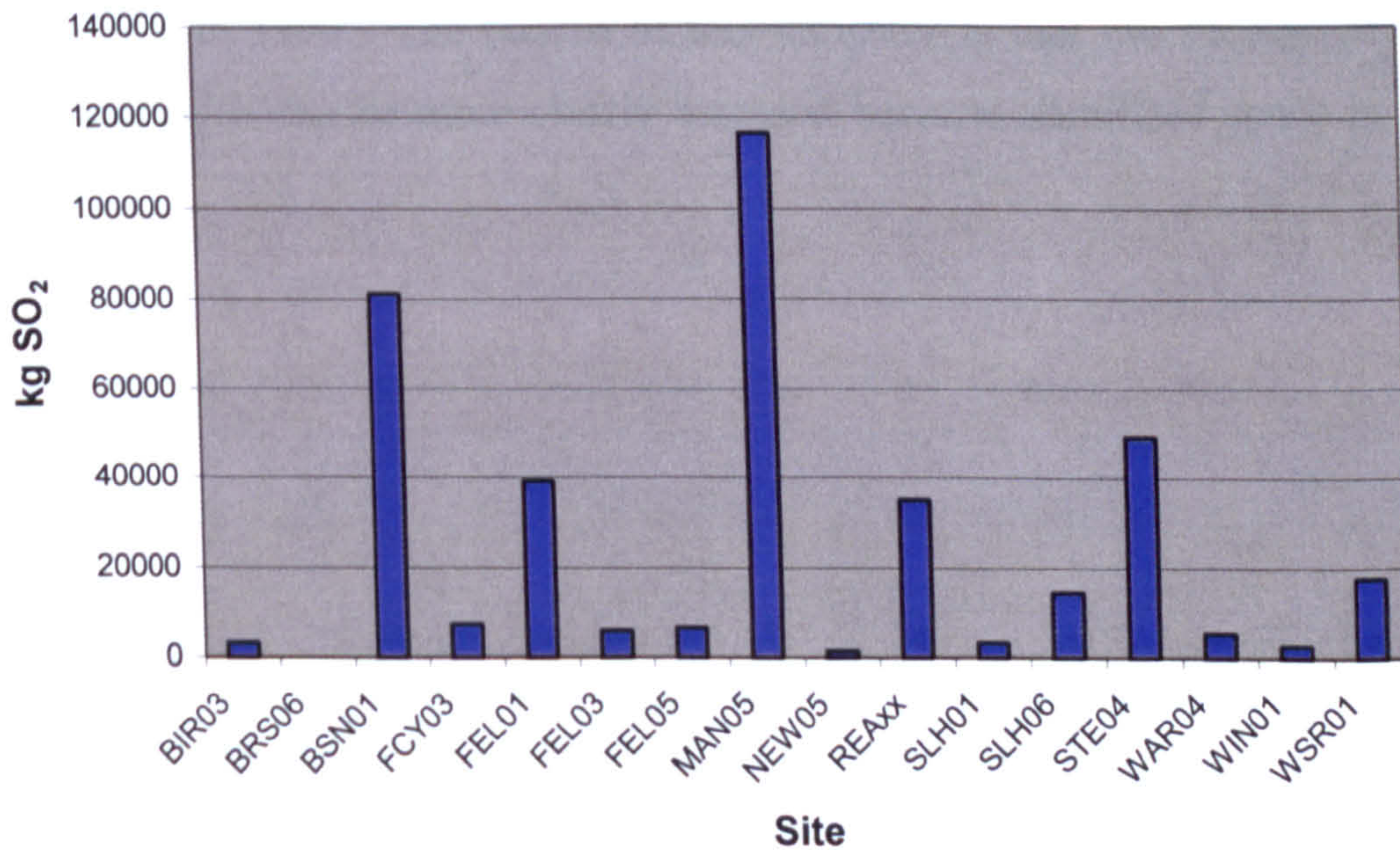


### Nitrogen Dioxide Emissions as a Result of 1999 Energy Use



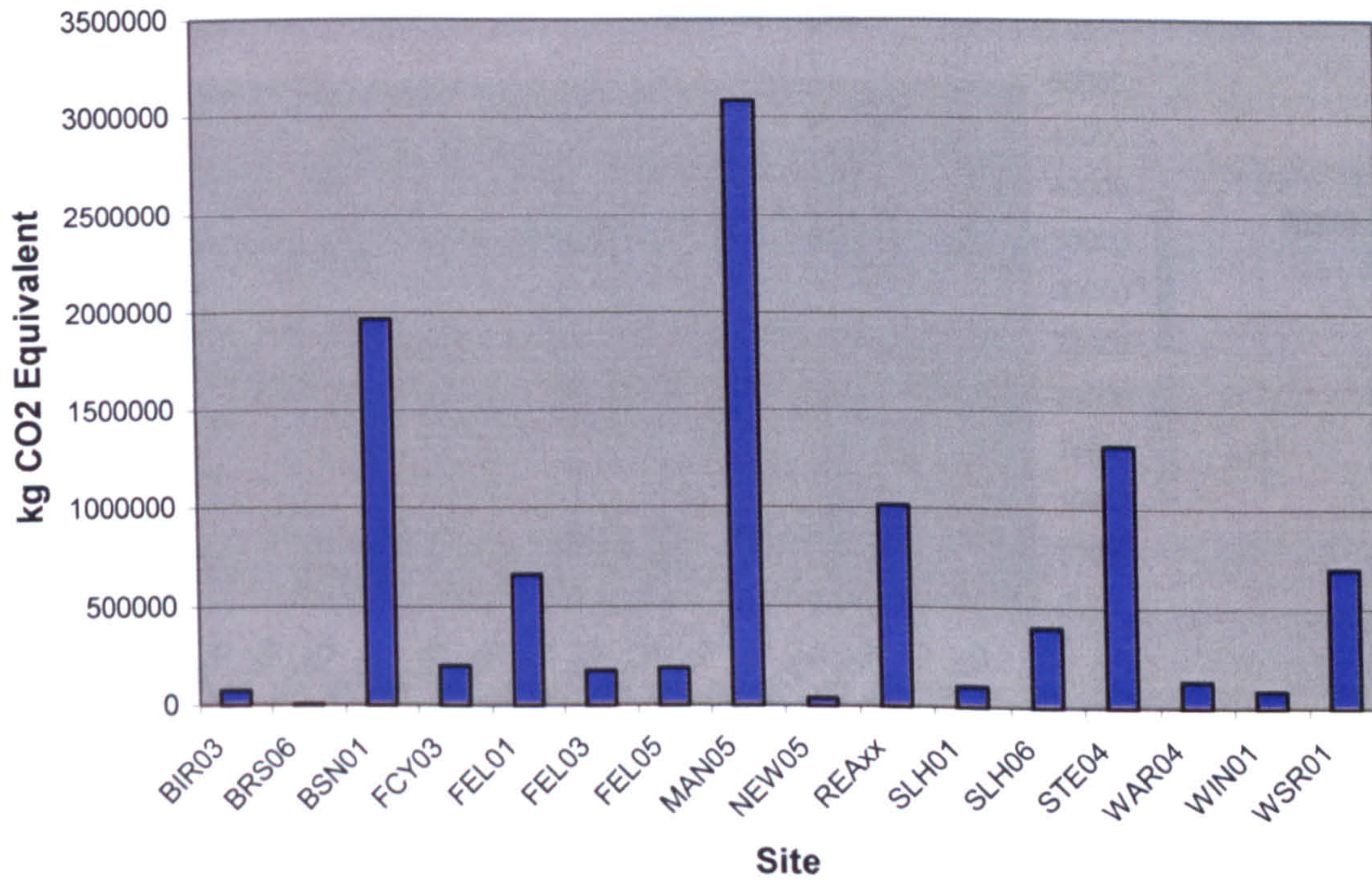
Note: 1 kWh from Gas  $\equiv$  0.00024kg NOx      Assumed 60% boiler efficiency  
 1 kWh from Electricity  $\equiv$  0.000891kg NOx      UK Fuel Mix 97  
 1 kWh from Oil  $\equiv$  0.00059kg NOx      Assumed 60% boiler efficiency

### SO<sub>2</sub> Emissions as a Result of 1999 Energy Use by Site



Note: 1 kWh from Gas  $\equiv$  0.0 kg SO<sub>2</sub>      Assumed 60% boiler efficiency  
 1 kWh from Electricity  $\equiv$  0.005895kg SO<sub>2</sub>      UK Fuel Mix 97  
 1 kWh from Oil  $\equiv$  0.012634kg SO<sub>2</sub>      Assumed 60% boiler efficiency

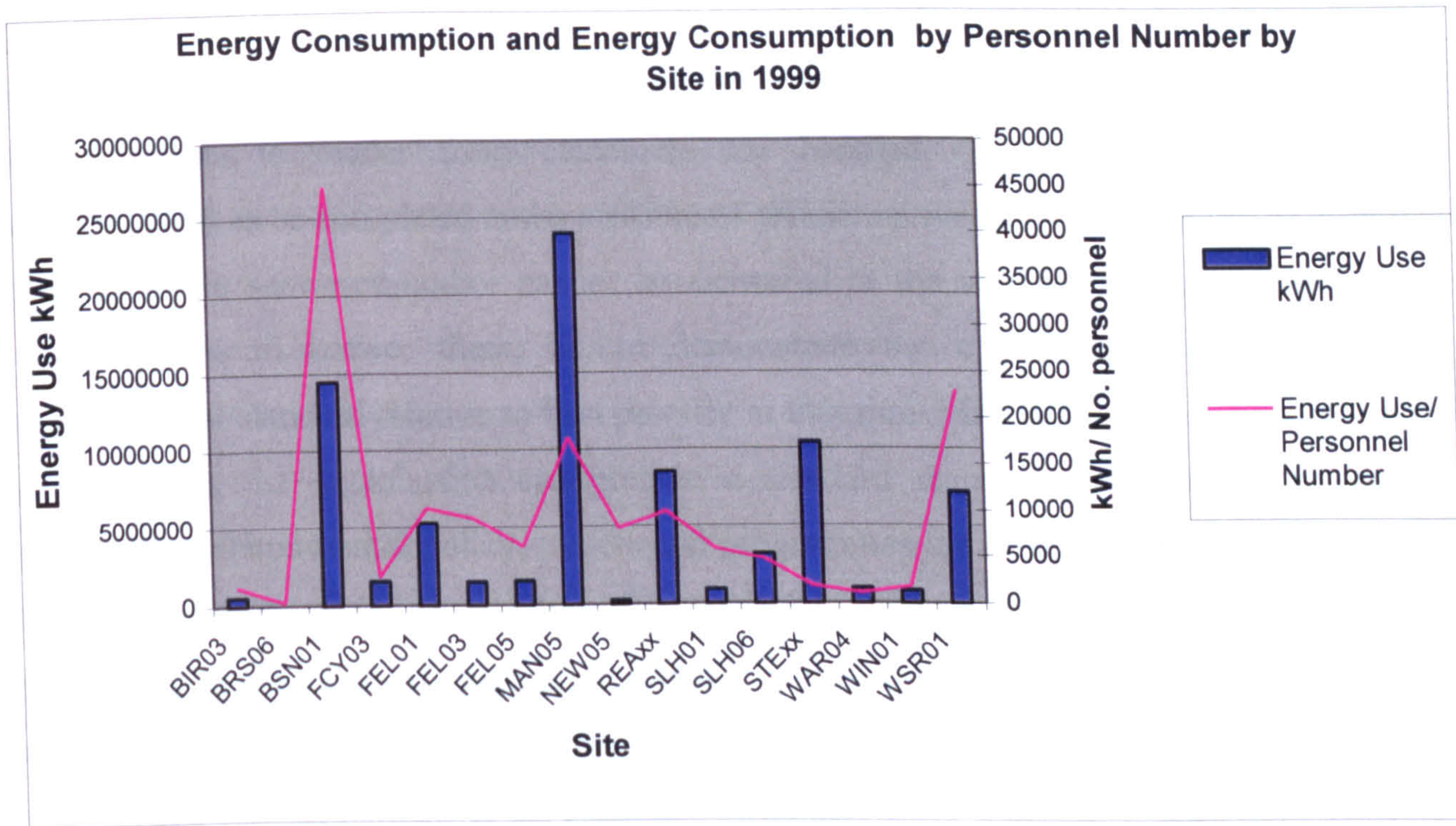
### Total Global Warming Potential as a Result of Energy Use by Site



Note: 1kg NO<sub>x</sub> ≡ 160kg CO<sub>2</sub>

The final graph shown in Figure 2.8 presents the energy consumption per number of personnel by site in 1999. The benefit of this indicator is that the success of 'switch-off' awareness campaigns can be more clearly assessed because unutilised space in buildings is not included.

**Figure 2.8 Graph to Show Energy Consumption Per Personnel Number**



### 2.5.7 Provision of Services

Each organisation's activities may be entirely different and require quite unique performance measures with respect to the services it provides. Various overlapping elements, such as procurement of product controls, have already been discussed in previous sections, however, it is worth noting that specific processes would need to be set up with the particular functions involved and it should become part of the job specification and appraisal system. An example of this would be a sales and marketing personnel whose role and responsibility it would be to communicate the company's environmental programmes to its customers. Training and awareness would need to concentrate on those particular staff that can be made responsible for reducing particular environmental impacts. For example, measures on fleet mileage and company car performance from an environmental perspective does not take into account the responsibility of the driver who may be a sales representative or engineer whose driving style may considerably affect the amount of pollution emitted by their vehicle. Training in this case may be particularly important in provision of their services to the customer from the efficient use of their vehicle to the provision of efficiently used resources and minimisation of wastage. An example of such resource efficiency and waste minimisation would be the removal of packaging for recycling from products supplied to customer sites, the set up of

energy efficient features as part of customer service and asset recovery/ reuse cycles of undamaged products and packaging.

An important measure to be considered here is the way with which environmental questions on invitations to tender from customers are handled. Usually, customers require questionnaires to be completed and a measure of efficiency would be the number of questions that cannot be answered and/or cannot be answered in the way in which the organisation would choose to answer them, i.e. to demonstrate the organisation to be of a high environmental standard relative to best practice at that time. In addition to responding to the questionnaire, the organisation can prepare a standard response document, detailing the company's environmental policy, targets and programmes, as a first step towards making an efficient response. This is particularly time-saving in the longer term as it allows references to be made to the standard response document in answers provided to the questionnaire. A more advanced organisation with more resources at its disposal would, however, be able to tailor its response documents to the particular customer.

### ***2.5.8 End of Life***

Whatever services an organisation provides, there will always be products that are integral to that service and a factor that every service-based organisation needs to take into account, if it takes its environmental responsibilities seriously, is how to deal with those products at end of life. ICL is a company that has exploited end-of-life routes for the products it supplies as part of its services. The Approved Recycler programme goes so far as to cover the requirements of the forthcoming European Directive on Waste from Electrical and Electronic Equipment and, in addition to pre-empting this legislation, provides an exemplary service to its customers whilst reducing the associated environmental impacts. The ongoing financial implications of such environmental initiatives as well as the savings in environmental impacts are useful indicators of an organisation's environmental performance.

### ***2.5.9 Documentation***

The final stage in integrating measures into processes is to ensure that all the existing and future processes for measuring environmental performance are included in the EMS documentation and formal record keeping. The reason for this being the final stage in addressing environmental performance measures is that written procedures are more likely to

be effective if they are written on the basis of what is actually done in practice rather than on what one might think should be done.

The documentation for an EMS may be incorporated within other systems such as the quality system. For the sake of clarity, however, a top-level EMS Manual provides the best way to guide the user or EMS Auditor around the system. The EMS manual provides the vital link between ISO 14001 and the EMS of the site. Documentation should not only cover the core elements of the EMS but should be arranged so that users can locate records, procedures, work instructions and other information such as operating licences. The purpose of the documentation is for the recording of procedures and actions which must be taken. Careful structuring of the documentation such as setting up different levels of information will ensure that the documentation and any necessary amendments will be kept to a minimum. Typically such levels would be: the EMS Manual at level one; procedures documents outlining specific programmes and associated work instructions or tasks as level two; and supporting documentation such as the effects register, the environmental review, objectives and targets and register of regulations as level three. The first level EMS manual is a signposting document which will need very few changes from year to year. The EMS Manual will be unique to an organisation but will collate the policy objective and the programme, document key roles and activities, describe systems interactions and will direct the reader to hold the system together. Procedures must be in place to ensure that documents can be easily located in the site or business. Furthermore, procedures should be in place for the revision of documents and the removal of obsolete documents. In addition to preparing the system documentation, implementation plans need to be drawn up and the necessary information systems created for data collection and analysis and for corrective action databases.

For the purposes of ICL's EMS it was decided that the rapid organisational changes rendered individual site certification ineffective and that a global certification should be applied for. The documentation drawn up, therefore, is for the top level of a multinational organisation and has been designed to be applied by individual business units and sites as appropriate. This documentation, that is perceived by the author to be important to such an EMS, is listed in Table 2.6. As can be seen from Table 2.6, the system includes an environmental performance indicators manual and environmental performance measurement procedures

(Annex 2, Appendices 1 & 2). The pertinent documents, including the EPIs and measurement procedures, have been written in full and are presented in Volume 2, Repts. 6 & 7. These elements will ensure that the organisation concentrates on, and will facilitate its efforts towards continuous improvements in environmental performance.

**Table 2.6 ISO 14001 Documentation Incorporating EPIs and Measurement Procedures.**

	<b>Level</b>	<b>Document Title</b>
[1]	ISO14001	Environmental management systems - Specification with guidance for use
[2]	1	Environmental Management System Manual
[3]	2	Environmental Performance Measurement Procedures
[4]	2	Environmental Legislation Update Notification Procedure
[5]	2	Emergency Preparedness and Response Plans
[6]	2	Training Plans
[7]	2	Awareness and Communication Programmes
[8]	2	Record Retention Procedures
[9]	2	Documentation Control Process
[10]	2 & 3 (res.)	Review and Audits Procedures and Records
[11]	3	Environmental Aspects and Impacts Register
[12]	3	Performance Indicators Register
[13]	3	Environmental Legislation Register
[14]	3	Environmental Input for Bids Procedures
[15]	3	Records Register

## **2.6 Discussion**

A company must take responsibility for improving its environmental performance because the ISO 14001 certification bodies will be obligated to assess only the performance of the system and not the actual level of environmental performance against any baseline standards. Continual improvement must be demonstrable for a company to maintain its certification but if an organisation is serious about its commitment to the environment its EMS needs to go beyond the ISO 14001 framework. One way in which an organisation can achieve this is to establish a key set of environmental performance measures and integrate these into its EMS.

The development of environmental performance measures is an iterative procedure. It is beneficial to start with simple measures and to extend the measures over time as collection and analysis becomes easier. Furthermore, the passage of time can highlight the more useful, or less effective, measures. The integration of environmental performance measures is not only dependent on what areas are suitable for processes and procedures to be set up but are also reliant on the commitment and motivation of all those involved in making any improvements. This can only be achieved by good communication, participation, and rewards for good performance.

The most important part of the analysis is to present the results in such a way as to show where improvements can be made and where efforts should be concentrated. The ultimate test of performance measures is their effectiveness in informing against, and aiding the achievement of, the objectives and targets. In a service-based organisation these processes are of a very different nature to those in manufacturing organisations and require different emphases especially with regards to indirect impacts via suppliers and the emerging importance of energy consumption and transport as prioritised environmental impacts. Particular legislative developments have been demonstrated to have high significance in the formation of EPIs in such organisations and the next chapter deals with the way in which packaging legislation in the UK is aiming to drive environmental performance measures within organisations' EMSs.

It is arguable that the EPE standard ISO 14031 is lacking in its provision for standardisation and implementation issues. Although various industrial bodies such as CEFIC and the GRI initiative are addressing standardisation, it is down to organisations to develop their own unique sets of performance measures and to implement them. The work presented in this chapter has sought to address the lack of guidance on implementation issues and has focused on service-orientated organisations, which have largely been neglected next to manufacturers. A set of performance measures have been established and their application to a particular organisation demonstrated. Furthermore, the research has developed a risk assessment methodology for EPE that supports organisational decision-making whilst taking account of business constraints.

This study has shown how performance measures can be developed for a service-orientated organisation and how environmental performance measures can be integrated into the EMS system and documentation. The system achieved is above and beyond the minimum requirements of measurement and monitoring within the framework standard ISO 14001. This ensures that the organisation will have an EMS that facilitates demonstration of continuous improvement in environmental performance. Furthermore, the EMS framework is applicable to individual business units and sites and is, therefore, suitable for achieving global certification for multinational companies or large complex businesses.



## Chapter 3

Response to the UK Packaging Legislation  
– ICL Case Study, Methodology for  
Compliance, and Policy Analysis

## CHAPTER 3

### RESPONSE TO THE UK PACKAGING LEGISLATION ICL CASE STUDY, METHODOLOGY FOR COMPLIANCE AND POLICY ANALYSIS

#### *Summary*

*This chapter provides a review of the UK Producer Responsibility Obligations (Packaging and Packaging Waste) Regulations 1997. Packaging is a key focus in industry as a result of increasing attention from legislators to regulate against its negative environmental impacts. This chapter seeks to outline the regulatory requirements concerned with packaging; the impact of the Regulations on ICL plc; and the current status implications for future policy formation and the producer responsibility approach to environmental legislation. A compliance methodology is proposed that can be employed by any organisation that is faced with the onerous task of compliance with the Regulations, whether they join a compliance scheme or not. The proposed methodology shows how an organisation can achieve compliance and conserve valuable resources for improving its environmental performance.*

### **3.1 Introduction**

This chapter provides a review of the UK Producer Responsibility Obligations (Packaging Waste) Regulations 1997 (DETR, 1998a), and the two sets of amendments made to the Regulations in June 1999 (No.1) (DETR, 1999a) and December 1999 (No.2) (DETR, 1999b). Since the introduction of the Regulations in March 1997, all significant producers and users of packaging have become legally obligated to meet packaging waste recovery and recycling targets and to gather and report on complex data to the Environment Agency (EA) or Scottish Environmental Protection Agency (SEPA).

### **3.2 Background**

The UK Producer Responsibility Obligations (Packaging Waste) Regulations 1997 were introduced in March 1997 to implement the EC Packaging Directive (94/62/EC). The Packaging (Essential Requirements) Regulations 1998 (DETR, 1999c) was a further regulatory measure to implement the EC Packaging Directive but the enforcement of these regulations does not fall under the Packaging Waste Regulations.

Packaging is a significant proportion of the household and industrial waste streams. It has been estimated that currently the UK uses around 11.7m tonnes of packaging per year and it is likely that between 4.5m and 5m tonnes of this ends up in the 111m tonnes annual waste stream. The UK recycled about 23% of household and industrial waste in 1996. The Regulations were introduced as part of European Union (EU) policy implementation and a national strategic plan in the UK to reduce the undesirably high level of waste sent to landfill having no value extracted from it (DETR, 1998b).

The next section provides an overview of the regulatory requirements concerned with packaging and the current status implications for future policy formation and the producer responsibility approach to environmental legislation. Against this background a compliance methodology is proposed that can be employed by any organisation faced with the onerous task of compliance with the Regulations.

### 3.3 Regulatory Requirements

The Regulations establish the 'shared approach' to producer responsibility favoured by industry. This means that each member of the packaging supply chain from the raw materials manufacturer to the final retailer/ seller accepts responsibility for the waste created or the environmental impacts occurring as a result of its production and supply. This responsibility is allocated according to specific obligations: firstly to register with the appropriate Agency (Environment Agency (EA) or Scottish Environmental Protection Agency (SEPA)); secondly to provide data on the quantities and types of packaging handled; and finally to recover and recycle a certain tonnage of packaging waste each year. The Regulations are aimed at encouraging businesses to recover value from packaging at the end of its life in line with the 'polluter pays' principle. Furthermore, they provide a cost incentive for obligated businesses. By reducing the quantity of packaging waste handled, a company can reduce its cost of compliance. Unfortunately, this is not always an improvement for the environment as the Regulations define a company's obligations on the basis of the weight rather than the environmental attributes of packaging used.

The EC Directive has imposed packaging recovery and recycling targets on member states. In the UK these targets are to recover between 50% and 65% of packaging waste and to recycle between 25% and 65% of packaging waste by 2001. The UK Government set interim recovery and recycling targets on an increasing scale to ensure that it meets the EC Directive targets by 2001 (Table 3.1).

**Table 3.1 The UK's Recovery and Recycling Targets**

<b>Year</b>	<b>Recovery Target</b>	<b>Recycling Target</b>
<b>1998</b>	<b>38%</b>	<b>7%</b>
<b>1999</b>	<b>43%</b>	<b>10%</b>
<b>2000</b>	<b>45%</b>	<b>13%</b>
<b>2001</b>	<b>52%</b>	<b>16%</b>

The Regulations place an obligation on businesses to recover and recycle specific tonnages of packaging waste materials that they handle in one year and to certify that this recovery and recycling has been carried out. The Regulations apply to companies that: carry out identified

activities within the packaging supply chain or have those activities carried out on their behalf by a third party; own the packaging on which these activities are carried out; supply to another in the packaging supply chain or to the end-user; handle more than 50 tonnes of packaging or packaging materials in a year; and had an annual turnover of at least £5m in the years 1997 to 1999 and at least £2m from 2000. The activities to which this refers are: raw material manufacturers of packaging; converters of packaging materials into packaging; packer/ fillers of products into packaging; and seller/ retailers of packaging to the end-user. Additional categories include importers, exporters and 'secondary producers' (a packer/ filler or seller/ retailer of secondary or tertiary packaging). Packaging can comprise of primary packaging (packaging in direct or immediate contact with products), secondary packaging (packaging surrounding a number of similar products), or tertiary packaging (outer transit packaging, e.g. pallets).

Packaging is defined as 'all products made of any materials to be used for the containment, protection, handling, delivery and presentation of goods, from raw materials to processed goods, from the producer to the user or the consumer'. Packaging materials are defined as 'materials used in the manufacture of packaging'. Packaging materials are listed in the Regulations to include paper/ cardboard, plastics, aluminium, steel and glass. Wood and other packaging were included for reporting purposes from the introduction of the Regulations but there is a requirement for companies to include wood in recovery obligations from the year 2000. Even though there will be no specific recycling target for wood packaging, wood recovery and recycling can be used to offset a company's overall recovery obligations.

Obligated businesses can choose whether to register individually with the appropriate Agency (EA or SEPA) or to register with a compliance (otherwise known as collective) scheme. Failure to register is an offence. The fees for companies registering with the EA or SEPA were £750 in 1997 and 1998 and were increased by 27% to £950 in 1999 (DETR, 1999b). Companies that register with collective schemes have to pay membership fees and administration charges in accordance with the scheme with which they register. At present the fee for joining a compliance scheme is calculated on the basis of the numbers of members in the particular scheme. Larger schemes being able to provide big discounts to their members are arguably unfair on smaller schemes that find it difficult to increase their

membership as a result (European and Packaging Waste Law, 2000). Therefore, this particular issue of compliance scheme fee structure is currently under consultation.

Part of the registration process is to provide data on packaging flows by material type throughout the obligated company for the previous year. Data requirements are extensive and include the quantities of packaging materials handled by weight and by the activities carried out on them. In 1997, the data submitted for 1996 had to be a 'reasonable estimate' of packaging handled, 1997 and 1998 data had to be submitted by 1 April of the following year. For 2000 data, the metrics have to be 'as accurate as possible' and submitted by 7 April 2001 (DETR, 1999b).

An obligated company must calculate its recovery and recycling obligations by first identifying the activity it performs on the packaging and then applying various activity percentage calculations to its data. Each activity is allocated a percentage figure under the Regulations. The activity percentages, extracted from the Regulations as amended (DETR, 1999b) are shown in Table 3.2 and are different for each stage of the packaging supply chain. So for example, a company whose main activity is making cardboard boxes, as a convertor, would have 10% responsibility on any packaging that it handles.

**Table 3.2 Activity Obligation Percentages**

<b>Activity</b>	<b>Obligation Percentages (1997-1999)</b>	<b>Obligation Percentages (2000-)</b>
<b>Raw material manufacturing</b>	6%	5%
<b>Converting</b>	11%	10%
<b>Packing/ filling</b>	36%	37%
<b>Selling/ retailing</b>	47%	48%
<b>Using transit packaging</b>	83%	85%
<b>Importing transit packaging</b>	100%	100%

The exceptions are if a company imports packaging on which it would have 100% responsibility or where it handles transit packaging on which it would have an 85% responsibility. Packaging that is exported is exempt from the Regulations as it is not entering

the UK waste stream and so carries no obligation. Some businesses may carry out more than a single activity on its packaging, for example it may repack products and sell them to an end-user in which case the packaging would carry both activity percentages on that packaging (37 + 48 = 85%).

Each obligated business must calculate the percentage of packaging that it must recover and the percentage of each material type that it must recycle using the following formulae:

Recovery obligation = [Obligated packaging handled] × [Activity obligation] × [UK recovery target]

Recycling obligation = [Obligated packaging handled] × [Activity obligation] × [UK recycling target]

The calculations are carried out on the quantity of packaging handled by the company in the previous year. The activity obligation is selected from the activity percentages given in Table 3.2 and from the reviewed (DETR, 1999a) recycling and recovery targets for the UK given in Table 3.1. Recovery refers to any recycling, energy recovery or composting activity and recycling refers to the reprocessing of waste materials for the original purpose or for other purposes. The recycling obligation is calculated for each packaging material type and forms part of the overall recovery obligation.

The final regulatory requirement is for obligated businesses and schemes to write to the relevant agency by 31 January following the end of the calendar year in which it is obligated, confirming that it has recovered and recycled the necessary tonnages of packaging waste. The Certificate of Compliance, as it is known, must be issued by an approved person, such as a company director or partner and should combine details of what the company's recovery and recycling obligations were in that year with a statement that the obligations have been fulfilled. This statement must be supported by evidence of compliance for which the most accepted form is 'Packaging Waste Recovery Notes' (PRNs). The PRN was primarily introduced to provide obligated businesses with a means of demonstrating compliance but they quickly had a commercial value attached to them. Packaging waste reprocessors need to be accredited by the EA or SEPA to issue PRNs for the amount of packaging waste that they

have recovered and recycled. Obligated businesses and compliance schemes can purchase PRNs from accredited reproducers in order to discharge their obligations. It is currently legitimate for a business or compliance scheme to provide PRNs as evidence of compliance that are not from the recovery and recycling of its own packaging waste.

### **3.4 Impact on ICL of the UK Packaging legislation**

#### ***3.4.1 Packaging Waste Audits***

ICL's first objective was to discover the quantity of packaging waste arising on its main sites in order to assess the amounts of packaging it could recycle. It was originally thought that this would enable the organisation to comply with the Packaging Waste Regulations before the Regulations came into force and PRNs were introduced as a means of compliance irrespective of the quantities of packaging recycled. Packaging measurement audits were carried out with the following objectives:

- To prevent or minimise any adverse impacts of the waste, i.e. pollution of land, air and/or water
- To ascertain the quantities and types of packaging waste and to identify possible packaging waste management strategies and means of compliance to the Packaging Waste Regulations.
- To identify possible strategies for the reduction of waste and associated costs from the Packaging Waste Regulations and the Landfill Tax.
- To identify the methods of waste production, handling, treatment, storage, and disposal in order to meet the Duty of Care provisions under the EPA 1990, in particular with regard to the prevention of fly tipping.

A methodology was drawn up by the author for the overall audit and was designed to include a measurement strategy. The methodology involved:

- Structured interviews of key staff using protocols.
- Observation of site activities
- Sampling and analysis of waste (detailed in 3.4.2)



Key issues considered included the environmental acceptability of processes and the maintenance of records including Special Waste transfer notes, the quantities of waste produced by sites, long-term waste storage and consignment notes which must be kept for 3 years. After the containment of waste had been assessed in terms of location and safety, the feasibility of waste segregation was considered. The objectives were to reduce costs, to meet legal requirements for packaging waste recycling and to minimise the risks from hazardous waste. In order to achieve efficient waste segregation staff awareness-raising and training requirements had to be addressed. In addition, written procedures were required along with the labelling of waste. The costs of waste disposal were investigated along with the types of waste materials that were already, or could be, reduced, reused, or recycled. Finally the types and quantities of the waste produced were measured in terms of paper/ cardboard, plastics, metals, glass and wood and an audit report was written (see Volume 2, Report no.2)

#### ***3.4.2 Measurement Process Development***

The main concern was to ensure that all procedures of waste sampling and weighing did not breach the requirements laid out in the EPA 1990 regarding Duty of Care. The second aspect considered was that of the weather conditions which defined the approach to sampling. Obviously, where the conditions were extreme, no sampling was carried out. It had to be taken into account that once waste was removed from the skips, it would be exposed to external factors of dampness etc. that would affect the measurement results. Furthermore, wet conditions create problems with sampling in addition to erroneously high results in that they can damage the material integrity and cause the creation of leachate. The locations of the drainage systems in the surrounding area were carefully assessed before any sampling was carried out. In addition, all sampling was carried out over plastic sheeting in order to prevent any run-off. Windy conditions can have two effects, namely odour problems and littering. Odour from any putrescibles or other waste material may be transported and affect other site personnel or members of the neighbouring public. This may cause a nuisance under part (d) of section 79 of the EPA 1990. The second effect is that during the process of sampling from the skip, extracted material may be transported away from the skip by windy conditions. This would be a breach of the Duty of Care and would be detrimental to the accuracy of the measurements carried out due to loss of sample.

Health and safety aspects were taken into account as regards notifying the responsible people of the timing of measurements and isolating compactors from the power supply. All those entering the skips wore protective clothing including masks, boiler suits and boots, and at any one time, one member of the team would remain outside the skip. The area around the skip was protected with a large plastic tarpaulin. The materials selected for sampling were collected in refuse sacks from inside the skip. This was because a bulk quantity of segregated waste is easier to weigh, as most of these materials are lightweight, and containment in a refuse sack prevented any wind-blown displacement.

Two of the main ICL sites were selected for waste audits, Stevenage and Warrington, as warehouse operations on the site typically produced substantial quantities of packaging waste. All of the skips on both sites were sampled in order to determine the total quantities of waste and the percentage composition of materials in the waste stream, particularly packaging. Skips were sampled the day before they were due to be collected and emptied. This meant that the skips were nearly full, and a relatively representative packaging waste sample could be taken. The skips' collection dates provided by the waste disposal sub-contractors were entered into a database, although in practice skips were collected only as required i.e. when full. Sampling therefore was often carried out at short notice so that measurements were consistently obtained from skips that were almost full thereby improving accuracy.

Any skip used for 'non-general' waste e.g. fluorescent light tubes or used as a recycling skip (for which data were already available) were not sampled. At Stevenage, there were eleven skips to be sampled, all approximately 25-30 ft in length, which posed a large problem in terms of the sheer size and quantities involved. It was decided, therefore, that one quarter of each skip should be sampled on three separate occasions. This was straightforward to do because each skip was measured and found to have separators that split the skip into four equally sized sections. In this way, the time spent measuring a skip could be kept to a minimum, thus causing minimum disruption to those using the skips, and at the same time any potential to breach the Duty of Care could be avoided. The time saved also meant that the measurements could be taken three times on a weekly basis providing results that could be extrapolated to give monthly or annual estimates.

Sampling from both large and small skips involved removing a portion of the packaging waste held in the skip using a black plastic bag to prevent any escape of the waste. The waste was separated into material type as it was collected, so that each bag contained only one type of waste. The material types weighed included card, metal, composites, paper, plastics and miscellaneous (unknown materials and wood). These packaging materials represented that packaging required by the legislation to be recovered and recycled. This segregation and collection scheme meant that reasonably large samples (considering the size of the skips and quantities of the waste to be accounted for) could be taken at any one time and weighed. The particular material type samples were then weighed on a set of recently calibrated post room type scales (i.e. 0.5 to 40 kilos). The difficulties gaining access for this type of waste measurement audit was highlighted by one particular skip that was highly compacted and only had a small one meter squared access point. After one unsuccessful attempt to take measurements from the skip, the sub-contractors were contacted and a request made for them to remove the compactor. The company raised concerns that any mishandling of the waste would make them liable under the Duty of Care. Corporate Environmental Affairs liaised with the Environment Agency in order to establish that the liability would in fact fall on ICL. Once the sub-contractors were assured of this, they removed the compactor and the measurements were made successfully. It turned out to be extremely useful in bringing to light the fact that the skip was being used for disposal of noncompliant waste.

It was clear that the waste review raised awareness amongst the staff and within about three weeks staff began to recycle more waste.

The precision of the weights taken was high in terms of reproducibility. The measurement method gave reasonably high resolution in terms of a monthly result, because the sampling was weekly. In addition, there was high reproducibility of results for the three occasions that each of the skips was measured. This indicated that the results were representative of the flow of waste over the month. However, the extrapolation of these data to an annual turnover gave a result of low resolution and a predictably high degree of error. Results were limited by product line changes and fluctuations in business trade. A comparison made between the audit's annual figure and that of the figures provided by ICL's site facilities sub-contractor Workplace Management Limited (WML) showed a large discrepancy.

The purpose of the waste measurement review was to find out whether ICL could use its packaging waste to meet its obligations under the legislation. The high degree of error in the annual figure therefore is unimportant because the aim was only to determine a percentage distribution of packaging types and an estimate of packaging waste produced per year. The measurements enabled the identification of non-conformance waste and this explained the high costs of waste disposal at the site. ICL's legal obligations and the overall results of the waste measurement review are summarised in Table 3.3. A more detailed breakdown of the results of the Stevenage audit is contained in Volume 2, Report no. 2 Annex 2, and of the Warrington audit, in Volume 2, Report no. 3 Annex 2.

**Table 3.3 ICL's 1997 Packaging Recovery and Recycling Obligations and Packaging Waste Production (Tonnes)**

Material	Obligation	Waste		Balance
		Stevenage	Warrington	
Paper	Recycling 61.29	374.7	86.5	399.91
Plastic	Recycling 4.91	107.3	23.8	126.19
Steel	Recycling 0.34	0	0	- 0.34
General	Recovery 361.19	(399.91+126.19= 526.1)		164.91

The results clearly showed that ICL could easily meet its packaging obligations from the two sites, thus minimising the environmental impacts such as transport that would be required to collect packaging. Other savings would have included the costs of collecting packaging from customers had the PRN procurement process not been introduced.

### **3.4.3 Packaging Programmes**

In response to these results ICL purchased and installed several bailers at the two main sites. In addition to this, ICL purchased a special EPS compactor to be located at the Basingstoke site to recycle a large amount of plastics from one major project. The resulting blocks of compacted EPS are recycled into wood replacement products by a company on the Isle of Wight. There is a sorting process at the Stevenage site for waste cardboard packaging for which two large bailers have been purchased. The Stevenage site uses a waste management company that delivers both cardboard and plastics for recycling. A bailer was installed at the

Warrington site storing cardboard ready to be taken away for recycling by its waste management company. ICL HQ site in Slough bought a compactor for cardboard recycling in 1997 as part of its environmental campaign following environmental reviews of the site. ICL's Manchester site set up a relationship with its recycler whereby ICL purchases PRNs to offset its cardboard and paper recycling obligations. This means that the company is at least enabled to maintain some relationship between what it recycles and its legal obligations. Where ICL's reprocessors do not provide PRNs for any reason, or where the PRN prices being charged are unacceptably high, alternative arrangements with other accredited reprocessors are made.

In addition to these recycling activities, other environmental initiatives have been set up in the company in response to the Regulations. One particular ICL Division reduced its packaging waste by minimising the use of packaging and replacing packaging for components with reusable boxes. The custom-designed packaging incorporates a compartmentalised section for components and a larger section on top for the PC. In order to reduce the amount of plastic packaging used, airbags have been used to replace the bubble-wrap or polystyrene chips used to cushion the machines. Once the package has arrived on site, the products are removed and the packaging is reused as part of the asset recovery cycle. A second ICL division also introduced the airbag and ran a reduction programme which achieved considerable cost savings. Details of ICL's packaging compliance activities are given in Volume 2, Rep. 4, Appendix 1 & Rep. 7, Annex 2, Appendix 2.

### **3.5 Methodology for Compliance**

#### ***3.5.1 Reporting Processes***

Firstly, a company has to decide whether to join a compliance scheme or register directly with the Environment Agency. In 1998 there were thirteen compliance schemes registered in the UK: Biffpack, Cleanapack, Difpack, Jempac, Paper Collect, Paperpak Ltd., Pennine-pack, Properpak Ltd., Recycle UK, SWS, Valpak, Wastepack, and Wespak (1999d). Valpak, Biffpak (set up by Biffa) Cleanapack (set up by Cleanaway Ltd.) and Wastepack (set up by UK Waste) are open to all companies obligated under the Regulations regardless of what type of packaging they handle. The Dairy Industry Federation set up Difpak for the Dairy industry

and Paperpak Ltd. was set up for the Paper industry. Additional schemes that have been set up are Firpac and Onyxpak.

Compliance schemes carry their member's legal liability for them, providing a safer route that 80% of companies opted for in 1999. However, there are a growing number of companies that are moving away from compliance scheme membership in favour of individual registration (Gaffney, 2000). It is debatable as to whether joining a compliance scheme actually diminishes a company's incentive to set up recovery and recycling programmes for packaging waste. This is due to the fact that compliance schemes provide easily accessible means with which to certify recovery and recycling, independently of any actual recycling activity being carried out by the company. In addition, businesses that join a compliance scheme still have to provide the extensive data required by the Regulations. Companies that take improving their environmental performance more seriously are arguably more likely to take the individual compliance route. For example, The Body Shop is recognised for achieving a high level of environmental performance and they have registered individually with the EA.

As the Regulations treat groups as a single entity when applying the threshold tests, groups of companies do well to coordinate their efforts. The stages a company must go through in order to achieve compliance begin with defining what exactly constitutes packaging and scoping the organisation's operational divisions in order to identify which areas of the business, or subsidiaries should report packaging data in to the central/ corporate area of the company or in to the main responsible person(s). The corporate strategy within many large organisations has been to coordinate the compliance of identified business units or subsidiaries through to environmental departments. The Regulations allow for subsidiaries above the threshold test to seek to comply individually, with the obligations of the smaller operations reverting to the holding company. This option in many cases would not decrease the workload on companies or reap any of the benefits associated with a more centralised approach such as:

- Prevention of the duplication of effort
- Prevention of 'double counting' (packaging may be shifted between business units and counted more than once)
- Prevention of the omission of any packaging from the final data returns

- Maximisation of any collaborative efforts in the pursuit of minimising compliance costs
- Maximisation of the potential for environmental innovations between the business units.

For many large organisations some of the divisions operate as autonomous business units and the structure of the reporting and management system required has to be developed with this requirement in mind. Each business unit needs to undergo some form of training in order to introduce the Regulations and explain the necessary compliance activities. Each business unit also needs to have a representative to act as the focal point for all issues regarding the Regulations and to make the data returns to the centralised area of the business. The representatives form a network within the business facilitating the transfer of information within the group. It is the responsibility of the senior manager, usually the environment manager, to support the business representatives in all issues including the customer/ supplier information requests and to work with their opposite numbers in sister companies where appropriate.

### ***3.5.2 Data Collection and the Calculations***

For accurate data collection, interpretation of the Regulations' definition of packaging must be understood. To this end, the Environment Agency has produced guidelines to help companies in making the assessment of borderline cases and has issued statements on others types of packaging e.g. plastic vending cups are classed as packaging. Although advice can be sought and guidelines followed as closely as possible, in the end the responsibility of the company to make decisions about the products they handle and what constitutes packaging or non-packaging on the basis of defensible reasoning.

Collection of data must be for the previous year, so companies due to register or re-register in the year 2001 are currently collecting data over the year 2000. For the majority of companies this was a new experience as packaging metrics are usually in terms of unit production and cost not weight by material type. Unlike the larger companies that registered in 1997 and could begin by producing estimates, companies below the threshold that are to register this year have to produce data that are as accurate as possible and are not simply estimates.

The types of data collection systems adopted are usually based on the type and size of operation in the particular business division and the information systems that it has in place

for storing product-related data. Where good information systems exist for warehousing or manufacturing operations it is often possible to calculate comprehensively the packaging handled by multiplying product weights by annual sales and shipping information. For more service-based operations, where product-packaging data are unknown, companies have sought information from suppliers. The usual outcome is a poor response rate from the suppliers and often inaccuracies in the small amount of data provided. The solution to the problem of unknown weights has been to sample physically the packaging but as many companies have large numbers of product lines that are changing all the time this can be an extremely time-consuming and resource-intensive task. Where operations handle large numbers of product lines a common approach adopted has been to assign various product lines with a set of generic packaging weights. These generic packaging weights have then been multiplied by annual sales and shipping information. Ready-reckoners, produced by the DETR and by companies and industry groups, were used as a much cruder version of this technique and as an interim measure when the Regulations were introduced. Ready-reckoners are no longer an acceptable means with which to calculate a company's obligations.

It is advisable at this stage to obtain or develop an information system that will calculate the company's obligation. A template of a spreadsheet that has been designed as part of this work to calculate a company's obligations and can be applied to any obligated company is shown in Table 3.4. The spreadsheet comprises of columns of material type (D-J) expressed as one of four data entry sections: packaging supplied (total packaging handled in previous year); packaging exported; packaging exported by a 3<sup>rd</sup> party; and imported packaging (including transit packaging). The final section contains the formulae necessary for the spreadsheet calculations to yield the company's obligations. All the fields which have a cell location entry (e.g. D4 to J7) are data entry cells. The important point to note is that where two activities are carried out on a certain tonnage of packaging, that tonnage should be entered in both fields, i.e. if 50 tonnes of cardboard packaging is used to repack product and is sold on to an end-user then 50 should be entered in both D6 and D7.

There follows a worked example using hypothetical data to show how the spreadsheet calculates the recovery and recycling obligations. The template is a close representation of the data forms to be submitted to the EA, SEPA or Collective Scheme, as required by the



**Table 3.4 Spreadsheet Details for Obligation Calculations**

A1	B	C	D	E	F	G	H	I	J
2	Table Name	Activity	Paper	Glass	Aluminium	Steel	Plastic	Wood	Other
3	Packaging supplied								
4		Manufacturer	D4	E4	F4	G4	H4	I4	J4
5		Converter	D5	E5	F5	G5	H5	I5	J5
6		Packer/filler	D6	E6	F6	G6	H6	I6	J6
7		Seller	D7	E7	F7	G7	H7	I7	J7
8	Packaging Exported								
9		Manufacturer	D9	E9	F9	G9	H9	I9	J9
10		Converter	D10	E10	F10	G10	H10	I10	J10
11		Packer/filler	D11	E11	F11	G11	H11	I11	J11
12		Seller	D12	E12	F12	G12	H12	I12	J12
13	Packaging Exported by 3 <sup>rd</sup> Party								
14		Manufacturer	D14	E14	F14	G14	H14	I14	J14
15		Converter	D15	E15	F15	G15	H15	I15	J15
16		Packer/filler	D16	E16	F16	G16	H16	I16	J16
17		Seller	D17	E17	F17	G17	H17	I17	J17
18	Packaging Imported								
19		Manufacturer	D19	E19	F19	G19	H19	I19	J19
20		Converter	D20	E20	F20	G20	H20	I20	J20
21		Packer/filler	D21	E21	F21	G21	H21	I21	J21
22		Seller	D22	E22	F22	G22	H22	I22	J22
23		Transit Packaging	D23	E23	F23	G23	H23	I23	J23
24	Calculations								
25		Activity Obligation	$=(D4-(D9+D14)) \times 0.05 + (D5-(D10+D15)) \times 0.1 + (D6-(D11+D16)) \times 0.37 + (D7-(D12+D17)) \times 0.48$	$=(E4-(E9+E14)) \times 0.05 + (E5-(E10+E15)) \times 0.1 + (E6-(E11+E16)) \times 0.37 + (E7-(E12+E17)) \times 0.48$	$=(F4-(F9+F14)) \times 0.05 + (F5-(F10+F15)) \times 0.1 + (F6-(F11+F16)) \times 0.37 + (F7-(F12+F17)) \times 0.48$	$=(G4-(G9+G14)) \times 0.05 + (G5-(G10+G15)) \times 0.1 + (G6-(G11+G16)) \times 0.37 + (G7-(G12+G17)) \times 0.48$	$=(H4-(H9+H14)) \times 0.05 + (H5-(H10+H15)) \times 0.1 + (H6-(H11+H16)) \times 0.37 + (H7-(H12+H17)) \times 0.48$	$=(I4-(I9+I14)) \times 0.05 + (I5-(I10+I15)) \times 0.1 + (I6-(I11+I16)) \times 0.37 + (I7-(I12+I17)) \times 0.48$	$=(J4-(J9+J14)) \times 0.05 + (J5-(J10+J15)) \times 0.1 + (J6-(J11+J16)) \times 0.37 + (J7-(J12+J17)) \times 0.48$
26		Roll-up on Import Obligation	$=(D20 \times 0.05) + (D21 \times 0.15) + (D22 \times 0.52) + D23$	$=(E20 \times 0.05) + (E21 \times 0.15) + (E22 \times 0.52) + E23$	$=(F20 \times 0.05) + (F21 \times 0.15) + (F22 \times 0.52) + F23$	$=(G20 \times 0.05) + (G21 \times 0.15) + (G22 \times 0.52) + G23$	$=(H20 \times 0.05) + (H21 \times 0.15) + (H22 \times 0.52) + H23$	$=(I20 \times 0.05) + (I21 \times 0.15) + (I22 \times 0.52) + I23$	$=(J20 \times 0.05) + (J21 \times 0.15) + (J22 \times 0.52) + J23$
27		Recovery Obligations	$=SUM(D25:D26) \times 0.45$	$=SUM(E25:E26) \times 0.45$	$=SUM(F25:F26) \times 0.45$	$=SUM(G25:G26) \times 0.45$	$=SUM(H25:H26) \times 0.45$	$=SUM(I25:I26) \times 0.45$	$=SUM(J25:J26) \times 0.45$
28		Recycling Obligations	$=SUM(D25:D26) \times 0.13$	$=SUM(E25:E26) \times 0.13$	$=SUM(F25:F26) \times 0.13$	$=SUM(G25:G26) \times 0.13$	$=SUM(H25:H26) \times 0.13$	$=SUM(I25:I26) \times 0.13$	$=SUM(J25:J26) \times 0.13$

Regulations. Therefore, once the spreadsheet has been input, the data are easily transferable to the requisite pro formas.

### ***Illustration of Worked Example***

If a company:

- manufactures and converts 23,000 tonnes plastic packaging;
- manufactures 2,000 tonnes plastic packaging without converting it, of which 1500 tonnes is exported;
- pack/fills and retail/sells 1000 tonnes wood, i.e. transit packaging;
- imports 45 tonnes cardboard and 10 tonnes wood packaging for converting;
- and imports 20 tonnes glass for filling

Then each of the following cells would be input as follows:

Table: Packaging Supplied

H4 = 2,000 + 23,000 (plastic manufactured)

H5 = 23,000 (plastic converted)

I6 = 1000 (wood pack/filled)

I7 = 1000 (wood retail/sold)

D5 = 45 tonnes (imported cardboard converted)

I5 = 10 (imported wood converted)

E6 = 20 (imported glass filled)

Table: Packaging Exported

H9 = 1500 (plastic manufactured for export)

Table: Packaging Imported

D20 = 45 (imported cardboard converted)

I20 = 10 (imported wood converted)

E21 = 20 (imported glass filled)

The manual calculation would be:

Recycling obligation for plastic =  $(((\text{tonnage supplied} - \text{tonnage exported}) \times \text{manufacturer activity obligation}) + (\text{tonnage supplied} \times \text{converter activity obligation})) \times \text{recycling obligation}$   
 $= (((25000 - 1500) \times 0.05) + (23000 \times 0.1)) \times 0.13 = 3475 \times 0.13 = 452 \text{ tonnes}$

Recycling obligation for cardboard =  $[(\text{tonnage supplied} \times \text{converter activity obligation}) + (\text{tonnage imported} \times \text{manufacturer activity obligation})] \times \text{recycling obligation} = [(45 \times 0.1) + (45 \times 0.05)] \times 0.13 = 6.75 \times 0.13 = 1 \text{ tonne}$

Recycling obligation for glass =  $[(\text{tonnage supplied} \times \text{packer/filler activity obligation}) + (\text{tonnage imported} \times (\text{converter activity obligation} + \text{manufacturer activity obligation}))] \times \text{recycling obligation} = [(20 \times 0.37) + (20 \times (0.1 + 0.05))] \times 0.13 = 10.4 \times 0.13 = 1 \text{ tonne}$

Recycling obligation for wood =  $[(\text{tonnage supplied} \times \text{converter activity obligation}) + (\text{tonnage supplied} \times \text{packer/filler activity obligation}) + (\text{tonnage supplied} \times \text{retailer obligation})] \times \text{recycling obligation} = [(10 \times 0.1) + (10 \times 0.37) + (10 \times 0.48) + (10 \times 0.05)] \times 0.13 = 10 \times 0.13 = 1 \text{ tonne}$

The recovery obligations are calculated in exactly the same way except that the recycling obligation of 0.13 is replaced by the recovery obligation of 0.45.

Overall recovery obligation =  $\sum \text{Individual recovery obligations} = 1564 + 3 + 4.5 + 4.5 = 1576 \text{ tonnes}$

This means the company will need to purchase PRNs or PERNs for 452 tonnes plastic, 1 tonne card, 1 tonne glass, and 1 tonne of wood. The remaining recovery obligation of 1121 tonnes  $(1576 - (452+1+1+1))$  can be covered by purchasing PRNs/ PERNs for any material type or energy from waste.

There are some common areas where erroneous data can occur and they include:

- data from suppliers that can be difficult to check
- incorrect use of units (a common error in any data collection process)
- the inclusion of packaging consumed and wastage (as an end-user of the packaging a company carries no obligation for it)
- the exclusion of importing obligation where using agents (as owners of the packaging a company carries an importers obligation on the packaging)
- the exclusion of secondary activity obligations (e.g. as sellers of products that are repacked a company picks up responsibility for both pack/ filling and selling)

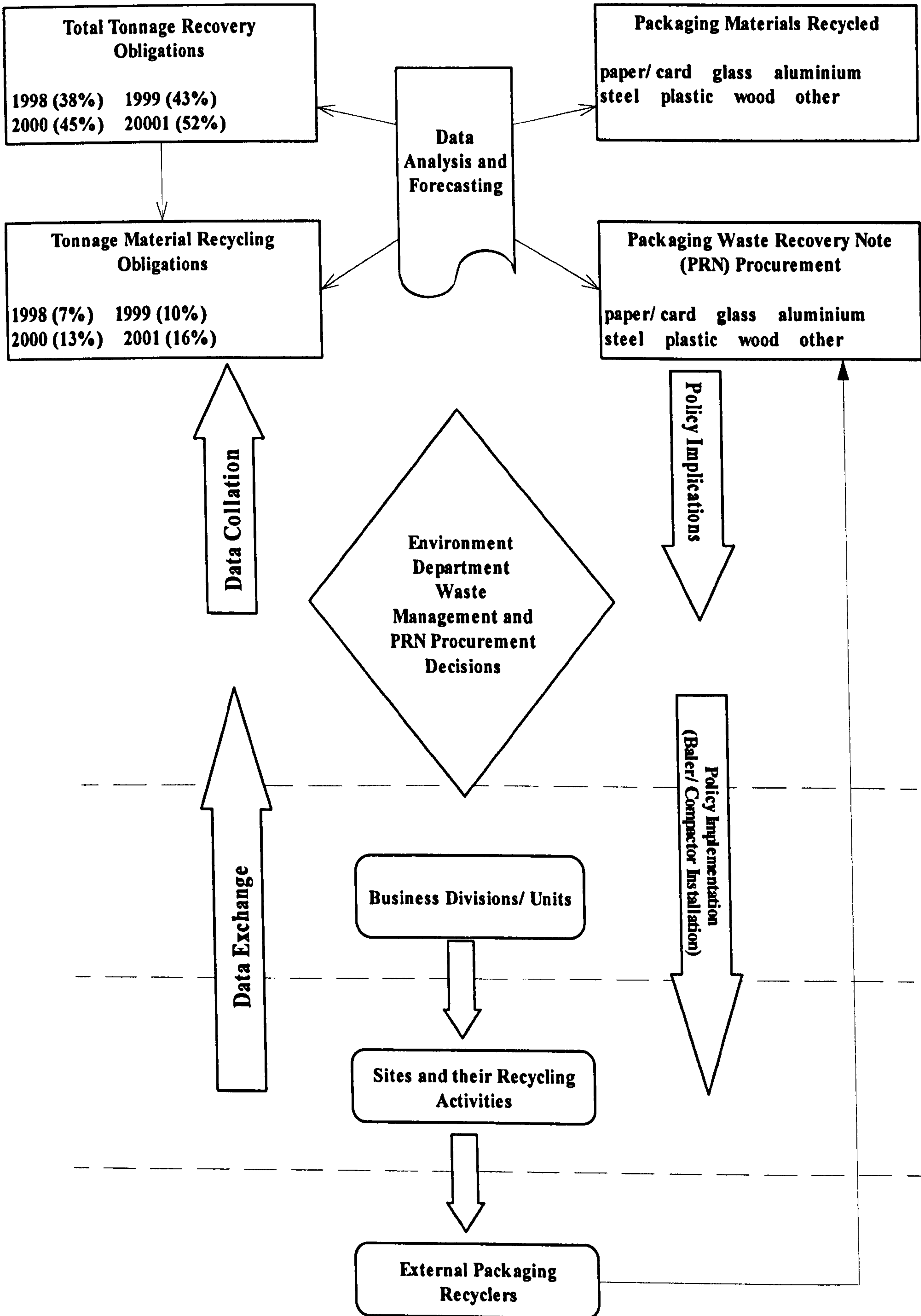
- the exclusion of packaging supplied to 3<sup>rd</sup> party exporters under the threshold test (this data is difficult to obtain)
- the exclusion of reused packaging (this is difficult to prove and should be included if in doubt)
- the use of out-of-date information (often where data is difficult to obtain)
- the inclusion of warehousing data which has been taken out of the Regulations

The best way to ensure accuracy of the data collected is to carry out internal audits to scrutinise the data being produced and to document all procedures and processes used to facilitate this process. The Environment Agency will be continuing to audit obligated companies and a company needs to be able to show that its data are as accurate as possible.

### ***3.5.3 Driving Environmental Performance***

It is currently the case that although PRNs derived from the recovery of a company's waste can be used to offset a company's obligations, reprocessors expect to receive part or all of the market value of the PRN. However, it is unlikely that this will remain the case when considering the planned target rises and the possible abolition of the 'value-added' PRN. This is explained in more depth in Section 3.6. Increasingly companies may plan to recycle their packaging waste, relate this to securing PRNs and implement the necessary systems (Figure 3.1). The initial stage should be to assess the amount of packaging waste produced at various sites and this can be achieved through a waste measurement audit. Once this has been carried out balers and compactors can be installed at the appropriate locations for the specific materials to be recycled (for example, a site producing mainly expanded polystyrene will need different equipment from a site producing mainly cardboard). Joining collection schemes such as the Save a Cup plastic vending cup recycling scheme can provide useful options for environmentally sound recycling.

Figure 3.1 Packaging Recycling and PRN Procurement System



As a company's obligations are based on the weight of packaging it uses, it is beneficial to identify and implement strategies for the minimisation of packaging usage. In addition, it may be beneficial for companies to replace certain heavy forms of packaging with lighter ones but only if they provide the more environmentally sound option. The Packaging (Essential Requirements) Regulations 1998 requires that companies minimise the pack weight and volume to maintain safety, hygiene and consumer acceptance, once the appropriate system has been chosen (DETR, 1999c). Choosing a system without regard for environmental considerations would not be acceptable.

Although there is no requirement under the Regulations to do so, companies should still endeavour to develop policies to purchase packaging that contains recycle material as part of their environmental programmes. However, an incentive may develop as the demand for PRNs increases and the market for end-use materials softens. In theory, the price of recycle is likely to fall significantly and should pose a low cost alternative to virgin packaging materials.

### **3.6 Current Developments and Future Policy Implications**

Data on the numbers of obligated companies are vague, the number has been reported to have apparently risen sharply from 3400 in 1996 (DETR, 1998b) to 9020 in 1998 (DETR, 1999d). The number of registrations was 4011 in 1998 (DETR, 1999d) rising to 4250 in 1999 (Gaffney, 2000). In 2000, the Regulations have reduced the threshold test for obligated businesses down from at least £5m turnover and over 50 tonnes packaging waste handled to at least £2m turnover and over 50 tonnes packaging handled. As of 4 April 2000 the Environment Agency had received 590 new registration requests for application forms; the majority of which represent new businesses of between £2m and £5m turnover (although some of these new registrants may be companies moving from compliance schemes to individual compliance or even businesses that should have been registered already). This figure is substantially lower than the DETR estimate of the additional number of businesses likely to be obligated in 2000, with threshold tests of over £2m/ 50 tonnes, being between 1,870 and 4,230 (DETR, 1999e).

It is clear that industries' response to the Regulations has been that of universal criticism and a lack of compliance. By April 2000 there had been 8 prosecutions under the Regulations. Businesses that have failed to register have faced fines of up to £10,000 plus costs (Gaffney, 2000). From 2000 the Regulations require that data provided to the Environment Agency should be as accurate as is reasonably possible. In 1998, the Environment Agency calculated that approximately 80% of companies had incorrectly calculated their obligations and, in addition, had under-reported by an average of 15%. The main problem areas have been identified as being where companies did not take account of imports or where packer/fillers failed to pick up the seller obligation on transit packaging (European and Packaging Waste Law, 2000). The Environment Agency has sent a clear message to obligated business to expect rigorous auditing in the year 2000.

There are real concerns that the UK is not on course to meet the EC Directive national target of 50% by the end of 2001. Estimates of the recovery rate in 1999 were much lower than expected at between 36% and 37% although the recycling target of 25% has already been reached (McKinley, 2000). After the DETR has assessed the packaging data for 1999, the 2001 targets are expected to be increased further in order that the UK can meet the EU targets. The Environment Agency is pushing for a 60% recovery obligation in order to cover those companies that are exempt (European and Packaging Waste Law, 2000). In addition, the European Directive on Packaging and Packaging Waste is currently under review and it is likely that targets will rise in 2002.

In the summer of 1999, the UK reported packaging arisings and recycling data for 1997 to the European Commission (as the EC requires all member states to report this information). It estimated that 7.75 million tonnes of packaging was placed on the market in that year, based on the data submitted to the Environment Agency by obligated companies and compliance schemes and the inclusion of an extra 10% to cover those businesses that are exempt because they fall below the threshold test. However, a further report from the DETR based on estimates from the packaging Material Organisations (MOs) and compliance schemes, at around 10.24 million tonnes (ENDS, 1999). There is no way of knowing where this gap of 2.5 million tonnes is coming from although there are two possible causes. One is that there may still be a number of companies that have not registered that should have done so by now

and the second is that it is likely that the shortfall reflects the packaging that is far more difficult to account for.

Two new requirements were introduced under the second set of amendments to the Regulations (1999b). The first requires sellers to provide the necessary information to users of packaging about the methods of reuse, recovery and recycling of packaging and packaging waste. This provision was introduced to implement Article 13 of the European Directive. The second permits producers that are using reusable packaging to spread their obligations over four years. The difficulty here for producers is that reuse is extremely difficult to prove. Furthermore, the fact that the Regulations encourage companies to switch to lighter materials means that reuse is often the least preferred option. For example, a chemicals' producer may be able to use glass jars for transporting its liquids within cardboard boxes or a lighter alternative of polystyrene that is more efficient in "drop tests". Although the more environmental option may be to use glass bottles that can be reused and cardboard that has a lower environmental impact on disposal, the company is far more likely to use polystyrene because it is cheaper under the Regulations to do so.

In addition to these changes the amendments to the Regulations included the requirement for obligated companies to use the simplified data form produced by the Environment Agency and for the Environment Agency to publish details of its monitoring policy from 2000 onwards. Finally, the complex wholesaler obligation, whereby producers that sold to exempt sellers (i.e. those below the threshold test) picked up the seller obligation, has been removed.

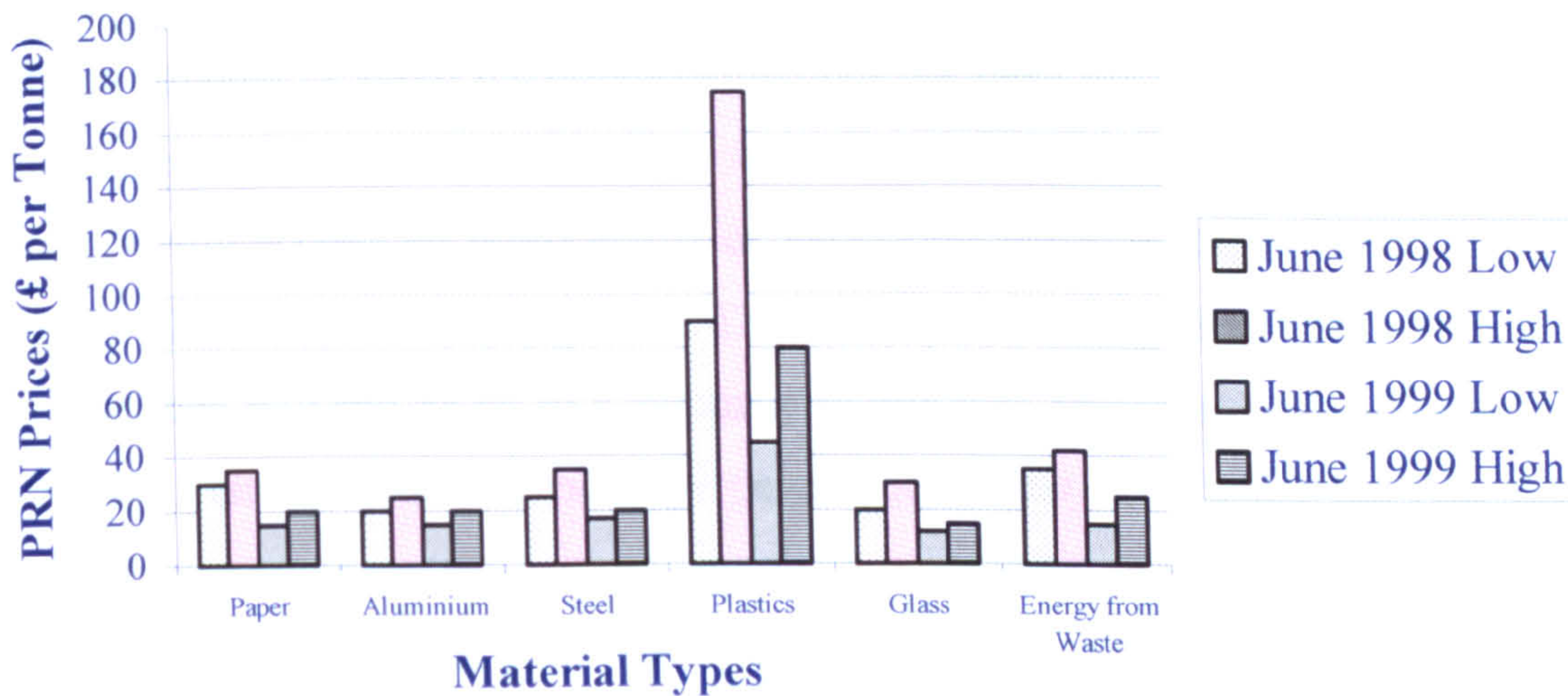
The Environment Agency has issued its second set of statutory guidelines (in respect of evidence only) for accredited reprocessors. Within the new guidelines, reprocessors are to issue PRNs only to obligated producers, compliance schemes and their agents and to provide them with first refusal on PRNs on their packaging waste. These measures are necessary to protect those making the effort to collect and recycle their packaging waste. Furthermore, reprocessors must now submit an annual return regarding the investment of PRN revenue. This has been a key factor in addressing the concerns voiced by industry that reprocessors were using PRN revenue to make windfall profits instead of investing in reprocessing infrastructure, and calls for greater transparency in the PRN market. The PRN/ PERN (Packaging waste Export Recovery Note) Revenue Account is to identify the percentage



PRN/ PERN revenue spent or future predicted expenditure on increasing capacity, supporting the collection infrastructure and developing the market for recyclates. Carried-over PRNs at year-end are to be retained by the Environment Agency and PRNs cannot be shared. Neither can PRNs be split beyond 31 January each year.

The market for tradable permits, PRNs, has been depressed due to the under-reporting and lack of compliance by many companies. It may also have been due to an underestimate of the original amount of recycling that had been taking place and the subsequent introduction of targets that were too low. Whatever the reasons for the low PRN prices it has had two main impacts. The first has been that the low PRN prices (Figure 3.2), in combination with the fact that prices have been erratic, has led to a lack of investment in the necessary recovery and recycling infrastructure. Some reprocessors that have tried to plan and invest in new equipment etc. have gone out of business as a result of the unpredictability of the market. This has led in turn to the concerns over whether the UK will be able to meet the European targets in 2001. The UK Government has tried to address this issue through the introduction of a requirement on businesses, with a turnover of at least £5m and that have individually registered with the EA or SEPA, to produce a compliance plan (DETR, 1999b). The compliance plan is to outline the company's plans for PRN procurement along with any relationships that it has set up with reprocessors. The second impact of depressed PRN prices has been that obligated companies have lacked the incentive to recover and recycle packaging waste because of the more cost-effective alternative of disposal to landfill.

**Figure 3.2 The Range of PRN Prices**



Adapted from DETR, 1999e

The PRN system is currently under consultation to address several issues: firstly, to examine whether the PRN system should be separated out from the reprocessor accreditation scheme; secondly, to examine whether value should be attached to the waste rather than the PRN (so PRNs would have no value attached to them other than the cost of their administration). The latter is certainly the view of the Environment Agency who introduced PRNs along the same lines as waste transfer notes (Gaffney, 2000). Support for this is also voiced by members of the waste management industry who have highlighted the distortions in recycle markets. Where packaging waste recycling has increased there has been a fall in the recycling of other materials such as newspapers (Conran, 2000). This substitution effect would not be of real concern if it were not for the fact that the tradable permit system has led to the subsidy of possibly less economically viable recycle markets at the expense of more viable ones. The third issue to be examined in the consultation process is whether PRNs should be more closely associated with the waste. However, even if these changes are found to be advantageous, they are unlikely to be implemented before 2001 because of the possibility that the disruption would interfere with reaching the EC Directive's recovery and recycling targets.

With these increasing pressures, the challenge for obligated UK businesses is to minimise compliance costs, maximise control as the PRN market toughens and to extract value from

their own packaging waste. One way in which a company can minimise costs whilst maximising control is to be aware of its packaging waste in terms of quantities and devise plans for recycling packaging waste in case there is a future scenario where PRNs are related to packaging handled. Even if the organisation does not have the luxury of producing its own packaging waste, it can achieve some degree of control by setting up contractual arrangements with accredited reprocessors of packaging waste whereby it can ensure that it can purchase PRNs when and as required. The fact that the reprocessors have some degree of certainty that they will sell PRNs to a company in this way should enable a more stable price to be offered in return. The methodology developed in this work using the ICL case study exemplifies how a company can not only go about complying with the Regulations in a cost-effective way but can channel its valuable resources into environmental programmes. The Packaging Regulations do hinder a company's ability to run effective environmental programmes at the present time, mostly because it is more cost-effective for a company to buy PRNs and landfill its packaging waste. This highlights the fact that, at the present time, the Regulations are providing little benefit to the environment other than to raise awareness of packaging waste as an issue. Regulatory compliance is so complex that the drain on resources is currently hindering environmentally conscious companies from investing in their environmental programmes. The financial pressure is driving money out of companies that could, for example, be running reduction, reuse and minimisation programmes and pushing it into the recycling industry, from which there is no evidence of increasing capacity. In addition, there is no guarantee that there will be a market for the large quantities of recyclates that will be generated. The detrimental effects on the virgin material producers have not been considered, two particular sectors being that of paper manufacturers who have been exceptionally active in improving their environmental performance, and forestry which is working towards sustainable production. Recycling is only one of many environmental solutions to the problem of waste and should form part of a packaging waste strategy. Only organisations that produce and use packaging have the control to develop holistic packaging waste strategies and the Regulations are exerting a strain on their ability to do this.

### **3.7 Discussion**

The widespread criticism regarding the complexity of the Regulations is demonstrably well founded. However, the Regulations were designed on the basis of the request by UK industry

for the responsibility to be shared throughout the packaging supply chain. The lesson perhaps to be learned by all parties is not to confuse financial burden with legal obligations. The result of the complexity of the Regulations has been high compliance costs to industry, not from PRN procurement or the costs of direct recovery and recycling of packaging waste but from the training of staff, the development of existing and/or the implementation of new information systems, and the manpower required to collect data and determine what the recovery obligations should be.

Although there are opportunities for deliberate miscalculation, the majority of companies that have been shown to do the right thing by registering under the Regulations are far more likely to be simply unable to produce accurate data. The opportunity for errors is vast and virtually untraceable for companies themselves let alone the enforcement agencies. The most serious result of this could be prosecutions that are based on the misinterpretation of 'unfeasibility' for 'excuses' by enforcement agencies and poses a real challenge for the agencies' discretion. One solution might be for further regulation that would require bar-coding of packaging by converters. This would go a long way to solving the problem of primary data collection by companies for populating information systems or manual calculations because it would save the current necessity for extensive weighing programmes. However, even this has its limitations in terms of traceability where, for example, a package containing fifty smaller packs is opened and repacked in a different configuration for shipping.

The UK Regulations are in direct contrast to most EU Member States where the legal responsibility lies with those companies specifying and placing packaging on the market. This approach may not be as fair as the UK's approach but it is a great deal simpler for companies to manage and for governments to enforce. In addition, placing the obligation on those that specify and put packaging on the market is advantageous because they have the most direct access to packaging waste and the greatest opportunity for minimisation and substitution.

At present, the fact that a PRN has a value to it means that those companies that handle a lot of packaging but have no access to packaging waste (because they themselves produce negligible amounts of packaging waste, if any at all) can purchase PRNs and thereby discharge their obligations. The difference between the tradeable permit system in the US for

air pollutants and the PRN system for packaging waste is that in the PRN system there is no direct connection between the permit and the polluter and no 'credits' for environmental protection efforts. If the cost of PRNs were to reflect only an administration charge when issued to the supplier of packaging waste then this would act as a real incentive for companies that produce packaging waste to recover and recycle it. However, it would be more difficult and possibly more costly for companies with no packaging waste to obtain PRNs. This downside of the PRN modification is far outweighed by the positive incentive on companies to recycle packaging waste. It would lead to a greater availability of packaging waste for recyclers in general and would offset the higher costs of PRNs expected by those without packaging waste in the longer term. The dilemma of whether to attach a value to PRNs or the waste recovered and recycled is complicated by the shared producer responsibility approach. Had the responsibility been put on the specifiers and placers of packaging onto the market then the tradeable permit system would have been far more straightforward. This is the case in other European member states where the approach may be less equitable but at least it does not suffer from the unwieldiness of the UK system. As to whether the single market point approach applied in other member states is actually perceived to be less equitable within those countries, in practice, is questionable. Without empirical data a survey is necessary in order to assess this. Furthermore, the UK Government and the European Union are both considering implementing a financing structure based on the PRN or tradeable permit system for the implementation of legislation concerning waste from electrical and electronic equipment. Industry is currently voicing severe misgivings over this approach. What can be learned from the PRN system is that much greater control would be necessary for ERNs to be effective. Integral to this is that a clear connection should be made between the ERN and recycling efforts in order to provide incentive. In addition, the necessary extended producer responsibility approach for integrating with an ERN financing system would need to be defined.

The question here is how can shared producer responsibility and environmental protection be compatible in a free market? Shared producer responsibility is a strongly appealing ideal that is in line with the polluter pays principle, however, it needs to be tempered with and to be treated with lower priority than achieving the objectives of environmental protection. Whatever solution the answer to this compatibility question provides, it is unlikely that any radical changes will be made to the Regulations in such close proximity to the EU recovery

and recycling targets. The Regulations are generally based on a sound ideology that was poorly thought through before introduction. Rushed timing after prolonged industry consultation may be partially to blame but it is possible that it was simply difficult to predict the problems that would arise, such as the evolution of the PRN. Now that the Regulations are in force it is clear that refinement is needed and that the modification to the PRN may necessitate certain exemption or lowering of obligations for those that have little or no access to packaging waste. In addition, the Regulations may be 'a pragmatic and cost-conscious policy which requires minimal state intervention' (Bailey, 1999) but it is an expensive and complex Regulation for industry. Such inefficiency caused by the Regulations ultimately causes higher costs that are passed on to the consumer.

Finally, where economic theory emphasises the efficiency gains to be had by the internalisation of environmental costs it says very little about why externalities exist (Lifset, 1992) and how organisations that have in the past externalised such costs can be convinced to take responsibility for them and for environmental protection as a whole. Regulations can be an important driver for environmental protection and can ensure that the polluter pays for environmental protection but how that environmental protection can best be achieved is in many cases better achieved by voluntary approaches.

## Chapter 4

Packaging as an Industry-Wide EPI  
– UK Packaging Compliance Scheme Survey

## CHAPTER 4

### PACKAGING AS AN INDUSTRY-WIDE EPI - UK PACKAGING COMPLIANCE SCHEME SURVEY

#### *Summary*

*This chapter presents a survey analysis of the key factors that could determine the effects of the recent packaging legislation on UK companies' environmental performance. The packaging legislation has been the first type of environmental legislation to affect all producers of product and services and has marked a turning point in the regulation of industries' environmental impacts. It is in this context that a national survey of companies, registered under the UK Packaging Waste Regulations, was carried out in order to gain insight into the effects of the regulations on their environmental performance. Furthermore, the study examines environmental performance measures with respect to packaging and the impact of the regulations on the introduction of packaging-related measures. A company can currently comply with the UK Packaging Waste Regulations by registering with the appropriate agency, either the Environment Agency (EA) or the Scottish Environmental Protection Agency (SEPA), or it can join a compliance scheme. This study has looked at the possible relationship between a company's choice of registration route and its environmental performance. The main outcome measures were: the perceptions of respondents on the Regulation's effects; the packaging measures employed; waste produced; packaging consumed/ handled, recycled, and reused; non-packaging recycled; energy consumed; and environmental policy and management status.*



## 4.1 Introduction

This chapter presents a national survey analysis, primarily by questionnaire, of the key factors that may determine the effects of the recent packaging waste legislation on UK companies' environmental performance. Prior to packaging legislation being introduced, environmental legislation had focused on manufacturers who were perceived to be the heaviest polluters in industry. The packaging legislation, however, has been the first type of environmental legislation to affect all producers of product and services and has marked a turning point in the regulation of industries' environmental impacts. The effectiveness of recent producer responsibility legislation in reducing industries' environmental impacts has been the focus of much attention in recent years. The UK Packaging Waste Regulations has been the first producer responsibility legislation to be implemented in the UK. This study has assessed the effects of the Regulations on companies' environmental performance and has examined environmental performance measures with respect to packaging. In addition to evaluating the impact of the regulations on the introduction of packaging-related measure, the work has looked at the possible relationship between a company's choice of registration route and its environmental performance.

## 4.2 Methodology

Of the 3783 companies registered under the UK Packaging Waste Regulations in 1998, 1000 were randomly selected for receipt of a survey form. Under the UK Packaging Waste Regulations, a company can either register individually with the respective agency, the Environment Agency (EA) or Scottish Environmental Protection Agency (SEPA), or it can displace its legal liability by joining a collective scheme. Therefore, the sample was stratified to account for the 20 per cent of companies registered with the Environment Agency and 80 per cent registered with collective schemes. Using a formula for sampling, the sample size was calculated as follows:

$$n = \frac{NZ^2 * 0.25}{[D^2 * (N-1)] + [Z^2 * 0.25]}$$

Where n = sample size required

N = total population size (from EA database the total number of registered companies is 3783)

D = precision level (0.1)

Z = number of standard deviation units of the sampling distribution corresponding to the desired confidence level (for 90% confidence level Z = 1.64)

Hence:

$$n = \frac{3783 * 1.64^2 * 0.25}{[0.1^2 * (3782)] + [1.64^2 * 0.25]} = 66$$

Stratification of sample:

$$94 * 0.8 = 53$$

$$94 * 0.2 = 13$$

For an expected response rate of 7%:

$$\text{Sample size} = n / 0.07 = 942$$

Therefore, the total sample size was set at 1000, with the number of individually registered companies sampled being 200 and the number of compliance scheme registered companies sampled being 800. The sample was selected from the Environment Agency database by the random sampling method. This was achieved using the random sampler in Excel. Once the sample had been selected and a new database created, names and addresses of the sample were transported into a word document using mail merge. Each survey form was accompanied by a covering letter to the Environment Manager and a reply paid envelope was enclosed. The survey questionnaires can be seen in full in Volume 2 Report no.7, Annex 3 Appendix 1. The survey was divided into six sections as follows:

(1) Personal details:

*Job title*

*Level of authority: Chairman/CEO/MD etc., VP/Dir/Asst/Dep.Dir etc, senior management, Higher functional, functional, other.*

*Area of responsibility: Legal/ Finance, Human Resources, Public relations, Environment, IT/ systems, Sales/ Marketing, R&D, Production, Health and Safety, Distribution.*

(2) Company details:

*Registration status (EA or collective scheme) under the Packaging Waste Regulations and*

*name of Collective Scheme*

*Total number of employees: <1000, 1001-4999 or 5000+*

*Approximate turnover in 1999: <£1m, £1-5m, £5-100m, £100m-£1Bn or £1Bn+*

*Based on the following FTSE sector indices, the percentage of company's turnover in each sector to the nearest 10%:*

*Oil & Gas/ Mining/ Chemicals/ Construction & Building Materials/ Forestry & Paper/ Steel & Other Metals/ Aerospace & Defence/ Diversified Industrials/ Electronic & Electrical Equipment/ Engineering & Machinery/ Automobiles/ Household Goods & Textiles/ Beverages/ Food Producers & Processors/ Health/ Packaging/ Personal Care & Household Products/ Pharmaceuticals/ Tobacco/ Distributors/ General Retailers/ Leisure, Entertainment & Hotels/ Media and Photography/ Restaurants, Pubs & Breweries/ Support Services/ Transport/ Food and Drug/ Retailers/ Telecommunication Services/ Electricity/ Gas Distribution/ Water/ Banks/ Insurance/ Life Assurance/ Investment Companies/ Real Estate/ Speciality & Other Finance/ Information Technology Hardware/ Software & Computer Services*

### **(3) Environmental Measures**

*Quantity of waste sent to landfill: in 1996/ 1997/ 1998 and 1999*

*Year in which following measures were introduced:*

*Packaging Consumption/ Packaging Consumption by material type/ Packaging Reused/ Packaging Reused by material type/ Packaging Recycled/ Packaging Recycled by material type/ Packaging Recyclate Purchased or Used/ Packaging Recyclate Purchased or Used by material type*

*Measures introduced as a direct result of the Packaging Waste Regulations: yes or no for each measure*

*Quantity of packaging handled: paper/card, plastics, metal, wood, other in 1996/ 1997/ 1998 and 1999*

*Quantity of packaging recycled: paper/card, plastics, metal, wood, other in 1996/ 1997/ 1998 and 1999*

*Quantity of packaging containing recycled material purchased and/ or used: 1996/ 1997/ 1998 and 1999*

*Quantity of non-packaging material recycled: paper/card, plastics, metal, wood, other in 1996/ 1997/ 1998 and 1999*

#### (4) Environmental Programmes

*Environmental Policy in place: yes or no and year introduced.*

*Accredited environmental management systems (EMS) in place: EMAS or ISO14001 and year introduced.*

*Energy consumption expressed as either kWh/ UP or kWh/ sq ft building in 1996/ 1997/ 1998 and 1999*

*Extent to which the Packaging Waste Regulations have influenced environmental programmes: A great deal/ Quite a lot/ Not very much or Not at all*

*Responses to statements about the effects of the Packaging Waste Regulations on environmental programmes and bottom line.*

#### (5) Packaging Consumption Reduction Initiatives

*Awareness of the Packaging (Essential Requirements) Regulations: yes or no*

*Steps taken, if any, to comply with these regulations*

*Number of initiatives for packaging reuse or minimisation set up in 1996/ 1997/ 1998 and 1999*

*Quantities of packaging reused: paper/card, plastics, metal, wood, other in 1996/ 1997/ 1998 and 1999*

*Replaced certain packaging materials with other lighter or more environmentally sound alternatives: Yes/ No*

*Details of what type of packaging materials were replaced, what materials they were replaced with, in what year they were replaced and why.*

#### (6) Compliance Schemes

*Responses to statements about the effects on environmental programmes of registration status.*

*Comments on: why a company has chosen its particular registration route/ how the UK Packaging Waste Regulations have improved the environmental performance of the company/ and in what ways the Regulations have had a negative impact on the environmental performance of the company*

Permission for a follow-up telephone call was requested and provision was made for respondents to request a copy of the survey report. A follow-up letter was sent to generate further responses and follow-up telephone calls were made in order to gain more detailed qualitative data from those respondents who gave their permission. A code sheet was

designed to record the data (see Annex 3, Appendix 1) and analysis of completed surveys was performed using Excel (see Annex 3, Appendix 2) for which graphical representations, along with the non-parametric data test results manipulated using the Statistical Package for Social Sciences (SPSS) are presented in Annex 3, Appendix 3.

## **4.3 Results**

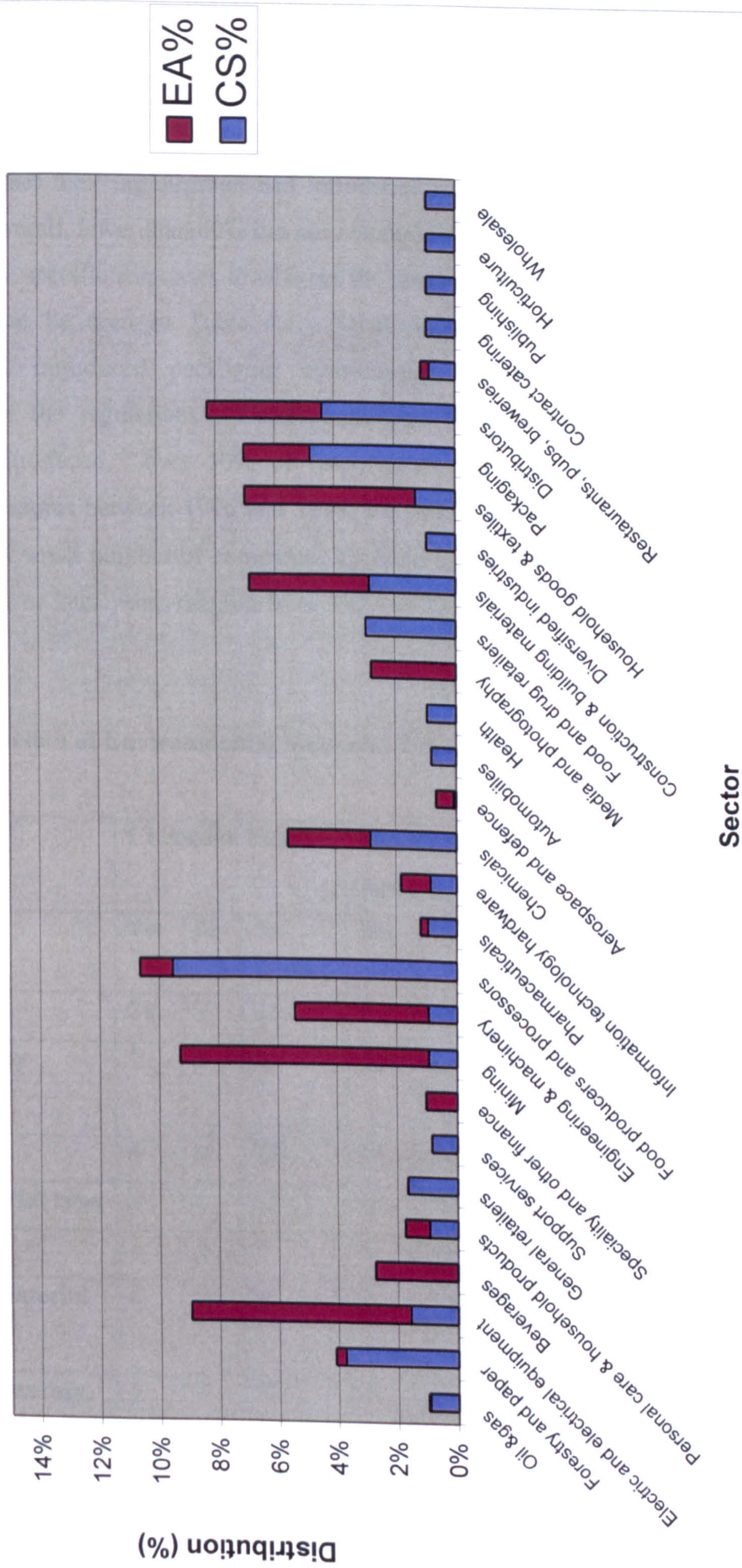
### **4.3.1 Respondents**

A total of 72 completed survey forms were returned by registered companies giving a response rate of 7%. Of the respondents, 18 (25%) were registered individually with the EA and 54 (75%) were registered with collective schemes, 34 (50%) of which were registered with currently the largest collective scheme, Valpak. Therefore, the percentage of respondents registered individually relative to those registered via collective schemes was slightly higher than the 20:80 ratio in the sample and total population.

The first section of the questionnaire, covering respondent details showed that in terms of the respondent's area of responsibility, 52 (29%) had an environmental role and 36 (20%) had responsibility for health and safety in the organisation. In a tiered management structure where tier 1 refers to a chairman, tier 2 a vice president, tier 3 senior management through to tier 6 which includes either non-executive advisors or other managers, the majority, 29 (40%) of respondents were in tier 3. This was followed by 14 (19%) of respondents in tier 2, (17%) in tier 5, and 9 (13%) in tier 4 positions. Only 3 (4%), within companies registered with collective schemes, were in tier 1 within their organisation.

The majority of organisations, 57 (76%), had a turnover of £5-100m and 26 (17%) organisations had a turnover of £100m-£1bn. The majority of organisations, 62 (87%), had <1000 employees and 6 (8%) had 1001-4999 employees. There was little difference between collective scheme and individually registered companies in respect of turnover and number of employees. The sample represented a wide distribution of industry sectors with the highest numbers of respondents within food production and processing, mining, electric and electrical equipment and distribution. Differences according to registration status are shown in Figure 4.1. The sectors that were not represented by the sample included insurance, steel & other

**Figure 4.1 Sectoral Distribution of Respondents According to Registration Status**



metals, leisure, entertainment & hotels, transport, gas distribution, life assurance, water, investment companies, telecommunication services, banks and real estate.

#### 4.3.2 Environmental Measures

When asked whether their organisation had introduced environmental measures concerned with packaging, overall, fewer than 60% did not respond, whilst over 20% said yes and fewer than 20%, no. The specific responses to whether the measures were introduced as a result of the regulations can be seen in Table 4.1. Over 40% of respondents said that their organisations had introduced packaging consumption measures as a result of the implementation of the regulations. Correspondingly, when asked the dates when the measures were introduced, over 50% of respondents said that their organisation had introduced the measures between 1996 and 1998, the years surrounding the introduction of the regulations. A small number of companies accounting for 6% of the sample introduced measures in earlier or later years ranging from 1977 to 2000 and the remaining 45% did not respond.

**Table 4.1 Introduction of Environmental Measures Concerning Packaging**

Measure	Collective Scheme			Environment Agency			Overall		
	Yes	No	No Answer	Yes	No	No Answer	Yes	No	No Answer
<b>Consumption</b>	24	7	23	7	3	8	31	10	31
<b>Consumption by material type</b>	7	3	8	25	7	22	32	10	30
<b>Reuse</b>	4	4	10	9	11	34	13	15	44
<b>Reuse by material type</b>	5	2	11	8	11	35	13	13	46
<b>Recycling</b>	4	5	9	8	15	31	12	20	40
<b>Recycling by material type</b>	4	6	8	7	10	37	11	16	45
<b>Recyclate purchasing</b>	3	5	10	4	8	42	7	13	52
<b>Recyclate purchasing by material type</b>	3	5	10	5	7	42	8	12	52

The results for all the other environmental measures relating to packaging, which included recycling, recycle purchasing, and reuse measures, were similar in that the majority of respondents did not answer as to whether the measures were introduced due to the introduction of the regulations. However, they were all similar to packaging consumption measures in that the majority of organisations had introduced recycling measures between 1996 and 1998.

When asked if they were aware of the Packaging (Essential Requirements) Regulations 1998, 47% of respondents said yes and 15% said no. This was reflected in the introduction of packaging substitution measures that had been introduced by the respondent's organisations with 65% of packaging substitutions being introduced between 1997 and 1999. The types of packaging material substitution and the reasons for their replacement given by collective scheme members (a) and Environment Agency registrants (b) are listed in Table 4.2. The predominant material replacements made by collective scheme registrants were for cardboard, which was either replaced by lightweight card or plastics mainly as a cost reduction exercise or to introduce the practice of reusability. For the EA individually registered companies the material replacements were far more varied with the predominant reasoning being that of reuse.



**Table 4.2 Material Substitutions**

**(a) Collective Scheme Members**

Original Material	Replacement Material	Reason for Replacement
Cardboard	stretch wrap plastic	Lower cost
	lightweight card	Weight improvement
	lighter card applied differently	Improved protective packaging
	recycled card	Cheaper, environmentally friendly
	polypropylene	reusable
	returnable plastics	Lower costs, meet obligation
	plastic trays	cheaper
	Stronger cardboard	Lower cost, better protection
Polystyrene	Recycled plastic	better environmental practice
	Paper	operational/ cost effective and customer preference
Polypropylene film	Polypropylene film 20µm (thinner)	Reduced costs
	returnable plastics	reusable
Misc:		
Aluminium	metalised film	Supplier decision
Fabricated timber-based cases	Purpose-bought cardboard boxes	reduction in weight and labour costs
steel drum	Plastic IBC	Economy
	Bulk tank	Economy
paper sack and plastic bottle	paper sack	reduction of waste/ cost. Ease of application by end-user
plastic	card	Ease of recyclability
plywood boxes	polypropylene	Reusable

**(b) Environment Agency Registrants**

Original Material	Replacement Material	Reason for Replacement
EPS	Card	part of Japanese continuous improvement programme
PVC	PET	Only on certain lines due to manufacturing change.
PE	Card	part of Japanese continuous improvement programme
cardboard cartons	polypropylene	Able to reuse again and again for storage
Shrink-wrap and card	PVC Blister	Recyclability
wood cases	metal reusable	economic
plastic bags	shrink wrapping	uses less material more economical
plywood boxes	polypropylene	Able to reuse again and again for storage
200ltr barrels	1000ltr IBCs	cheaper
Shrink wrap	thinner shrink wrap	reduce costs
Steel	plastic	cost/weight
pallets	steel totes	cost-savings and environmental improvements through reuse

None of the results relating to environmental measures showed any significant difference between responses from companies registered via collective schemes or individually with the EA/ SEPA.

#### ***4.3.3 Perceptions of the Effects of the Regulations on Environmental Programmes***

When asked whether the Regulations had influenced environmental programmes within their company, the majority of companies, 11 (61%) of EA registered companies and 21 (39%) of collective scheme registered companies, said 'not very much'. The most distinctive difference between registration statuses was that only companies within collective schemes, 5 (9%), committed to saying that it had influenced their environmental programmes 'a great deal'.

The responses to questions about the influence of the Regulations on environmental programmes and bottom line produced some interesting results. The responses to the first question about environmental effects were simply on the effects of the Regulations, whereas the responses later on in the questionnaire related specifically to the company's registration status. The responses to the two related sets of questions were often different indicating that when questioned about registration route it altered perceptions of the effects of the Regulations on environmental programmes.

To the first set of statements, the majority of companies, overall, perceived that the Regulations have had no effect on their environmental programmes but have significantly affected the company's bottom line. A majority of 45 (63%) disagreed with the statement 'the Regulations have significantly driven environmental programmes'. In relation to registration status, the perception that this was the case was much stronger for those in collective schemes than for those registered with the EA directly. When asked if the Regulations had not affected environmental programmes, the answers were mixed without a clear majority for any one response with, overall, 38 (53%) agreeing. To the statement 'the Regulations have had a detrimental effect on environmental programmes' the overall majority of 47 (65%), 'disagreed strongly'. As to whether the company's bottom line had been significantly affected, the majority, 34 (63%) of companies in collective schemes agreed.

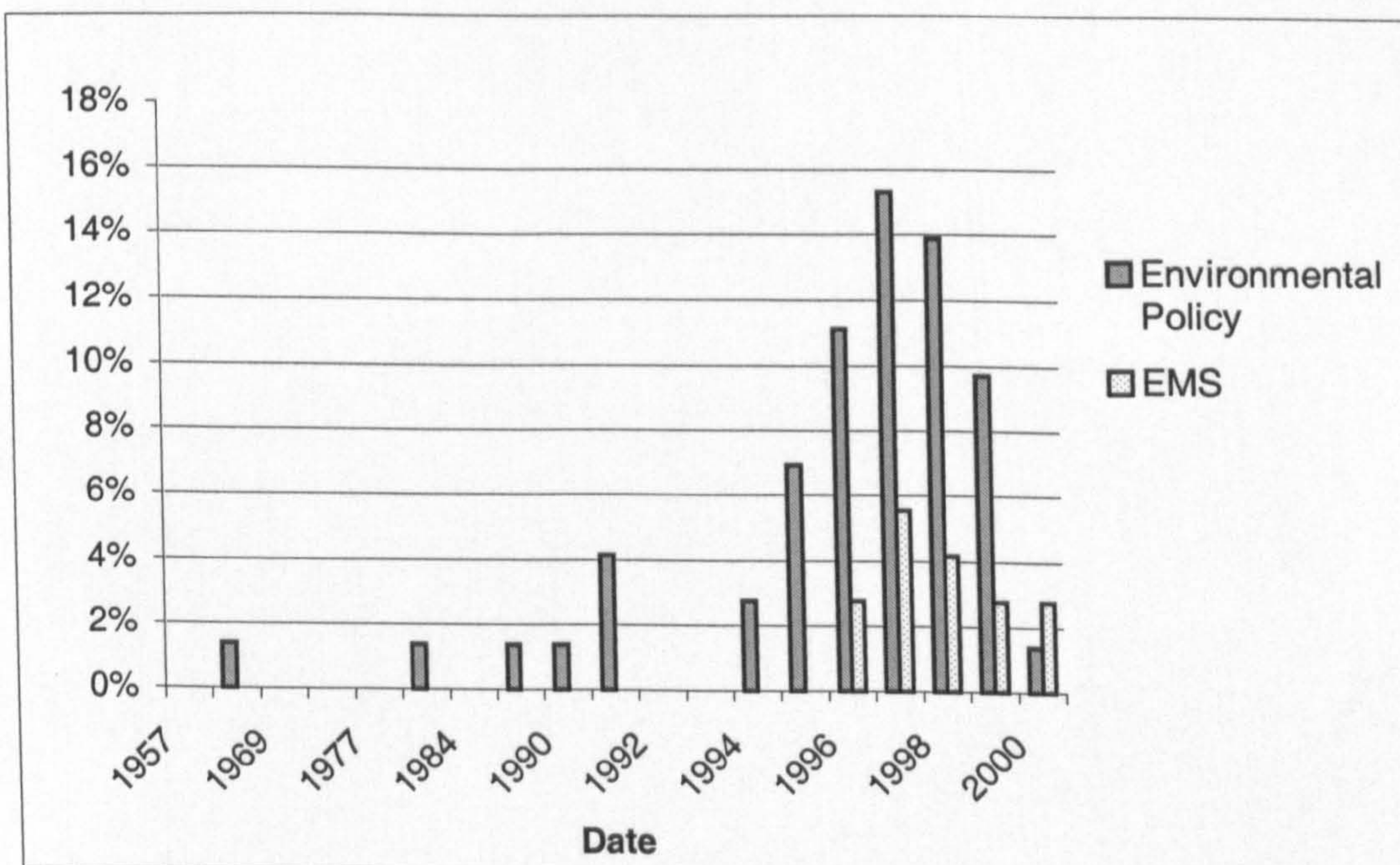
However, companies that were registered individually with the EA gave an equal spread of agree and disagree.

To the second set of statements, the majority of both individually registered, 16 (70%), and compliance scheme, 34 (63%), companies disagreed with the statement, [respective] registration status has significantly driven environmental programmes. Overall, individually registered companies clearly agreed with the statement 'Individual registration has not had any effect on environmental programmes' whereas collective scheme members were less sure, with only a slight majority of 57% agreeing. Finally, both the collective scheme members and the individual registrants clearly disagreed with the statement 'registration [status] has had a deleterious effect on environmental programmes'.

#### 4.3.4 Environmental Policy and Management

The majority of respondents, 52 (72%) had introduced an environmental policy statement whilst only 17 (24%) had introduced, either partially or fully, an environmental management system. All but one of these companies either had or was in the process of achieving ISO 14001 certification. The one remaining company had achieved EMAS. Again the dates of introduction of an environmental policy and management system coincided with the introduction of the packaging regulations as shown in Figure 4.2.

**Figure 4.2 Dates of Environmental Policy and EMS Introduction**

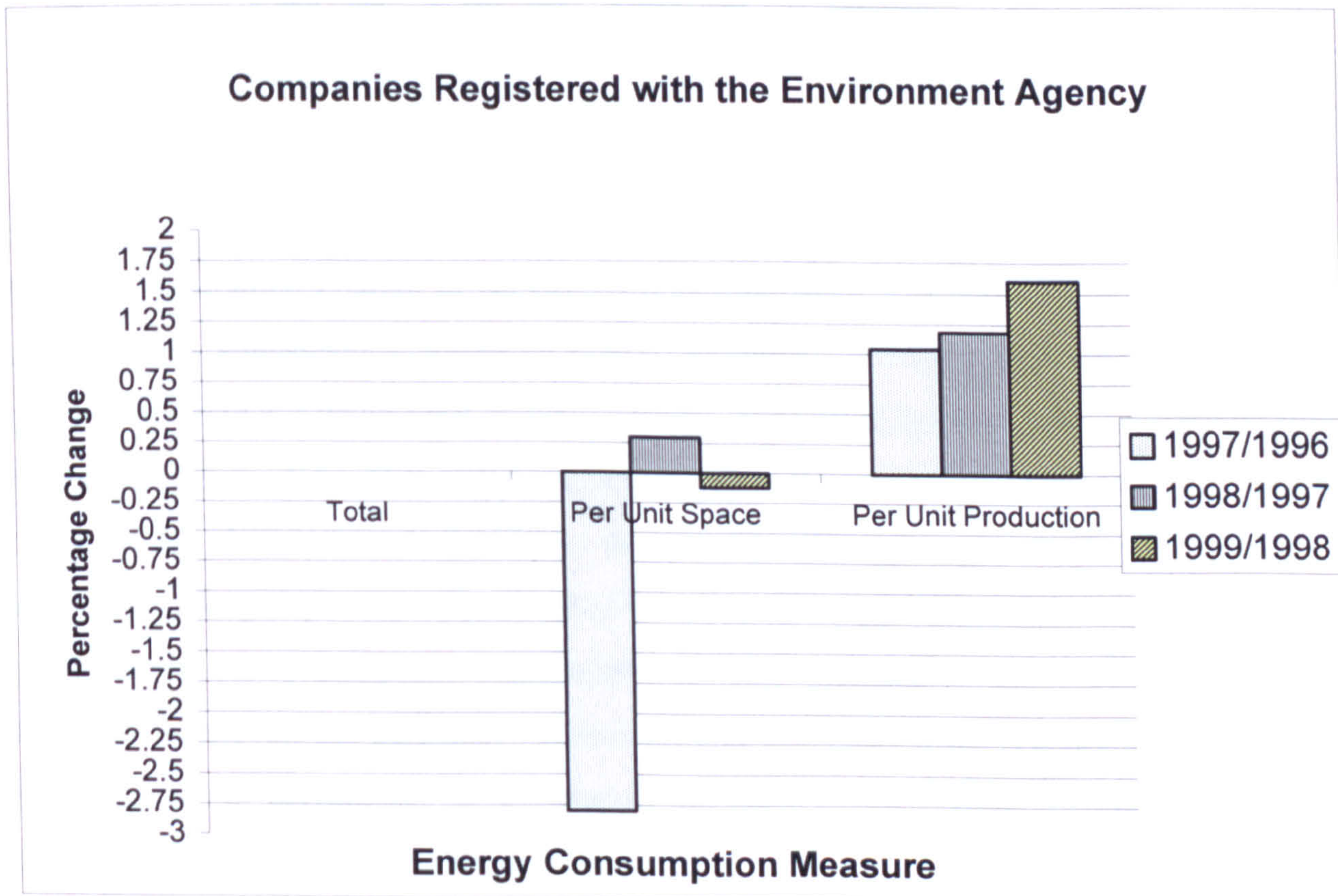


#### ***4.3.5 Energy Consumption Measures and Data***

Energy measures were used as a control to register effects on environmental performance aside from packaging and waste measures. Only 10 collective scheme members and 5 EA registered companies had energy consumption measures in place. Of these measures, one collective scheme member measured total energy consumption, 5 companies measured energy per unit space, 6 companies measured energy consumption per unit production and 3 companies measured energy consumption per unit space and per unit production.

The percentage change in energy consumption by the companies that measured energy consumption is illustrated in Figure 4.3. These graphs were plotted using an average figure determined from the individual sample differences in energy consumption between one year and the previous year, divided by the total energy consumption for the chosen year and multiplied by 100 (Annex 3, Appendices 2 & 3).

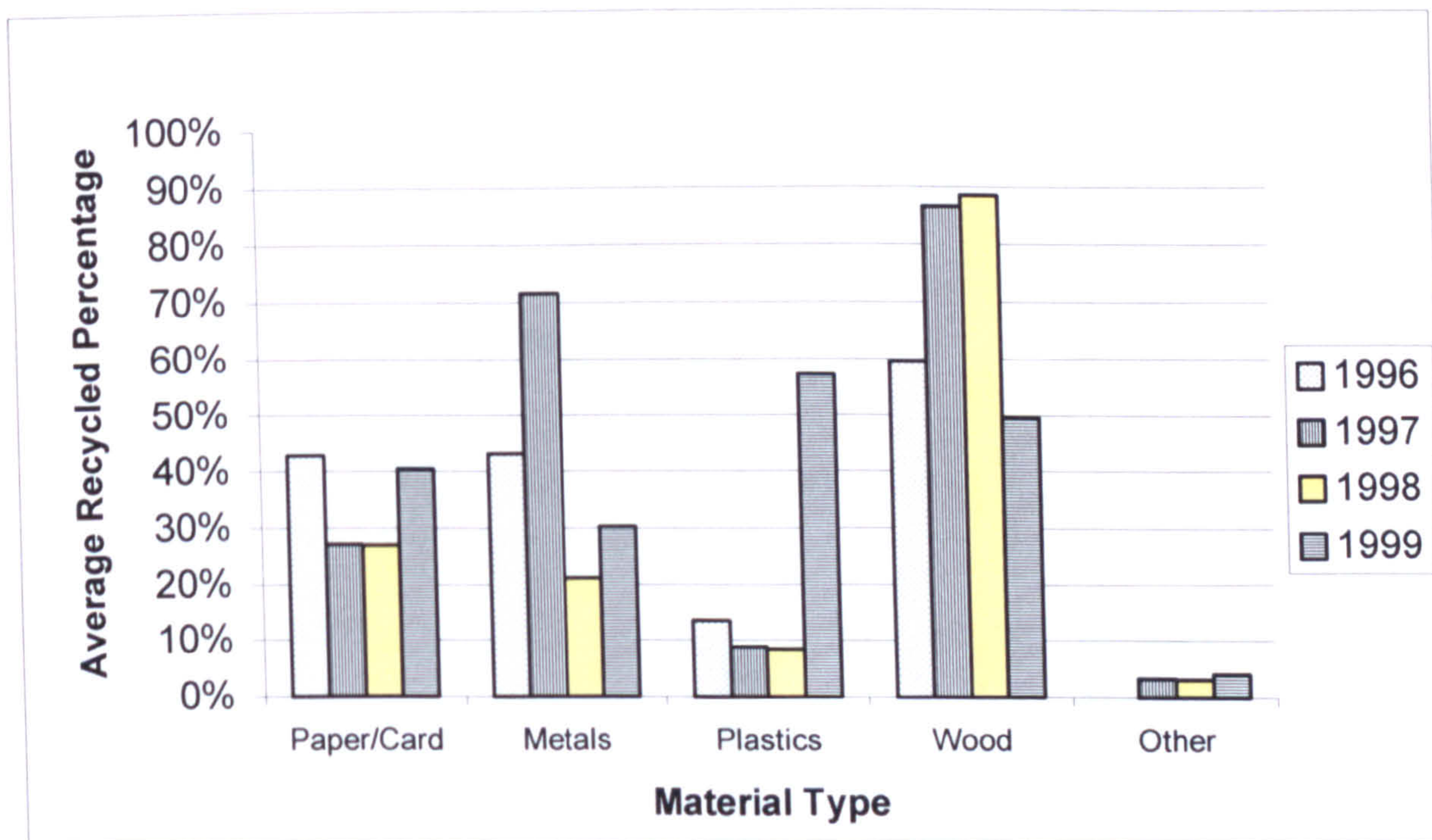
Figure 4.3 Percentage Change in Energy Consumption



#### 4.3.6 Packaging and Waste Data

The recycling data collected showed an overall increase in the amount of packaging materials being recycled. However, once these data were adjusted to take into account the amounts of packaging being handled/ used, no overall increase in packaging recycling was observed (see Figure 4.4).

**Figure 4.4 Average Material Recycling as a Percentage of Packaging Material Handled/ Used**

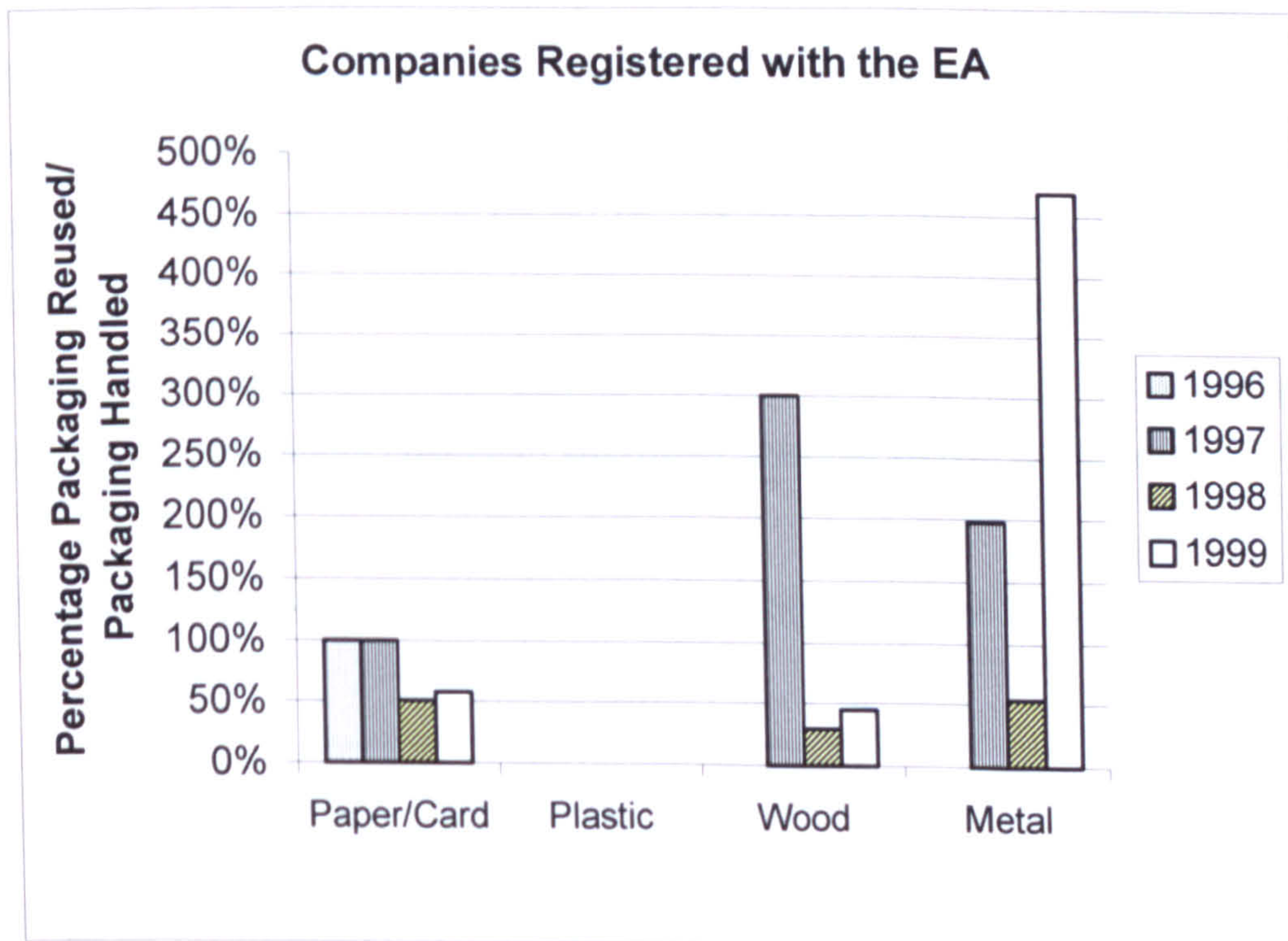


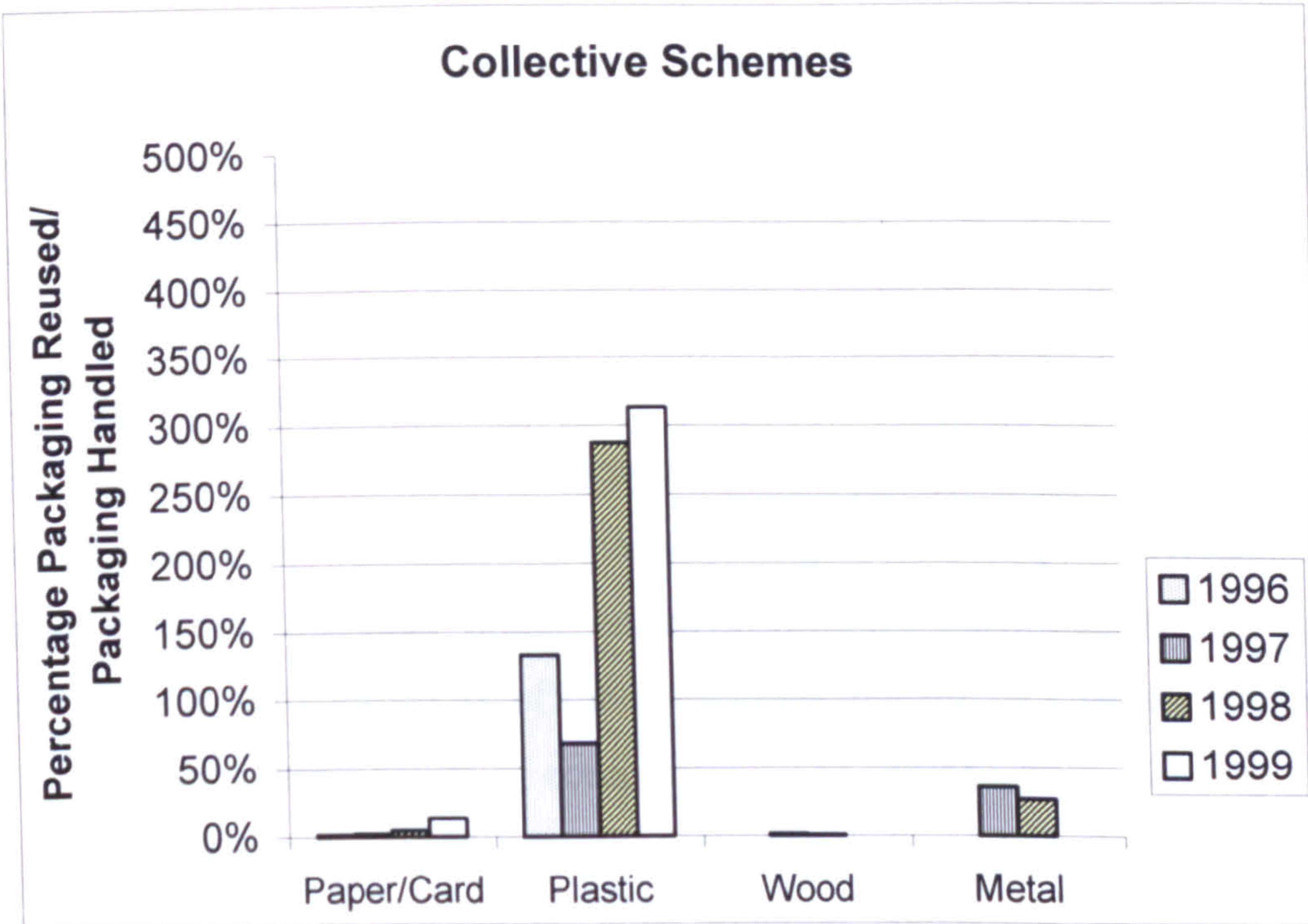
The only substantial change in packaging recycling as a percentage of packaging handled/ used was the significant increase in plastic packaging between 1998 and 1999. A large quantity of wood recycling (and correspondingly, handling/use) was carried out by companies registered with the EA. This may have arisen due to the large percentage of these companies being in the electrical and electronic, mining and building and construction sectors. A substantially larger quantity of packaging recycling as a percentage of packaging handled was being carried out by companies registered with the EA compared with members of collective schemes. However, the collective scheme members showed a gradual increase in packaging recycling as a percentage of packaging handled/ used where individually registered companies data were much more random.

As part of the study it was observed that the amount of non-packaging recycled peaked in 1998 for most material types but showed a distinct fall off in 1999 especially in materials other than those commonly used for packaging.

Initiatives to reuse or minimise packaging were only introduced by companies in collective schemes and they increased from 2 in 1996 to 9 the following year. Since then the quantity rose to 10 in 1998 and 1999. The average quantity of packaging reused as a percentage of packaging handled increased for wood and paper/ card between 1998 and 1999. Metal packaging reuse by companies registered with the EA showed a big increase in 1999 (Figure 4.5).

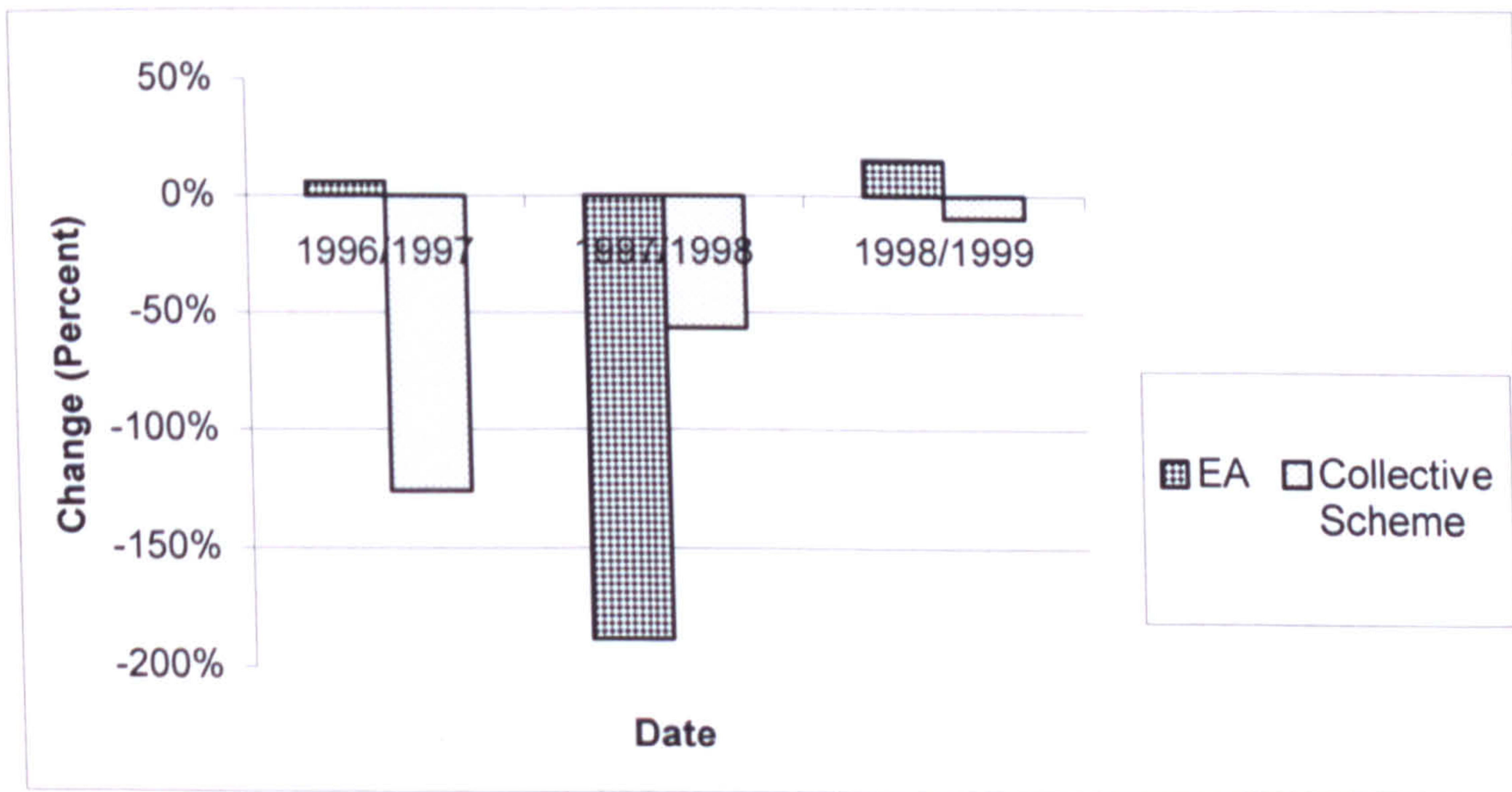
**Figure 4.5 Packaging Reused as a Percentage of Packaging Handled**





The average waste reported to have been landfilled showed a steady increase from 7200 tonnes in 1996 to approx. 8000 tonnes in 1998 with a 2000 tonne increase to over 10000 tonnes in 1999 for companies registered with the EA. Companies in collective schemes showed a substantial drop in landfilled waste from 14000 tonnes 1996 to 7600 tonnes in 1997 before a steady increase in 1998 and 1999 to 8800 tonnes. An aggregated average of each individual percentage change in landfilled waste is shown in Figure 4.6.

**Figure 4.6 Aggregated Average of Percentage Change in Landfilled Waste**





#### ***4.3.7 Comments on the Effect of the Regulations on Environmental Performance***

The majority of respondents commented that they thought the main impact on their companies environmental performance had been one of awareness raising of the packaging quantities involved, environmental regulations, the costs incurred and the future pressures to be expected from environmental regulations. The second area where the packaging Regulations had affected environmental performance was in the area of packaging minimisation and reuse. The main reasons given for why the Regulations were thought to have had a detrimental effect on environmental performance was in the high cost of compliance, the complexity of the regulations and the lack of comprehensive guidance, and the time-consuming nature of compliance. The reasons given for why the Regulations were not perceived to have had any effect on environmental performance was that other factors such as economics, customers, other national legislation, and ISO 14001 were the main drivers. Each reason was assigned a weighting and these are listed in Table 4.3.

**Table 4.3 Reasoning Behind Perceptions Regarding The Effect of the Regulations on Environmental Performance**

<b>Reasons Why Regulations are Driving Environmental Performance</b>	<b>EA Registered</b>	<b>Collective Scheme Members</b>
Improved awareness of environmental regulation and/or costs and/or indicator of future pressures and/or quantities involved	4	11
Lowered packaging costs		1
Now measure packaging so can measure future activities		1
Reduction in packaging used/ minimisation/ reuse	1	4
Material Replacement/ packaging type selection		1
Waste segregation/ recycling/ minimisation	1	3
Some recycling now economically viable		1
Become reprocessors		2
Legislation made compliance with environmental measures/ policies compulsory		1

<b>Reasons Why Regulations Have Had Detrimental Effect on Environmental Performance</b>	<b>EA Registered</b>	<b>Collective Scheme Members</b>
Expect PRN cost to rise (cheaper to landfill)/ high cost of disposal	2	
High cost of compliance/ complex Regs and little guidance/ increased bureaucracy/ time consuming	8	20
Unable to reclaim waste/ recycle/ recycling of card and paper almost impossible	1	4
Resources drawn away from environmental projects	1	3
Waste as a cost not a benefit	1	
Hardened company attitude to red tape/ contentious issue		2
Tax/ burden on environmentally benign business (wood is renewable resource/ paper sustainably managed)	1	1
Excessive cf. other European member states	1	
Have to Recycle instead of reuse	1	

<b>Reasons Why Legislation Has Not Had Any Effect on Environmental Performance</b>	<b>EA Registered</b>	<b>Collective Scheme Member</b>
Other drivers (Economics/ Customers/ US legislation/ ISO 14001)	2	4

#### ***4.3.8 Choice of Registration Route***

The key reasons offered for choosing collective scheme membership as a registration route were to save time, conserve resources and the benefits arising from central administration. Other reasons included: ensuring compliance and off-loading the company's legal liability, and obtaining guidance and legislative interpretation from the schemes. A noteworthy reason given for joining a compliance scheme was that the companies had no direct access to PRN procurement.

Similarly the most common reasoning for registering individually with the EA was to achieve least cost compliance. The reason for changing registration status from collective schemes to the EA was also given as a route to reducing cost. Other reasons given for individually registering centred on the overall confidence of the companies in their ability to comply with the Regulations and to cope with the workload. Table 4.4 shows the weightings given to each data area corresponding to choice of registration route.

**Table 4.4 Reasoning Behind Choice of Registration Route**

<b>Reasons for Choice of Registration Route</b>	<b>EA</b>	<b>Collective Member</b>	<b>Scheme</b>
Time saving/ ease/ simpler/ conserving resource/ lowest cost/	1	36	
Minimise paperwork		2	
Difficulty in determining usage		2	
Guidance/ Legislative interpretation/ Awareness		8	
Ensure compliance/ offload liability		9	
No direct access to recyclable packaging waste/ eliminate need to procure PRNs		4	
To support green links		1	
Most vocal/ popular/ credible/ suitable/ established industry scheme		4	
Considering switching to EA (lowest cost)/ EA lowest cost option	12	1	
Too small to do otherwise		1	
EA refused individual registration		1	
Group decision	2	1	
Gives greater control over our packaging		1	
Non-cooperation of recyclers	1		
Can cope with work load/ confident in ability to comply	4		
Gain knowledge/ more control	2		
Tonnages do not lend themselves to a scheme	1		

### 4.3.9 Telephone and Non-response Data

Several questionnaires were returned with letters of apology for non-completion. Common reasoning given for non-completion was that it was the organisation's policy not to complete questionnaires. One respondent stated that their reasoning for not completing the questionnaire was because the information requested was of a sensitive nature, despite the reference to confidentiality in the covering letter sent to them. A second commonly given reason was that of lack of resources available at the time of the survey to respond. Two respondents' reasoning are provided in Table 4.5 along with data collected from follow up telephone calls.

**Table 4.5 Telephone Calls and Non-Response Data**

#### Responses to Initial Letter

Level of Responsibility	Justification for Non-response
1. Director	"I'm sorry but the UK Packaging Regs are enough of an administrative and extremely costly nightmare without having to fill in any additional forms! I regret we cannot take part in your survey." Director
2. Quality Manager	"I am unfortunately unable to complete [the questionnaire], due to the questions asked ... The impact that the [Regulations] have had on our company are visibly negligible....Beyond this declaration annually, I have no idea of what impact the regulations have had."

#### Follow-up Telephone Calls

##### Landfill Tax

Sample Number	Comments
5	"We have made a big effort to reduce our waste, yes. Recycling has been increased of speciality papers by reducing our production wastage...primarily this has been cost driven by the escalating landfill tax."
9	"We do recycle mainly to reduce the amount going [to landfill] because it's cheaper."
17	"The Landfill tax has not drastically effected our waste which has gone down from 3x14 <sup>3</sup> ft to 3x10 <sup>3</sup> ft skips but it has been a factor. We recycle off-cuts of plastic waste and have invested in bailers for this. Both the packaging regulations and the landfill tax have to some extent driven this..."
30	"Our waste is increasing because we are getting bigger. We have not reduced waste but are handling it in a different way."

*Cost/ Resources*

Sample Number	Comments
Unknown	"[The Regulations] have taken approx. £2k p.a. off our bottom line that is unrecoverable....cost on industry is ridiculous...the government has abstained from their responsibility...the government has had to implement otherwise the EC would stop grants and have passed the cost on to industry"
Unknown	"In order to comply with these Regulations properly we would need to employ someone full-time...we sell around 10,000 odd product lines and these are changing all the time."
32	"You are talking about £10,000 to £15,000 to do anything because we don't segregate our waste. It's not clever to damage the environment but we have to take commercial view on it...If we could turn round to customers and say our recycled cartons are cheaper then there is some incentive but it costs them so much to recycle and transport [especially] that it's cheaper to buy new ones. Until they address this they'll get nowhere"
60	"[The Regs have had a negative impact] because all I'm doing is paying a fee to Valpak to manage documentation...its just a tax on business...it is not saying to me how can I get this money back or save money...Both [data management and PRNs] actually have affected us because we don't have access to PRNs so the cost is controlled by Valpak."
66	"It is costing us £4,000 to put in Packtrak [a system to calculate packaging obligations]."

*Registration Route*

Sample Number	Comments
5	"We would have needed a lot of resource for collating data if we were to comply individually"
17	"We have recently gone in with the Group and switched to a compliance scheme because it gives us greater PRN buying power."
24	"It costs too much for us to join a compliance scheme"
32	"There were four companies within the Group that needed to register and we joined Biffpak...we were then sold by the Group and bought by an Irish company which separated us into four standalone companies. This meant it was cheaper to register with the EA than Biffpak."
60	"Before we used the scheme we just new of the Regulations [but didn't think too much about it] but when we joined the compliance scheme we realised that we had to produce more information and they pushed us along a bit."

*Drivers of Environmental Performance*

Sample Number	Comments
Unknown	<p>“What I hate most about these Regulations is that there is no incentive to reuse or to buy/use recycled material packaging...The most environmentally friendly way to package our products is to bottle them and use cardboard packaging because the bottles can be reused and the cardboard recycled...but because they are very heavy the lighter and cheaper material to use which is more efficient in drop tests, is polystyrene but this tends to get damaged and the disposal is more harmful than cardboard.”</p>
5	<p>“Our waste minimisation programme has not been influenced by the packaging regulations because it has focused on minimising production wastage”</p>
9	<p>“Since the Regulations were introduced we have had more trouble recycling PE from heavy duty shrink wrap and I don’t know why...our packaging is designed for customer requirements and we are minimising it. Recycling is not an option for us because we don’t get any packaging back from our customers. We have not been sold on implementing an environmental management system yet...We are putting in energy consumption reduction measures with the climate change levy coming in.”</p>
17	<p>“We are very environmentally mindful which has led to our waste minimisation programme...The Group is environmentally conscious because the top companies in the building and construction industry are very green...yes, this is most undoubtedly due to increasing regulation”</p>
24	<p>“There is not much possibility for us to recycle...Environmental management system is being produced and our objective is to achieve ISO 14001...this is environmentally motivated...no, the packaging regulations have not driven this.”</p>
30	<p>“The problems we are having are to do with recycling. We can’t get recyclers to take our cardboard boxes...we are too far from paper recycling plants so our recycling is going down...We have got rid of boxes and use pallets and plastic wrap...we do not buy packaging in so we reuse whatever we get. We reuse pallets and boxes.”</p>
32	<p>“We did absolutely nothing about this [waste reduction]...The waste policy we had was to chuck it away and they paid us to take our waste. There is so much waste now floating around that we have started looking at segregating our waste and talking to customers [about what they would find acceptable] in order to minimise packaging such as returning our cartons. We have not done anything structured or planned...it is mainly cost driven but environmentally as well because we are asked by our customers to provide environmental policy statements. There is no incentive whatsoever in the legislation to recycle...I feel the environment is important. There is a tremendous environmental cost to recycling paper, for example, it has to be de-inked and it takes twice as much ink to print on recycled paper [because it is absorbed so readily] and recycled paper is lower quality than virgin because the fibres are destroyed...You use a lot of energy to get paper back to pulp form and clean pulp form. They are getting</p>

	better at it and are getting more energy efficient. Then there are the oil products and coatings that come off the paper to dispose of. Manufacturers of paper are the most environmentally friendly companies because they clean the water and recycle the heat into energy and don't waste any wood."
60	"[The Regulations] it doesn't encourage us to recycle product...If it encouraged everybody to recycle then it would be good."
66	"We do recycle but we don't record it because we only have to provide PRNs...We don't pack/fill we distribute wine so the only way we could improve is to have lighter packaging but we have to protect the quality of the [glass bottled] product...The costs of environmental improvements are too high and so there is no incentive for us to do anything. Our packaging is integral to the product [marketing aspects]. The majority of our cases are recyclable but we don't reuse."

***Data Management Difficulties***

Sample Number	Comments
Unknown	"The problem we face is that we distribute office-related stationary and logos etc. No information is available from suppliers with regards to packaging weights. We don't know weights of cardboard packaging or recycled contents and it is almost impossible to achieve providing information to the EA because we don't enjoy the information from our suppliers. We made a best effort and manually calculated over one week all the weights and multiplied these amounts by the products going out of the factory door...our methods have had to be very haphazard and paper and string because we don't have the mechanisms in place to track the packaging going through our doors and we don't have information from suppliers. If an inspector wanted to they could have a field day with the inaccuracies. It seems to me as long as you've had a go at attempting to register the EA is happy but it is almost pulling figures out of the air."
Unknown	"We wrote to our top 200 suppliers and only receive 50 responses most of which couldn't supply [the data] we needed. Most were not obligated themselves plus there is the problem that we are supplying different things. We are at the end of the supply chain and it is impossible to obtain accurate data...if we were [provided with incentives] to buy recycled material it would be easier to get the information Bar-coding would not really work [for many of our product lines] because say we buy 50 pH electrodes in a big box, inside are 50 small boxes, the supplier doesn't know so they would barcode the outside but we might separate these out and sell them separately."
32	"We estimated packaging weights before [and that is why we didn't provide data on the questionnaire] now we are putting in the measures...we record it...and enter categories. We assume that if we bought packaging we sent it out. Backdoor waste is so negligible that we don't count it."
60	"The Regulations have had a totally negative effect on our company because we are



	finding it difficult to compile all the information”
66	“We are putting in system to calculate obligations for us.”

**General Comments on the Regulations**

Sample Number	Comments
Unknown	“They [The Regulations] are an absolute nightmare...the regulators don’t know what they’re doing...they have been set up by an old boys club... [the Regulations] need total reforming and simplifying.”
Unknown	“The Regulations as they were introduced seemed very daunting but every credit is due to Department of Environment for providing guidelines and organising seminars etc. They deterred us from individual compliance scheme because they can prosecute any company that doesn’t meet its obligations. The EA set up a database of those companies that requested information and compared it against their database of those companies that have registered which gave them a hit list of suspects who possibly should have registered and haven’t.”
Unknown	“Committee was formed by the old boy network who decided that they should share responsibility and that no one should get away with not paying.”
9	“Hopefully this [administration costs] will get easier as time goes by and we put systems in place.”
30	“We have concentrated on taking on packaging but we have to tread a tightrope between reducing the amount used and preventing shrinkage at the point of sale...by shrinkage I mean stealing...if pens are attached to cardboard they are less likely to be taken than if they are loose on the shelf...so there are limits for security.”
32	“The whole thing is totally unworkable and the revenue taken from it is not being used to recycle...Eventually, the cost of waste is going to keep going up and everything is going to need recycling...It’s a waste of time bringing in legislation if the infrastructure isn’t there. Recyclers don’t want the stuff...If there was any money in recycling ICI and all the other big companies would have been setting up recycling plants everywhere years ago”
66	“The Regulations aren’t very clear and one guy was told that he had to weigh the nails in the packaging!!!”

One respondent stated that the rising costs of landfill tax had driven their organisation to reduce wastage from their production operations but that this had not affected packaging. Two respondents said that the landfill tax had driven their recycling programmes. The recognition of the expense of the Regulations to industry was clearly stated by three respondents, one of who emphasised a lack of control over the costs being a contributory factor in the lack of incentives for introducing environmental programmes. Another

respondent commented that the costs of implementing recycling programmes meant that they were not commercially viable at the present time. General comments on the Regulations pointed towards their bureaucracy and complexity and in one case the comments made showed a lack of faith in the Regulations because of the belief that the markets for raw material recyclates simply do not exist. Amongst the reasons offered for joining compliance schemes was the belief that individual registration would be more resource intensive with respect to the collation of data. Other reasons included the increased PRN buying power created by compliance scheme registration. A smaller company switched to individual registration because the cost of registration is less. For one company, the compliance scheme played a strongly educative role for them and they felt that this had driven their organisation. The main complaint about the Regulations was that they provided no incentive to reuse, recycle, or to buy and use recyclates. Several respondents complained that they could no longer recycle certain packaging materials because the recyclers simply didn't want the waste. This in itself, ironically, seemed to offer an incentive for waste reduction programmes because of the need to keep costs down. The only positive reaction from one respondent towards the Regulations was that the Regulations had driven their waste management programme, but in conjunction with the landfill tax and a generally high level of environmental consciousness driven by the organisation's customers. In two cases, the drivers for environmental improvements were described to be coming from customers also and in one case from a foundation of environmental values and a move towards implementing an ISO 14001 compliant environmental management system. The difficulty of data collection, especially with regards to obtaining data from suppliers, was highlighted by three of the respondents.

#### **4.4 Discussion**

The initial number of responses totalled 55 and after the follow-up letter had been sent a further 17 were completed and returned. The low response rate of 7% was to be expected for two reasons: firstly, the questionnaire was complex in nature and required a large amount of quantitative and qualitative data to correlate the perceptions of respondents with the quantitative data given; and secondly, compliance with the Packaging Waste Regulations is extremely complicated, bureaucratic and time-consuming process and it was thought likely that there would be a certain amount of apathy with regard to another form-filling exercise.

In terms of the sample, the level held by respondents was found to be mostly a senior position within the organisation with responsibility for the environment amongst a number of other responsibilities. The majority of companies from whom responses were obtained fell into the £5-100m turnover and <1000 employees' categories. The percentage split between registration routes taken by the respondents matches the percentage split in the total population. The fact that there were slightly more respondents that were registered individually with the EA could possibly reflect that these people or organisations have more energy, commitment and/or time to devote to environmental issues. The sample represented a wide coverage of different industry sectors.

The main impact of the Regulations has been to stimulate the introduction of a whole range of packaging-related measures within organisations. Although many companies did not say that the majority of measures were introduced as a direct result of the Regulations, the dates that they were introduced coincide directly with the implementation of the Regulations.

Most organisations were aware of the Packaging (Essential Requirements) Regulations 1998 and a substantial number have been introducing initiatives to replace packaging materials. The main difference between EA and collective scheme registered organisations was that the collective scheme registrants seemed to focus on cardboard substitution and were motivated more by cost whilst the EA registered companies were substituting a far more varied array of packaging materials and were motivated more by reusable alternatives.

The fact that half EA registered companies thought that the Regulations have had a detrimental effect on their environmental programmes, and that half thought they had not implies an ambiguity over this issue that does not exist within collective scheme members. The detrimental effects of the Regulations were clearly cited as time-consuming, high cost of compliance, and the withdrawal of resources away from environmental programmes. The overall response has shown that the Regulations are indeed perceived as burdensome, bureaucratic and costly. They have not significantly affected environmental programmes within companies and the only real perceived difference has been that of awareness raising. There is no evidence to show that the rate of packaging recycling has increased since the Regulations were introduced and this confirms the belief that the recovery and recycling targets introduced by the Regulations have been too low. The fact that Producer

Responsibility Note (PRN) prices have been low has previously been explained by the introduction of inadequate targets.

It is important, however, to consider the other factors that may play a large part in the environmental programmes within companies. The fact that the Regulations were perceived by many to have had no effect on environmental programmes within companies is explained by the emphasis the companies made on the importance of other factors such as international legislation, customers, economics and obtaining environmental management systems certifications. Improvements in waste management may also be attributable to other legislation, e.g. landfill tax, and voluntary action driven by factors such as the need to gain marketing differentiation through greener products and to report sound environmental performance.

The survey shows that although the majority of companies responding published an environmental policy statement, generally at the time of the introduction of the Regulations, only a few are in the process of or have gained certification for an environmental management system. The fact that only a very small number of companies are measuring their energy consumption, even if they are sophisticated in nature, shows that many respondents' environmental programmes are still in their infancy. This is because energy measures are generally accepted to be one of the most important and easily accessible environmental measures a company can make. In addition, there is little evidence from the data to show that the waste being sent to landfill is being systematically reduced.

Those that perceived that the Regulations had improved their environmental performance were few in number and, although some of them were able to produce sound data to back up their perceptions, the overall results of the survey shows that the Regulations do not inherently drive improvements in environmental programmes nor do they improve environmental performance overall. Overall, with the exception of plastic packaging between 1998 and 1999, the amount of packaging being recycled has not increased in the surveyed organisations.

There is little difference at present between companies that are members of compliance schemes and those registered with the EA in terms of their environmental performance and

development and implementation of environmental programmes. EA registered companies appear to have more energy, resources and confidence in respect to complying with the Regulations. However, they handle a lot of wood packaging and it will be these companies that are hardest hit now that the Regulations include wood packaging under its recovery and recycling targets by the year 2000.

Only collective scheme registrants have had initiatives for the minimisation and reuse of packaging between 1996 and 1999, which suggests that collective schemes promote these initiatives. The amount of wood packaging reused increased in 1998 and 1999 suggesting that companies are preparing for the inclusion of wood under the Regulations by the year 2000.

Finally, the majority of respondents decided on their choice of registration route on the grounds of minimising compliance costs. Those that are switching registration route are doing so to reduce costs. The additional benefits of joining a compliance scheme were deemed to be off-loading the legal liability and the attainment of legislative interpretation and guidance. An interesting factor in the data provided by companies was that companies in compliance schemes seemed often less able to provide data. The current consultation on compliance schemes (DETR, 2000) is questioning the rationale behind the compliance scheme fees charged by the EA. Currently the larger the scheme, the less the registrants have to pay, on the basis that larger schemes should be easier to monitor and so incur less of an administrative burden on the EA. Compliance schemes are not, however, checking out their members' data and the EA is having to deal with more comprehensive audits than the expected sampling audits originally proposed (ENDs, 2000).

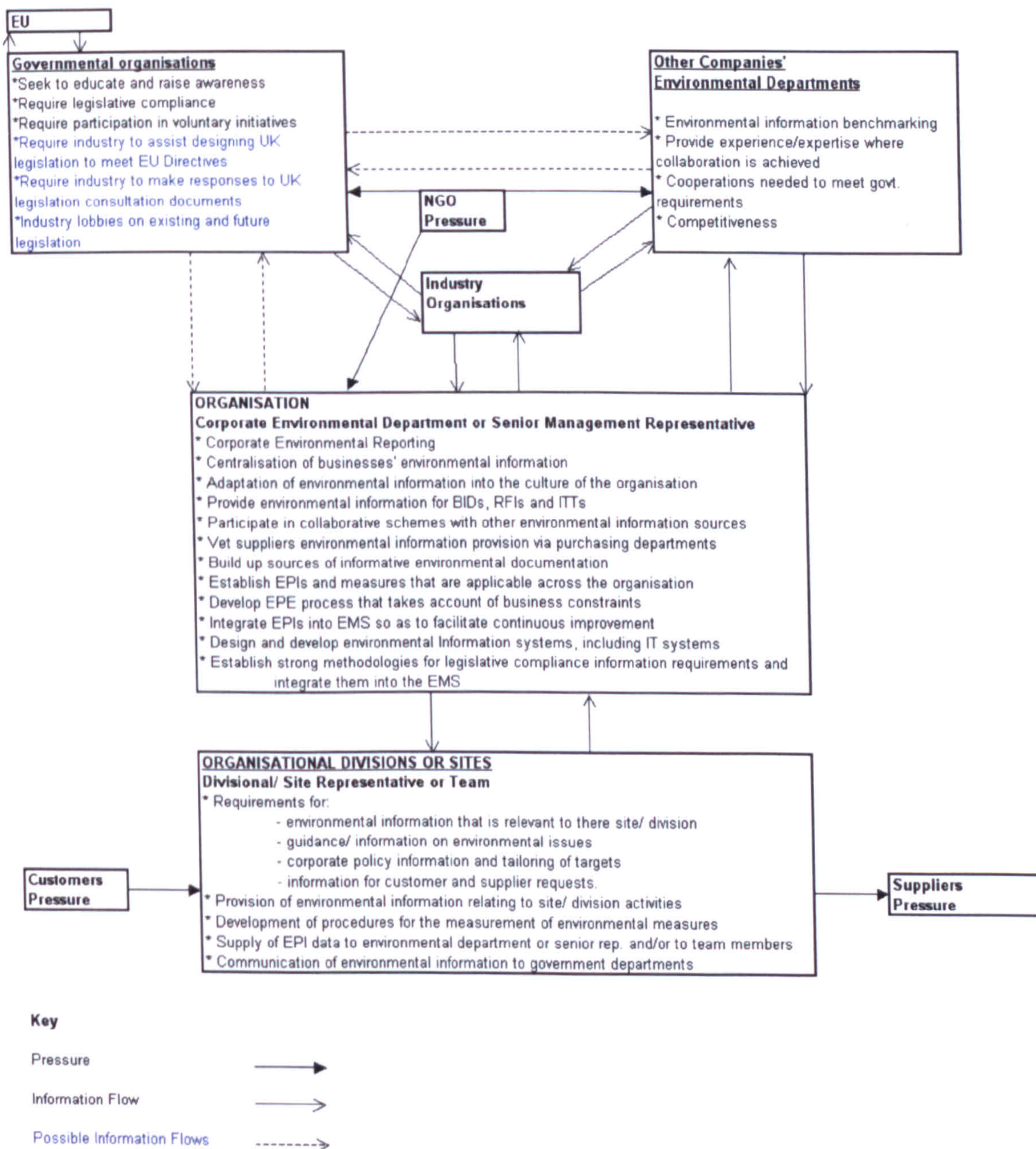
# Chapter 5

## Conclusions

## 5. CONCLUSION

The flow of environmental information within an organisation is complicated and the following model of environmental information management (EIM) has sought to document this process (Figure 5.1). It has been extended in the final two years of the project through the investigation of environmental performance measures and their integration into an ISO 14001 compliant Environmental Management System (EMS) to provide a model which is generic for application across all industry sectors. This generic EIM model shows the flow of environmental information both within and external to an organisation.

**Figure 5.1 The Role of Environmental Information Management (EIM)**



Companies who develop a varied set of environmental performance indicators (especially those that relate to best practice, cost reduction and stakeholder interests) have greater opportunity to demonstrate their position as leading edge companies that are attractive to stakeholders and have greater competitive edge. In order to develop varied and feasible indicators a whole host of different barriers and drivers need to be addressed and integrated into the decision-making processes. The management of change is becoming an important issue for many businesses in today's economic climate and one that environmental managers need to address. In the case whereby the drivers or barriers identified have a large impact on an organisation to the extent where changes to core business functions need to be made, the EPI decision-making process has to be revisited. Using ICL plc. as a case study in this work, it has been demonstrated that where a company does not manufacture, but is the provider of services, supply chain issues have to be addressed closely in the development of EPIs for the purposes of developing any environmental management system, ISO 14001 certification, and ensuring legal compliance. Furthermore, the emphasis on more generic performance measures such as energy consumption per unit of building space or numbers of personnel and transport measures is increased. Risk assessments carried out on environmental impact categories need to be evaluated not only in terms of the environmental, economic and legal drivers but also in terms of the constraints that will dictate the potential success of programmes and the effort required to make them effective. In order to maintain an ISO 14001 certification year on year an organisation needs to be able to demonstrate continuous improvement. In this research a model has been developed for companies to use to integrate environmental performance measures into their EMS and thereby ensure that performance improvements can be shown.

One of the most important drivers of environmental performance measures in any organisation is that of legislation. The UK Producer Responsibility Obligations (Packaging Waste) are the first example of shared producer responsibility legislation to be introduced in the UK that has affected all producers of products and services. Furthermore, the requirement for companies to report on various packaging measures taken has meant that an assessment could be made of the impact of the Regulations on environmental programmes within an individual organisation and within industry as a whole.



The UK Packaging Regulations are complex and administratively burdensome for industry to comply with. The increasing pressure of the Regulations on businesses to provide accurate data is based on unrealistic expectations. Furthermore, there is no supporting regulation on suppliers of packaging to provide data to other obligated businesses. Businesses are often simply unable to obtain basic metrics with which to populate their information systems. This not only poses a challenge for enforcement agencies in the application of their discretion to prosecuting firms but also for industry to apply sound methodologies in their compliance.

The application of a sound compliance methodology can enable companies to comply with the Regulations at least cost, and to channel valuable resources into the implementation of their environmental programmes for using the most environmentally-sound packaging materials, minimising packaging use, maximising packaging reuse as well as recovering value from packaging waste. The question of whether compliance schemes provide support for environmental programmes within companies or whether more environmentally conscious companies are better off registering individually needs to be addressed.

The financing system implemented under the Regulations, although based on the philosophy of the tradeable permit system, is flawed and is in need of thorough consultation and review. There are possible solutions to the problems of the PRN system but they are in partial conflict with the shared producer responsibility approach. This raises real concerns for the implementation of similar financing systems for shared producer responsibility based legislation. Even if an ERN (Electronic and electrical equipment waste Recovery Note) is not implemented as a financing system for the EU Directive on Waste from Electrical and Electronic Equipment, the UK is likely to follow a similar approach in its transposal of the Directive. Unless the problems with the PRN system are resolved, the implementation of similar financing schemes for other shared producer responsibility legislation, such as an ERN system, could endanger the success of the application of future legislation on particular industry sectors and the industry's perception of environmental regulation. Therefore, it has important implications for the formulation of future environmental legislation as a whole.

A survey of companies has shown that companies have been encouraged and obligated to implement packaging measures that otherwise would not have been used. The Regulations have raised awareness of environmental regulations within companies and there has been a

substantial number of minimisation, reuse and packaging material substitution initiatives since the Regulations came into force. At present, the survey has shown that the Regulations have not been an important driver of environmental programmes within companies and that there are more significant drivers for organisations such as environmental management system implementation and economic factors. That said, most of the organisations' environmental programmes were in their infancy and decisions appeared to be made more often than not on economic grounds.

The most significant observation that can be drawn from the survey is that to date the Regulations have not caused an increase in recycling. It may be that as the targets rise, PRN prices will rise and the amount of recycling undertaken by companies should in theory increase. However, if there are no direct incentives for companies to recycle their own waste then it may simply become a struggle for companies to obtain PRNs. One way in which this could be achieved is for companies to have first refusal on the PRNs associated with the packaging waste that they are recovering and recycling. Only when the targets rise enough to begin to exert pressure on the PRN market, however, will there be the potential for companies to begin to implement environmentally sound programmes with regards to packaging waste. Research needs to be carried out to determine whether the Regulations do in fact have such a desirable effect over the next few years, and environmental performance measures have an important role to play in this process. In conclusion, a model for the application of EPIs to guide policy makers in the formulation of environmental legislation has been developed. This is particularly important for the assessment of the implications for future producer responsibility legislation.

# Chapter 6

## Future Work

## 6. FUTURE WORK

The development of performance indicators should be tracked in the environmental management systems of service-based organisations and the way in which it is influenced by existing and future environmental legislation assessed. The model for environmental performance measures within a service-based organisation developed in this work should be applied and tested within any organisation that is implementing ISO 14001. Once ICL produces its first Corporate Environmental Report (CER), an assessment needs to be carried out of the EPIs capacity to meet ICL's stakeholder and reporting requirements, including benchmarking against similar organisations. Research has shown that the comparative risk process shows promise as a tool for democratising selection and implementation of environmental priorities (Feldman et.al. 1999). Therefore, research is needed on how to improve stakeholder dialogue throughout the environmental priority-setting process. This is an area that has not been considered by companies within the IT sector who have so far taken a very insular approach to environmental performance evaluation and priority-setting.

One particular area of interest for future work should be the assessment of the impact of any changes in the PRN financing system and how these may alter the environmental performance of the Regulations. The UK will have to rapidly increase the targets in order to meet the current EU targets. The target rises that are anticipated from the review of the European Packaging and Packaging Waste Directive will also potentially exert pressure on the UK to tighten control over its packaging waste. A future survey could be carried out to investigate how such changes to the PRN system and the increasing rise in the targets have changed the following factors with time:

- the way in which companies measure their environmental performance
- the perceptions held about the effects of the Regulations
- the indicators that are developed
- the changes in registration status
- the changes in perceptions caused by differing registration status
- the cost of compliance
- recycling and recovery data
- material substitution and reuse initiatives

- other indicators such as energy consumption as control factors of changes in environmental programmes
- necessary/ lack of incentives

The way in which legislative policy is formulated can benefit from the data provided by such studies. It will be useful if the impacts of other environmental legislation can be assessed in a similar way as and when it is introduced. The window of opportunity is limited since the increasing quantity of, in a sense, overlapping legislation will eventually mean that the ability to differentiate between what is or is not effective will become increasingly difficult. The EPIs that an organisation adopts reflect what they perceive to be the most important measures environmentally, economically and legislatively whether according to formal risk assessments or intuitive managerial skill. Such EPIs will, in addition, be based on the environmental programmes that pose the least problems in terms of organisational constraints and the greatest potential for success.

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## Annex 1

Publications: Three Papers

**Annex 1**

**Appendix 1**

**Paper I**

**Developing environmental performance indicators for an information technology systems and services company**

**Developing environmental performance indicators for an information technology  
systems and services company**

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**Abstract:** Improved measurement of environmental performance should be part of the regular business activities of any organisation. However, it requires a set of environmental performance indicators (EPIs) that can be applied to the particular organisation's unique functions and culture. This paper presents the development of EPIs within an information technology systems and services organisation, ICL plc. (International Computers Limited). EPIs have been developed, based on the company's environmental policy and targets, and a framework for their measurement outlined. ISO 14001 certification requires that certified companies demonstrate continuous improvement in their environmental performance and EPIs have been developed in order that the company can demonstrate such improvements year on year. The results show that a simple and logical methodology can be applied to identify EPIs that are compatible with ISO 14031. Finally, a risk assessment methodology is applied to demonstrate the effects of business constraints in the decision-making process regarding environmental programmes.



**Key words:** Environmental performance indicators; ISO 14001/ 31; Environmental management systems; risk assessment; decision-making.

**Biographical notes:** Gail Collins was awarded a BSc degree in Applied Chemistry from Kingston University and an MSc in Environmental Pollution Science with Legislation and Management from Brunel University. She has completed a four year Engineering Doctorate (EngD) in conjunction with Corporate Environmental Affairs at ICL plc. and the Centre for Environmental Research at Brunel University. Her research has been in the field of environmental regulation and corporate environmental management.

Dr Sue Grimes is Head of the Centre for Environmental Research at Brunel University, University Reader, and Director of Environmental Masters courses. Both an experienced research supervisor of industrial and academically-based projects and a senior management consultant, Dr Grimes has supervised more than 50 research students studying for PhD and EngD degrees and has over 100 published papers in refereed scientific journals.

Joy Boyce is Head of Corporate Environmental Affairs at ICL (International Computers Ltd.).

## **1 Introduction – Drivers for Environmental Performance Measures**

As in a range of other industries, environmental performance within the information technology sector has developed increasing importance in recent years. This is due to companies recognising the impact their businesses are having on the environment. Increasingly, stakeholders are not only showing interest in the improvements a company is making in its environmental performance but are also demanding information that demonstrates environmental best practice and management. Such interest by stakeholders derives from the fact that those companies which successfully develop environmental performance evaluation methods will improve their competitiveness and indicate in a broader

sense their management and business performance abilities. Associated with this demand for improved environmental performance is the need to report or communicate the levels of environmental performance being achieved. This is especially so for companies implementing ISO 14001 where continuous improvement in environmental performance is a requirement and can only be demonstrated via the evaluation and measurement of performance<sup>1</sup>. It is often the case that an organisation's decision to produce an environmental report promotes the realisation that clear measures of environmental performance are required for environmental improvements to be demonstrable. The pressure on companies to produce environmental reports is set to increase with statements by Michael Meacher, the UK's Environment Minister, indicating the intention to make corporate environmental reporting mandatory. The requirement under ISO 14001 to demonstrate continuous improvement in environmental protection is adding to the pressure on companies to develop sound measures of environmental performance. This is because companies will need to maintain their certification year on year, thereby protecting the investment made. The environmental performance evaluation standard, ISO 14031, is currently in draft format and it provides guidelines to companies that are developing their own set of EPIs<sup>2</sup>.

The 1990s have been called by some the decade of the merger and this is reflective of the increasing rate of change in the size of many organisations. Companies are constantly changing both their shape and their business functions. For example, ICL has moved towards the provision of services, away from manufacturing and is now becoming an e-business. These organisational changes result in the need for environmental performance measures that are related to business size and function and as such can reflect the real rate of environmental improvements. Furthermore, the increasing pressure from legislation has led to many organisations having to measure previously unaccounted-for environmental impacts. A good

example of this has been the UK Producer Responsibility Obligations (Packaging and Packaging Waste) Regulations 1997 that has required extensive data provision on packaging-related material consumption by material type. It is arguable that without such legislation, companies would not adopt an environmental performance indicator for packaging materials because of the lack of previously available data and the extensive resources that are required to implement the necessary measurement systems<sup>3</sup>. There is also the perception that packaging is benign and, therefore, not an environmental problem. Finally, drivers with a direct economic link or consequence that can be equated to demands for improved performance clearly exist across industry. An example of this is that by optimising logistics, a company can reduce its transportation impacts thereby minimising the associated costs and environmental impacts.

This paper seeks to outline a methodology that has been devised for the development and risk assessment of environmental performance indicators in a service-orientated business and the integration of such measures into an ISO 14001 compliant environmental management system

## **2 Environmental Indicator Selection**

One way in which a company goes about identifying performance indicators is on the basis of reviewing currently available Corporate Environmental Reports produced by a range of other industries<sup>4,5</sup>. In this way, a company can identify which indicators are relevant to its own environmental impacts on the basis of which categories of indicators are in common usage. Increasingly, however, it is being shown that indicator selection and the development of performance evaluation measures is a complex process that requires careful planning and a structured approach<sup>4,5</sup>. If a company relies on identifying indicators on the basis of those used by others, the initial process of identifying significant aspects may be inadequate. This could

result in a lack of emphasis on the measurement of important aspects or worse still, an aspect being omitted entirely. The identification of significant aspects demands an understanding of the following:

- Risk of environmental impacts on the surrounding areas
- Risk of environmental impacts evolving from products and processes
- Risk of environmental impacts of suppliers
- How the above are inter-related and the implications for collating/aggregating the significance of different business activities

In addition, not only do the environmental aspects need to be understood but the measures have then to be re-prioritised according to drivers such as legal or stakeholder pressures and resource limitations. In this context, consideration needs to be given as to how and where the data need to be gathered and how the data can be used internally to provide the necessary tools for enabling continuous improvement and its effective communication.

According to the ISO 14031 guidelines on environmental performance evaluation there should be three basic types of indicator, Environmental Condition Indicators (ECIs) and Environmental Performance Indicators (EPIs) which is then further divided into Operation Performance Indicators (OPIs) and Management Performance Indicators (MPIs). Figure 1 shows the relationship between the three major categories of indicator and their functionality within the sphere of the organisation, the environment and environmental performance evaluations (EPE). ISO 14031 additionally identifies five types of quantitative measure, defined in terms of the basis of their calculation. These are: direct, relative, indexed, aggregated and weighted. Direct data are basic data or information such as tonnes of waste

produced. Relative measures are direct data that have been related to another parameter such as tonnes of waste produced per tonne of product manufactured. Indexed data are data that are converted into units or to a form that relates the information to a given baseline or standard. This indexed type of quantitative measure is often used to represent air emissions data. Aggregated data are data of the same type that have been collected from different sources and added together. Finally, weighted data are data that have been modified by applying a factor relating to their significance<sup>2</sup>. These definitions should hopefully facilitate a common usage of terms as to date there has been a substantial number of differently defined and used terms for various EPIs.

A recent study carried out by James and Bennett<sup>6</sup> provides a good description of the relationship between the ISO 14031 model and current practice. The study showed that only a small majority of those companies surveyed used any kind of ECI, the most common being biological oxygen demand (BOD) and (COD) indicators of the impacts of effluents into watercourses. This is unsurprising as they are, in most instances, the most difficult to measure. The study also showed that most EPE activity is still focused on OPIs and particularly resource, emissions and wastes indicators. This is probably because the aspects that they measure are highly visible and the necessary data are usually readily available within the organisation. It is foreseeable that there will be significant further developments in the types and applications of EPIs in future years. Standardisation of EPIs for the purposes of comparability is a complex issue to address. It is thought that standardisation should not mean that all companies report on the same information but that the overall structure of the documents should be harmonised and the main classes of indicators defined<sup>7</sup>. ISO 14031 has been criticised for not meeting the need for this type of standardisation and for not addressing implementation issues, i.e. how key indicators might be measured<sup>8</sup>. As such, although its

intentions may be complementary to, it is lacking in its more functional support of the EMS standard ISO 14001.

Once EPIs have been identified and agreed within an organisation, standard methods for their measurement need to be determined and communicated across the organisation. As there is no description in the ISO 14031 standard of how various EPIs may be measured, individual companies may adopt their own methodologies and there are various studies showing different approaches used<sup>4,5</sup>.

### **3 Environmental Performance Indicators for an IT Systems and Services Company**

In order for ICL to assess its environmental performance, EPIs have been identified in this study, based on the Corporate Environmental Policy and Targets as set in 1994/7<sup>3</sup>, that are compatible with ISO 14031. On the basis of this the indicators have been assessed in terms of those which are currently measured and those for which measurement systems will need to be set up. Table 1 has been constructed to show the drivers behind different indicators and which measurement systems will, therefore, be feasible to implement. A good example of stakeholder pressure and the driver for best practice is that one of ICL's customers requested a statement concerning ICL's readiness to comply with the EU Directive on Waste Electrical and Electronic Equipment (WEEE). ICL was able to respond on the basis of not only its participation in lobbying the EU on the Directive, but also on the basis of the EPIs it has established, particularly over the last five years concerning the methods for collection, take-back, disassembly and recycling of end-of-life IT equipment. These EPIs include both operational and management performance indicators. In essence ICL has set up a stringent environmental auditing programme of its recycling partners which includes a set of

performance criteria against which ICL's own internal take-back and recycling operations are also measured. They have set up a certification scheme for recyclers who are appointed ICL-approved recyclers or ICL-approved remanufacturers together with a programme of continuous improvement and re-auditing of recycling partners.

Once EPIs had been identified and agreed within ICL, a standard method for their measurement is determined and communicated across the organisation. This often involves the use of information systems to collate all the information but has to be assessed manually and recirculated back to the origin to gain validation of the data. The overall process used at ICL is outlined in figure 2 and highlights the drivers and barriers involved in such a process. The process can be seen to be a generic one and may well be applicable to any industry. The drivers and barriers may be so intense that they may cause changes to the core business functions of an organisation which in turn would lead to a re-identification of environmental impacts and a new cycle of EPI identification and measurement systems implementation. One example of these effects might be the introduction of a levy on company parking spaces leading to a move towards hot-desking and home working. Another example might be the introduction of a lead ban whereby electronic and electrical goods producers would have to ensure that engineers were not using Pb solder and that no components contained Pb etc.

#### **4 Risk Assessment and Decision Making**

The final stage for an organisation to evaluate its environmental performance and to make decisions about its environmental improvement programmes, is to carry out a risk assessment of the main categories of EPIs on the basis of legal, economic and environmental risk. Table 2 shows how each environmental impact is rated out of five for each of these three factors,

with 0 being no associated risk and 5 being high risk. The fourth column represents the adjustments necessary for the constraints on, or barriers to, carrying out related environmental activities. This includes costs, manpower, longevity of projects, senior 'buy in', and the culture of the organisation that includes both the values of the organisation and its mode of operation. In the case of environmental incidents, the score relates to the level of uncertainty and/or lack of control.

The scores given in the table correspond with ICL's EPI risk assessment. For example, energy consumption has a high risk factor due to the company's high level of environmental impacts both in the building's energy use and in the use of IT. The constraints are relatively low which means that overall the risk factor is 1 and action should be taken to improve environmental performance relating to energy consumption. As a service-based organization the risk factor attached to high risk/ large suppliers is predictably high and emphasis should be given to this area when drawing up environmental programmes. A good example of how ICL has addressed this is through the auditing of its waste electrical and electronic equipment recyclers. The company ensures that the recyclers it uses meet certain environmental criteria through its Approved Recycler scheme. Both packaging and waste electronic and electrical equipment have high risk factors due to both high legislative and associated financial risks and high environmental impacts. Transport is particularly high in the various risk assessment categories but it is also extremely high in the level of constraints imposed. This is because its business depends on business travel and to reduce business mileage directly may be damaging to business activities. However, there are areas within the transport category, such as commuter travel which may be open to some indirect influence such as encouraging the use of public transport to get to work etc.



## **5 Integration of Environmental Performance Measures into ISO 14001**

The difficulty with establishing environmental management systems for a service-based organisation is that it is at risk of producing what is essentially a facilities management orientated system. This arises because the most obvious environmental impacts at first glance appear to be those associated within the buildings in which the organisation operates. The impacts associated with the business activities of an organisation such as purchasing, provision of products and services, and transport are more difficult to identify and control, as they are more often controlled by contractors, sub-contractors, suppliers and customers. Over the course of this study, the flow of environmental information, environmental impacts and their measures has been tracked through the organisation. Figure 3 shows a model that has been produced to illustrate the key processes involved in an ISO 14001 certifiable environmental management system within a service-based organisation.

## **6. Discussion**

The development of environmental performance measures is an iterative procedure. It is beneficial to start with simple measures and to extend the measures over time as collection and analysis becomes easier. Furthermore, the passage of time can highlight the more useful, or less effective, measures. The integration of environmental performance measures is not only dependent on what areas are suitable for processes and procedures to be set up but are also reliant on the commitment and motivation of all those involved in making any improvements. This can only be achieved by good communication, participation, and rewards for good performance. A bedrock for environmental measures is that they have their own

place in the EMS documentation, above and beyond the minimum requirements of measurement and monitoring within framework standards such as ISO 14001.

The most important part of the analysis is to present the results in such a way as to show where improvements can be made and where efforts should be concentrated. The ultimate test of performance measures is their effectiveness in informing against, and aiding the achievement of, the objectives and targets. In a service-based organisation these processes are of a very different nature to those in manufacturing organisations and require different emphases especially with regards to indirect impacts via suppliers and the emerging importance of energy consumption and transport as prioritised environmental impacts.

## **7. Conclusion**

The more varied the environmental performance indicators an organisation develops, especially those that relate to best practice, cost reduction and stakeholder interests, the more opportunity it has to demonstrate itself to be a leading edge company that is both attractive to its stakeholders and has strengthened its competitive edge. In order to develop varied and feasible indicators a whole host of different barriers and drivers need to be addressed and integrated into the decision-making processes. The management of change is becoming an important issue for many businesses in today's economic climate and one that environmental managers need to address. In the case whereby the drivers or barriers identified have a large impact on an organisation to the extent where changes to core business functions need to be made, the EPI decision-making process has to be revisited. The example of ICL plc. has shown that where a company does not manufacture, but is the provider of services, supply chain issues have to be addressed closely in the development of EPIs for the purposes of

developing any environmental management system, ISO 14001 certification, and ensuring legal compliance.

## **Acknowledgements**

This work was supported by a grant from the Engineering and Physical Sciences Research Council, UK. The authors wish to thank all the people that supported this work through their advice and information, especially the Corporate Environmental Affairs Department, International Computers Limited (ICL plc.) and the Centre for Environmental Research (CER), Brunel University.

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**Table 1: Table showing EPIs and Measurement Systems Feasibility**

Environmental Management Area	Environmental Performance Indicators	Drivers of Actual EPIs	Drivers of Potential EPIs	Units of Measure
Life Cycle of Product	<b>Design</b>			
	Number of new products with low energy consumption and increased processing power		R S	
	Number of products altered for design for disassembly		R S (L)	
	Number of products utilising recycled plastics		R S	
	Number of hazardous components eliminated		R S L	
	<b>Distribution and Packaging</b>			
	Weights of packaging by material type recycled (paper/card, steel and plastics)	L (R)		kg
	Percentage packaging recycled of total waste produced	R		%
	Weights of recycled packaging used	L	R	kg
	Weights of reusable pallets used	L		kg
	Number of procurement partnerships for reuse	L Sk C		
	Total weights of packaging used	L (R)		kg
	Number of CD-ROMs used for software and documentation.		R	
	<b>End-of-Life</b>			
Weights of equipment taken back for recycling, reuse and refurbishment	L (R)		kg	
Weights sent to landfill	L (R)		kg	
Weights of equipment recycled from ICL's operating companies across Europe		L (R)	kg	
Number of improvements to suppliers' recycling processes mandated	B Sk & (L R)			
Number and best practice rating of ICL Approved Recyclers	B Sk & (L R)			
<b>Batteries</b>				
Number of batteries recycled			L R	
Accreditation and Auditing	Number of ICL sites and businesses ISO 14001 certified		I	
	Number of sites internally and externally audited	R, C & I		
ICL's Suppliers	Number of suppliers ISO 14001/ EMAS certified		R I	
	Number of suppliers with an Environmental Policy		R I	

**Table 1. Continued...** (Table showing EPIs and Measurement Systems Feasibility)

Environmental Management Area	Environmental Performance Indicators	Drivers of Actual EPIs	Drivers of Potential EPIs	Units of Measure
Accreditation and Auditing	Number of ICL sites and businesses ISO 14001 certified Number of sites internally and externally audited	R, C & I	I	
ICL's Suppliers	Number of suppliers ISO 14001/ EMAS certified Number of suppliers with an Environmental Policy		R I R I	
Energy Efficiency	Quantity of energy consumption (electricity, gas and oil) on office sites Quantity of energy consumption (electricity, gas and oil) on warehouse sites	C R (L) C R (L)		kg NO <sub>x</sub> kg SO <sub>x</sub> kg CO <sub>2</sub>
Transport	Numbers of vehicles with catalytic convertors Number of air and road miles saved by video conferencing facilities Business miles travelled Logistics (of product) miles travelled	R B R (C) R Sk & (C)	R Sk C	kg CO <sub>2</sub> kg CO <sub>2</sub> kg CO <sub>2</sub>
Elimination of Waste	Weight of waste to landfill Quantities of water consumption at metered sites		R C R C	kg '000 m <sup>3</sup>
Recycling of Consumables	Weights of cardboard recycled Weights of plastic recycled Weights of paper recycled Weights of plastic cups recycled Number of laser printer units recycled	L (Sk) L (Sk) R (Sk) R (Sk) R (Sk)		kg kg kg kg
Training and Awareness	Number of environmental training programmes across Europe Number of environmental action awards given Number of suppliers supported through EMS implementation Number of schemes involving community action for the environment		Sk (R) Sk (R) Sk (R) Sk (R)	
Costs	Environment Agency Fees Environmental Taxes (e.g. Climate change levy) Running of Environment Affairs Dept. Regulatory Compliance Programmes	L L L	L (Sk) R (Sk)	£ £ £

**Key to Drivers:**

- |    |                                   |      |                            |
|----|-----------------------------------|------|----------------------------|
| R: | Corporate Environmental Reporting | L:   | Legal Requirements         |
| C: | Cost Reduction                    | I:   | Specific to ISO 14001      |
| S: | Standards (actual or de facto)    | Sk:  | Stakeholders               |
| B: | Best Practice                     | ( ): | Indicates secondary driver |

**Table 2 EPI Risk Assessment**

<b>EPI Category</b>	<b>Legal</b>	<b>Economic</b>	<b>Environmental</b>	<b>Constraints</b>	<b>Total</b>	<b>Percentage of Modulus Total</b>
Energy Consumption	1	3	4	-7	1	3%
Transport	2	2	4	-12	-4	-13%
Water	0	2	1	-5	-2	-7%
Waste	1	3	3	-7	0	0%
Packaging	4	3	3	-6	4	13%
Consumables	0	2	2	-5	-1	-3%
End-of-Life	5	5	4	-9	5	17%
<b>MPIs</b>						
EMS	4	4	4	-10	2	7%
Suppliers large size and/or impacts	3	4	4	-7	4	13%
Suppliers medium size and/or impacts	2	3	3	-7	1	3%
Suppliers small size and/or impacts	1	2	2	-7	-2	-7%
Environmental incidents	3	3	2	-8	0	0%
Community relations	0	3	3	-10	-4	-13%
<b>Modulus Totals</b>	<b>26</b>	<b>39</b>	<b>39</b>	<b>100</b>	<b>30</b>	

**List of Captions**

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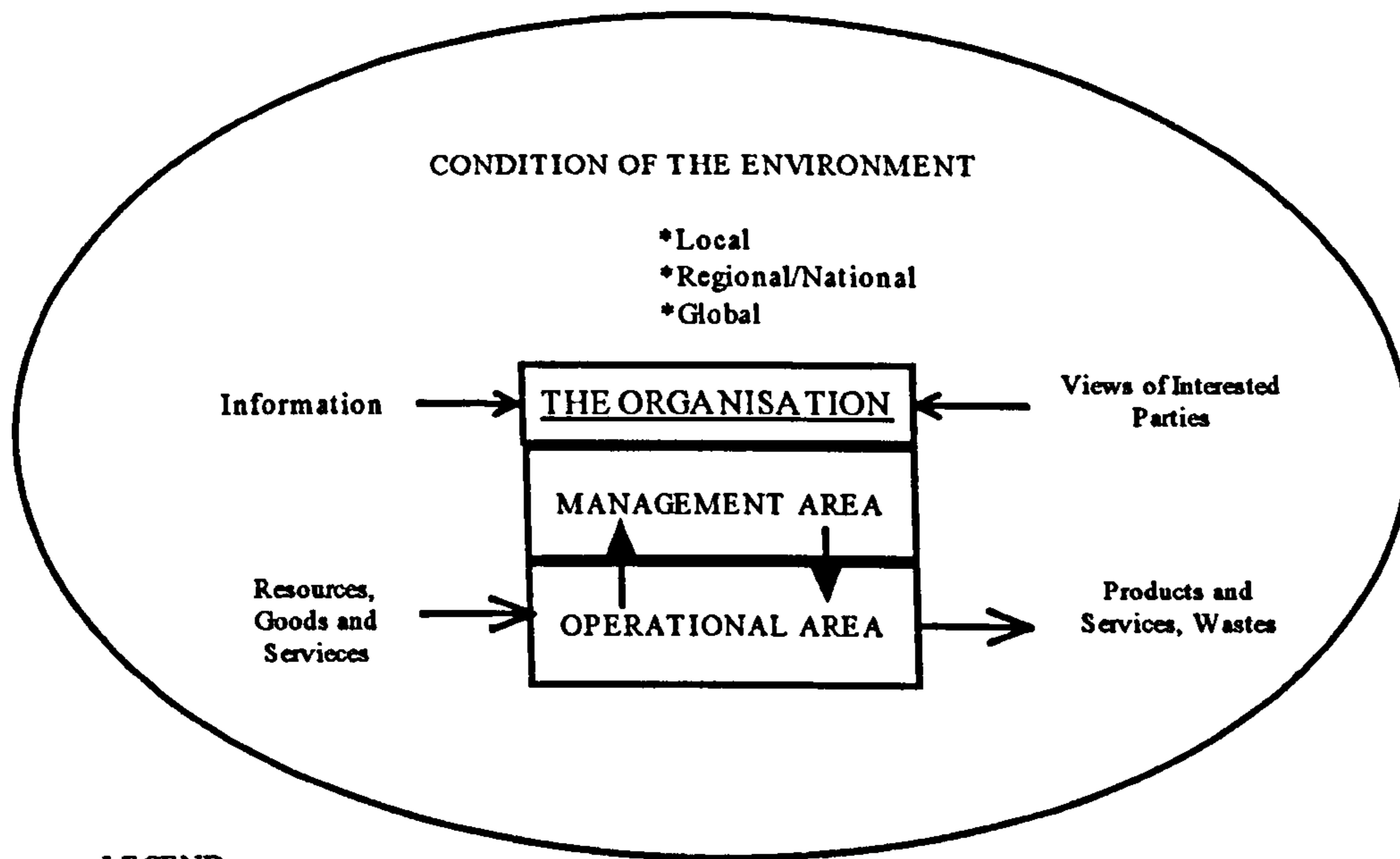
**Figure 1:** EPE Evaluation Areas and their Interrelationships

**Figure 2:** Approach to EPE Development

**Figure 3:** Elements of a Service-based Organisation's ISO 14001 Certifiable Environmental Management System

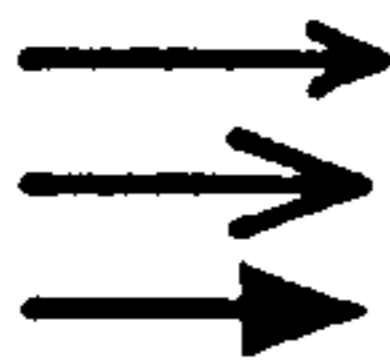


**Figure 1: EPE Evaluation Areas and their Interrelationships**



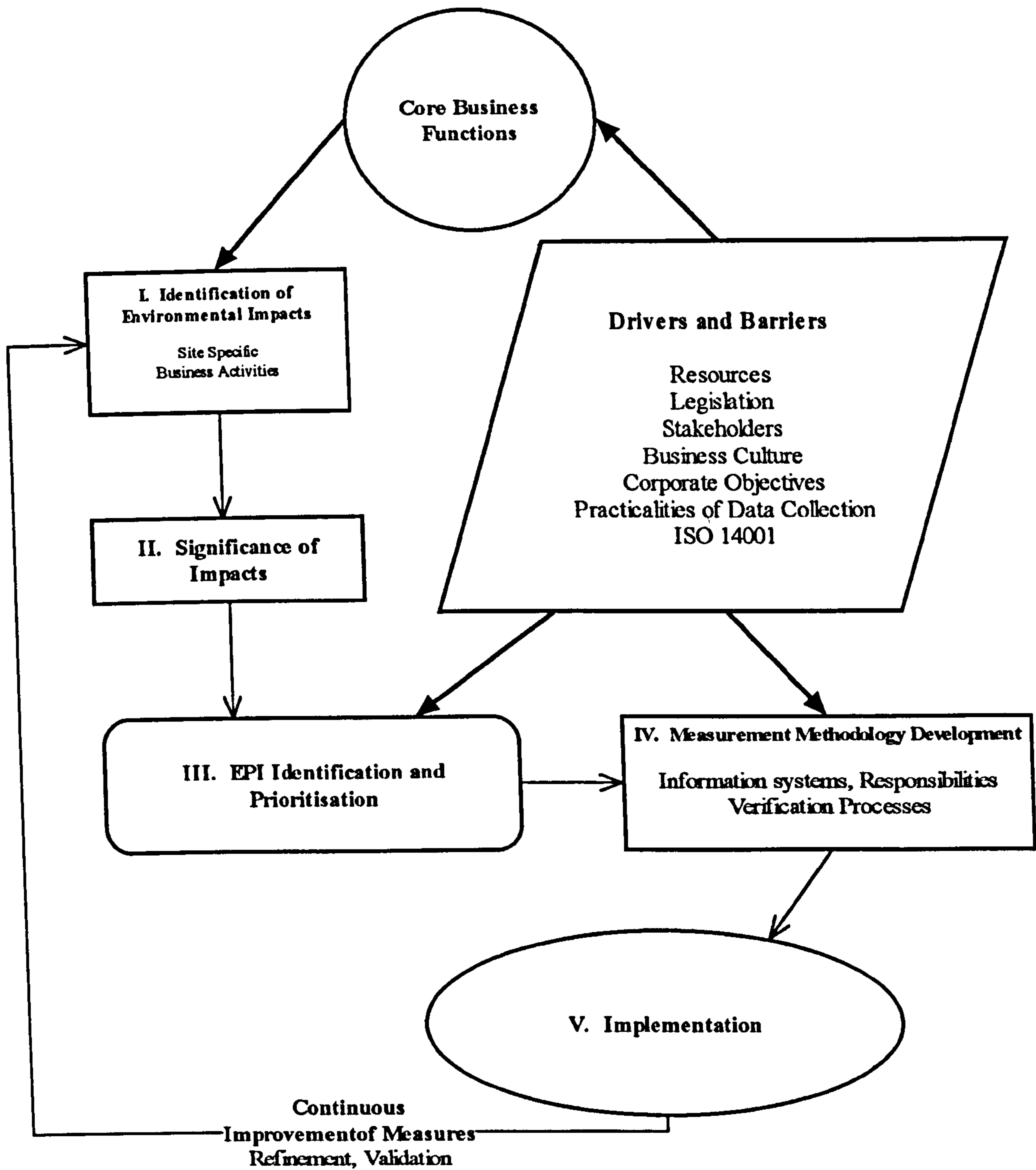
**LEGEND**

Information flows  
Mass and Energy Flows  
Decisions



Source: ISO/WD 14031.5 (1996)

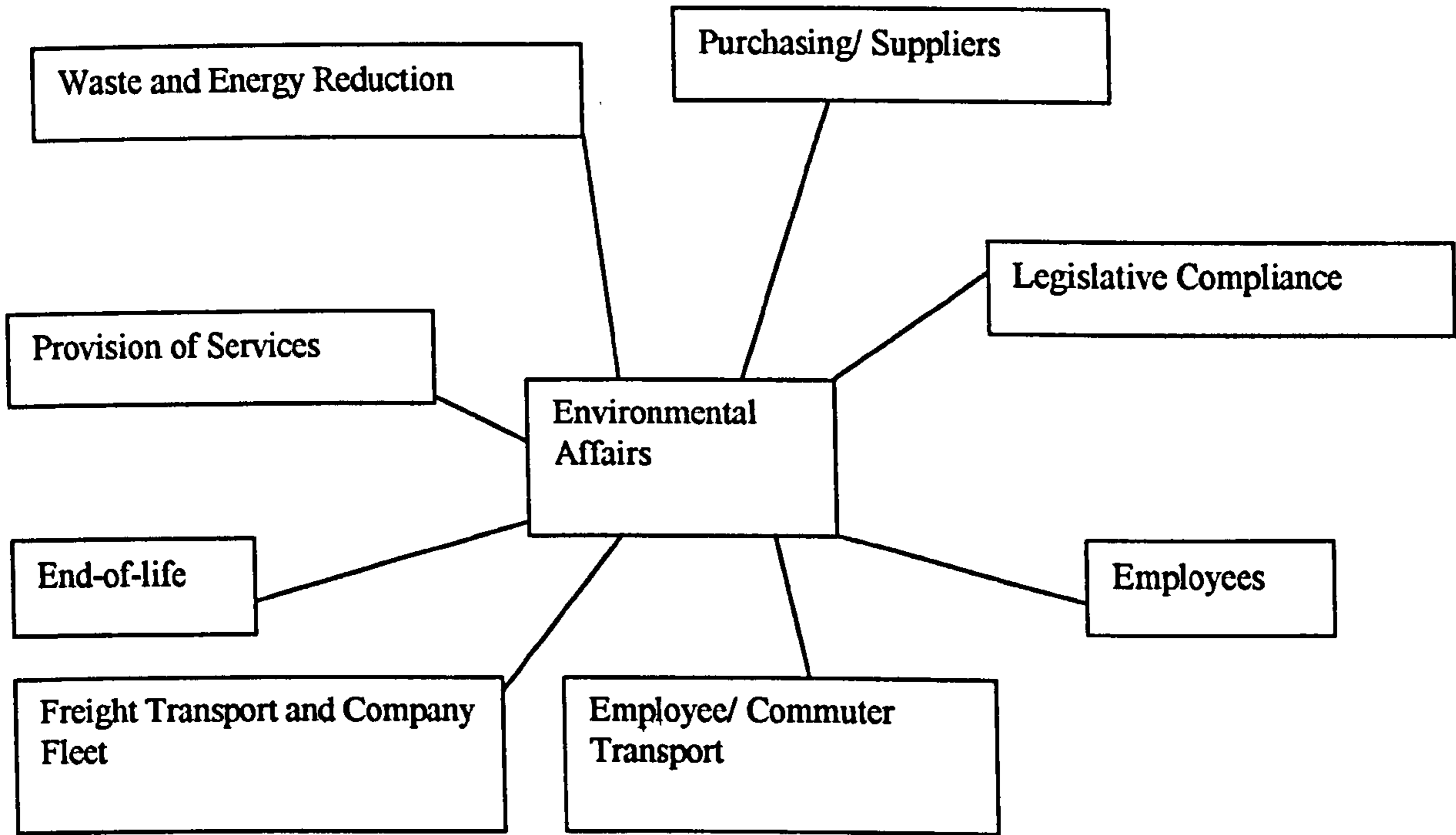
**Figure 2: Approach to EPE Development**



Key:

Process Flow →  
Pressures →

**Figure 3: Elements of a Service-based Organisation's ISO 14001 Certifiable Environmental Management System**



**Annex 1**

**Appendix 2**

**Paper II**

**The UK Producer Responsibility (Packaging and Packaging Waste) Regulations 1997 –  
A Methodology for Compliance**

**The UK Producer Responsibility (Packaging and Packaging Waste)  
Regulations 1997 – A Methodology for Compliance**

**Shortened Title: UK Packaging Regulations Compliance Methodology**

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**ABSTRACT / This paper provides a review of the UK Producer Responsibility Obligations (Packaging and Packaging Waste) Regulations 1997 (DETR, 1998a), including the two sets of amendments made to the Regulations in June 1999 (No.1) (DETR, 1999a) and December 1999 (No.2) (DETR, 1999b). Since the introduction of the Regulations in March 1997, all significant producers and users of packaging have become legally obligated to meet packaging waste recovery and recycling targets and to gather and report on complex data to the Environment Agency (EA) or Scottish Environmental Protection Agency (SEPA). Packaging is a key focus in industry as a result of increasing attention from legislators to regulate against its negative environmental impacts. This paper seeks to outline the**



regulatory requirements concerned with packaging and the current status implications for future policy formation and the producer responsibility approach to environmental legislation. It further proposes a compliance methodology that can be employed by any organisation that is faced with the onerous task of compliance with the Regulations, whether they join a compliance scheme or not. Joining a compliance scheme only displaces a company's liability and not the requirements for extensive information collection and analysis. The proposed methodology, based on a case study within a multinational organisation, shows how an organisation can achieve compliance and conserve valuable resources for improving its environmental performance.

**KEY WORDS:** Regulations; Legislation; Packaging; Waste; Environmental; Compliance

The UK Producer Responsibility Obligations (Packaging and Packaging Waste) Regulations 1997 were introduced in March 1997 to implement the EC Packaging Directive (94/62/EC). The Packaging (Essential Requirements) Regulations 1998 (DETR, 1999c) was a further regulatory measure to implement the EC Packaging Directive but the enforcement of these regulations does not fall under the Packaging Waste Regulations.

Packaging is a significant proportion of the household and industrial waste streams. It has been estimated that currently the UK uses around 11.7m tonnes of packaging per year and it is likely that between 4.5m and 5m tonnes of this ends up in the 111m tonnes annual waste stream. The UK recycled about 23% of household and industrial waste in 1996. The Regulations were introduced as part of European Union (EU) policy implementation and a national strategic plan in the UK to reduce the undesirably high level of waste sent to landfill having no value extracted from it (DETR, 1998b).

Here we present an overview of the regulatory requirements concerned with packaging and the current status implications for future policy formation and the producer responsibility approach to environmental legislation. Against this background a compliance methodology is proposed that can be employed by any organisation faced with the onerous task of compliance with the Regulations.

## Regulatory Requirements: An overview

The Regulations establish the 'shared approach' to producer responsibility favoured by industry. This means that each member of the packaging supply chain from the raw materials manufacturer to the final retailer/ seller accepts responsibility for the waste created or the environmental impacts occurring as a result of its production and supply. This responsibility is allocated according to specific obligations: firstly to register with the appropriate Agency (Environment Agency (EA) or Scottish Environmental Protection Agency (SEPA)); secondly to provide data on the quantities and types of packaging handled; and finally to recover and recycle a certain tonnage of packaging waste each year. The Regulations are aimed at encouraging businesses to recover value from packaging at the end of its life in line with the 'polluter pays' principle. Furthermore, they provide a cost incentive for obligated businesses. By reducing the quantity of packaging waste handled a company can reduce its cost of compliance. Unfortunately, this is not always an improvement for the environment as the Regulations define a company's obligations on the basis of the weight rather than the environmental attributes of packaging used.

The EC Directive has imposed packaging recovery and recycling targets on member states. In the UK these targets are to recover between 50% and 65% of packaging waste and to recycle between 25% and 65% of packaging waste by 2001. The UK Government set interim recovery and recycling targets on an increasing scale to ensure that it meets the EC Directive targets by 2001 (Table 1).

The Regulations place an obligation on businesses to recover and recycle specific tonnages of packaging waste materials which they handle in one year and to certify that this recovery and recycling has been carried out. The Regulations apply to companies that: carry out certain activities within the packaging supply chain or have those activities carried out on their behalf by a third party; own the packaging on which these activities are carried out; supply to another in the packaging supply chain or to the end-user; handle more than 50 tonnes of packaging or packaging materials in a year; and had an annual turnover of at least £5m in the years 1997 to 1999 and at least £2m from 2000. The activities to which this refers are: raw material manufacturers of packaging; converters of packaging materials into packaging; packer/ fillers of products into packaging; and seller/ retailers of packaging to the end-user. Additional categories include importers, exporters and 'secondary producers' (a packer/ filler or seller/ retailer of secondary or tertiary packaging). Packaging can comprise of primary packaging (packaging in direct or immediate contact with products), secondary packaging (packaging surrounding a number of similar products), or tertiary packaging (outer transit packaging, e.g. pallets).

Packaging is defined as 'all products made of any materials to be used for the containment, protection, handling, delivery and presentation of goods, from raw materials to processed goods, from the producer to the user or the consumer'. Packaging materials are defined as

‘materials used in the manufacture of packaging’. Packaging materials are set out in the Regulations to include paper/ cardboard, plastics, aluminium, steel and glass. Wood and other packaging were included for reporting purposes from the introduction of the Regulations but there is a requirement for companies to include wood in recovery obligations from the year 2000. Even though there will be no specific recycling target for wood packaging, wood recovery and recycling can be used to offset a company’s overall recovery obligations.

Obligated businesses can choose whether to register individually with the appropriate agency (EA or SEPA) or to register with a compliance (otherwise known as collective) scheme. Failure to register is an offence. The fees for companies registering with the EA or SEPA were £750 in 1997 and 1998 and were increased by 27% to £950 in 1999 (DETR, 1999b). Companies that register with collective schemes have to pay membership fees and administration charges in accordance with the scheme with which they register. At present the fee for joining a compliance scheme is calculated on the basis of the numbers of members in the particular scheme. Larger schemes being able to provide big discounts to their members is arguably unfair on smaller schemes that find it difficult to increase their membership as a result (European and Packaging Waste Law, 2000). Therefore, this particular issue of compliance scheme fee structure is currently under consultation.

Part of the registration process is to provide data on packaging flows by material type throughout the obligated company for the previous year. Data requirements are extensive and include the quantities of packaging materials handled by weight and by the activities carried out on them. In 1997, the data submitted for 1996 had to be a ‘reasonable estimate’ of

packaging handled, 1997 and 1998 data had to be submitted by 1 April. For 2000 data, the metrics have to be 'as accurate as possible' and submitted by 7 April (DETR, 1999b).

An obligated company must calculate its recovery and recycling obligations by first identifying the activity it performs on the packaging and then applying various activity percentage calculations to its data. Each activity is allocated a percentage figure under the Regulations. These reviewed (DETR, 1999b) activity percentages (Table 2) are different for each part of the packaging supply chain. So for example, a company whose main activity is making cardboard boxes, as a convertor, would have 10% responsibility on any packaging that it handles. The exceptions are if a company imports packaging on which it would have 100% responsibility or where it handles transit packaging on which it would have an 85% responsibility. Packaging that is exported is exempt from the Regulations as it is not entering the UK waste stream and so carries no obligation. Some businesses may carry out more than a single activity on its packaging, for example it may repack products and sell them to an end-user in which case the packaging would carry both activity percentages on that packaging (37 + 48 = 85%).

Each obligated business must calculate the percentage of packaging that it must recover and the percentage of each material type that it must recycle using the following formulae:

Recovery obligation = [Obligated packaging handled] × [Activity obligation] × [UK recovery target]

Recycling obligation = [Obligated packaging handled] × [Activity obligation] × [UK recycling target]

The calculations are carried out on the quantity of packaging handled by the company in the previous year. The activity obligation is selected from the activity percentages given in Table 2 and from the reviewed (DETR, 1999a) recycling and recovery targets for the UK given in Table 1. Recovery refers to any recycling, energy recovery or composting and recycling means the reprocessing of waste materials for the original purpose or for other purposes. The recycling obligation is calculated for each packaging material type and forms part of the overall recovery obligation.

The final regulatory requirement is for obligated businesses and schemes to write to the relevant agency by 31 January following the end of the calendar year in which it is obligated, confirming that it has recovered and recycled the necessary tonnages of packaging waste. The Certificate of Compliance, as it is known, must be issued by an approved person, such as a company director or partner and should combine details of what their recovery and recycling obligations were in that year with a statement that they have been fulfilled. This statement must be supported by evidence of compliance for which the most accepted form is 'Packaging Waste Recovery Notes' (PRNs). The PRN was primarily introduced to provide obligated businesses with a means of demonstrating compliance but they quickly had a commercial value attached to them. Packaging waste reprocessors need to be accredited by the EA or SEPA to issue PRNs for the amount of packaging waste that they have recovered and recycled. Obligated businesses and compliance schemes can purchase PRNs from accredited reprocessors in order to discharge their obligations. It is currently legitimate for a business or compliance scheme to provide PRNs as evidence of compliance that are not from the recovery and recycling of its own packaging waste.

## Current Developments and Future Policy Implications

Data on the numbers of obligated companies are at present seemingly unclear, the number has been reported to have apparently risen sharply from 3400 in 1996 (DETR, 1998b) to 9020 in 1998 (DETR, 1999d). The number of registrations was 4011 in 1998 (DETR, 1999d) rising to 4250 in 1999 (Gaffney, 1997). This year the Regulations have reduced the threshold test for obligated businesses down from at least £5m turnover and over 50 tonnes packaging waste handled to at least £2m turnover and over 50 tonnes packaging handled. As of 4 April 2000 the Environment Agency had received 590 new registration requests for application forms; the majority of which represent new businesses of between £2m and £5m turnover (although some of these new registrants may be companies moving from compliance schemes to individual compliance or even businesses that should have been registered already). This figure is substantially lower than the DETR estimate of the additional number of businesses likely to be obligated in 2000, with threshold tests of over £2m/ 50 tonnes, being between 1,870 and 4,230 (DETR, 1999e).

It is clear that industries' response to the Regulations has been that of universal criticism and a lack of compliance. By April 2000 there had been 8 prosecutions under the Regulations. Businesses that have failed to register have faced fines of up to £10,000 plus costs (Gaffney, 1997). From 2000 the Regulations require that data provided to the Environment Agency should be as accurate as is reasonably possible. In 1998, the Environment Agency calculated that approximately 80% of companies had incorrectly calculated their obligations and, in addition, had under-reported by an average of 15%. The main problem areas have been identified as being where companies did not take account of imports or where packer/fillers failed to pick up the seller obligation on transit packaging (European and Packaging Waste

Law, 2000). The Environment Agency has sent a clear message to obligated business to expect rigorous auditing in the year 2000.

There are real concerns that the UK is not on course to meet its recovery target with a current recovery rate of between 36% and 37% (DETR, 1998b). After the DETR has assessed the packaging data for 1999, the 2001 targets are expected to be increased further in order that the UK can meet the EU targets. The Environment Agency is pushing for a 60% recovery obligation in order to cover those companies that are exempt (European and Packaging Waste Law, 2000). In addition, the European Directive on Packaging and Packaging Waste is currently under review and it is likely that targets will rise in 2002.

In the summer of 1999, the UK reported packaging arisings and recycling data for 1997 to the European commission (as the EC requires all member states to report this information). It estimated that 7.75 million tonnes of packaging was placed on the market in that year, based on the data submitted to the Environment Agency by obligated companies and compliance schemes and the inclusion of an extra 10% to cover those businesses that are exempt because they fall below the threshold test. However, a further report from the DETR based on estimates from the packaging material organisations (MOs) and compliance schemes, at around 10.24 million tonnes (ENDS, 1999). There is no way of knowing where this gap of 2.5 million tonnes is coming from although there are two possible causes. One is that there may still be a number of companies that have not registered that should have done so by now and the second is that it is likely that the shortfall reflects the packaging that is far more difficult to account for.



Two new requirements were introduced under the second set of amendments to the Regulations. The first requires sellers to provide the necessary information to users of packaging about the methods of reuse, recovery and recycling of packaging and packaging waste. This provision was introduced to implement Article 13 of the European Directive. The second permits producers that are using reusable packaging to spread their obligations over four years. The difficulty here for producers is that reuse is extremely difficult to prove. Furthermore, the fact that the Regulations encourage companies to switch to lighter materials means that reuse is often the least preferred option. For example, a chemicals' producer may be able to use glass jars for transporting its liquids within cardboard boxes or a lighter alternative of polystyrene that is more efficient in drop tests. Although the more environmental option may be to use glass bottles that can be reused and cardboard that has a lower environmental impact on disposal, the company is far more likely to use polystyrene because it is cheaper under the Regulations to do so.

In addition to these changes the amendments to the Regulations included the requirement for obligated companies to use the simplified data form produced by the Environment Agency and a requirement on the Environment Agency to publish details of its monitoring policy from 2000 onwards. Finally, the complex wholesaler obligation, whereby producers that sold to exempt sellers (i.e. those below the threshold test) picked up the seller obligation, has been removed.

The Environment Agency has issued its second set of statutory guidelines (in respect of evidence only) for accredited reprocessors. Within the new guidelines, reprocessors are to only issue PRNs to obligated producers, compliance schemes and their agents and to provide them with first refusal on PRNs on their packaging waste. These measures are necessary to

protect those making the effort to collect and recycle their packaging waste. Furthermore, reprocessors must now submit an annual return regarding the investment of PRN revenue. This has been a key factor in addressing the concerns voiced by industry that reprocessors were using PRN revenue to make windfall profits instead of investing in reprocessing infrastructure and calls for greater transparency in the PRN market. The PRN/ PERN (Packaging waste Export Recovery Note) Revenue Account is to identify the percentage PRN/ PERN revenue spent or future expenditure on increasing capacity, supporting the collection infrastructure and developing the market for recyclates. Carried-over PRNs at year end are to be retained by the Environment Agency and PRNs cannot be shared. Neither can PRNs be split beyond 31 January each year.

The market for tradable permits, PRNs, has been depressed due to the under-reporting and lack of compliance by many companies. It may also have been due to an underestimate of the original amount of recycling that had been taking place and the subsequent introduction of targets that were too low. Whatever the reasons for the low PRN prices it has had two main impacts. The first has been that the low prices (Figure 1), in combination with the fact that prices have been erratic, has led to a lack of investment in the necessary recovery and recycling infrastructure. Some reprocessors that have tried to plan and invest in new equipment etc. have gone out of business as a result of the unpredictability of the market. This has led in turn to the concerns over whether the UK will be able to meet the European targets in 2001. The UK Government has tried to address this issue through the introduction of a requirement on businesses, with a turnover of at least £5m and that have individually registered with the EA or SEPA, to produce a compliance plan (DETR, 1999b). The compliance plan is to outline the company's plans for PRN procurement along with any relationships that it has set up with reprocessors. The second impact of depressed PRN

prices has been that obligated companies have lacked any incentive to recover and recycle packaging waste because, at present, it is far more cost-effective for a business to landfill its packaging waste and buy PRNs.

The PRN system is currently under consultation to address several issues. Firstly, to examine whether the PRN system should be separated out from the reprocessor accreditation scheme. Secondly, to examine whether value should be attached to the waste rather than the PRN (so PRNs would have no value attached to them other than the cost of their administration). This is certainly the view of the Environment Agency who introduced PRNs along the same lines as waste transfer notes (Gaffney, 1997). Support for this is also voiced by members of the waste management industry who have highlighted the distortions in recyclate markets. Where packaging waste recycling has increased there has been a fall in the recycling of other materials such as newspapers (Conran, 1997). This substitution effect would not be of real concern if it were not for the fact that the tradable permit system has led to the subsidy of possibly less economically viable recyclate markets at the expense of more viable ones. The third issue to be examined in the consultation process is whether PRNs should be more closely associated with the waste. However, even if these changes are found to be advantageous, they are unlikely to be implemented before 2001 because of the possibility that the disruption would interfere with reaching the EC Directive's recovery and recycling targets.

With these increasing pressures, the challenge for obligated UK businesses is to minimise compliance costs, maximise control as the PRN market toughens and to extract value from their own packaging waste.

## Compliance Methodology

### Reporting Processes

Firstly, a company has to decide whether to join a compliance scheme or register directly with the Environment Agency. In 1998 there were thirteen compliance schemes registered in the UK: Biffpack, Cleanapack, Difpack, Jempac, Paper Collect, Paperpak Ltd., Pennine-pack, Properpak Ltd., Recycle UK, SWS, Valpak, Wastepack, and Wespak (1999d). Valpak, Biffpak (set up by Biffa) Cleanapack (set up by Cleanaway Ltd.) and Wastepack (set up by UK Waste) are open to all companies obligated under the Regulations regardless of what type of packaging they handle. The Dairy Industry Federation set up Difpak for the Dairy industry and Paperpak Ltd. was set up for the Paper industry. Additional schemes that have been set up are Firpac and Onyxpak.

Compliance schemes carry their member's legal liability for them, providing a safer route which 80% of companies opted for in 1999. However, there are a growing number of companies that are moving away from compliance scheme membership in favour of individual registration (Gaffney, 1997). It is debatable as to whether joining a compliance scheme actually diminishes a company's incentive to set up recovery and recycling programmes for packaging waste. This is due to the fact that compliance schemes provide easily accessible means with which to certify recovery and recycling, independently of any actual recycling activity being carried out by the company. In addition, businesses that join a compliance scheme still have to provide the extensive data required by the Regulations. Companies that take improving their environmental performance more seriously are arguably more likely to take the individual compliance route. For example, The Body Shop is recognised for achieving a high level of environmental performance and they have registered

individually with the EA. Research is being carried out by the author to investigate whether this is demonstrably the case and will form the subject of another paper.

As the Regulations treat groups as a single entity when applying the threshold tests, groups of companies do well to coordinate their efforts. The stages a company must go through in order to achieve compliance begin with defining what exactly constitutes packaging and scoping the organisation's operational divisions in order to identify which areas of the business, or subsidiaries should report packaging data in to the central/ corporate area of the company or in to the main responsible person(s). The corporate strategy within many large organisations has been to coordinate the compliance of identified business units or subsidiaries through to environmental departments. The Regulations allow for subsidiaries above the threshold to seek to comply individually, with the obligations of the smaller operations reverting to the holding company. This option in many cases would not decrease the workload on companies or reap any of the benefits associated with a more centralised approach such as:

- prevention of the duplication of effort
- prevention of 'double counting' (packaging may be shifted between business units and counted more than once)
- prevention of the omission of any packaging from the final data returns
- maximisation of any collaborative efforts in the pursuit of minimising compliance costs
- maximisation of the potential for environmental innovations between the business units.

For many large organisations some of the divisions operate as autonomous business units and the structure of the reporting and management system required has to be developed with this requirement in mind. Each business unit needs to undergo some form of training in order to

introduce the Regulations and explain the necessary compliance activities. Each business unit also needs to have a representative to act as the focal point for all issues regarding the Regulations and to make the data returns to the centralised area of the business. The representatives form a network within the business facilitating the transfer of information within the group. It is the responsibility of the main responsible person, usually the environment manager, to support the business representatives in all issues including the customer/ supplier information requests and to work with their opposite numbers in sister companies where appropriate.

### Data Collection and the Calculations

For accurate data collection, interpretation of the Regulations' definition of packaging must be understood. To this end, the Environment Agency has produced guidelines to help companies in making the assessment of borderline cases and has issued statements on others, e.g. plastic vending cups are classed as packaging. Although advice can be sought and guidelines followed as closely as possible, in the end it is down to the company to make decisions about what of the products they handle constitutes packaging or non-packaging on the basis of defensible reasoning.

Collection of data must be for the previous year, so data are currently being collected over the year 2000 by companies for registration in the year 2001. For the majority of companies this was a new experience as packaging metrics are usually in terms of unit production and cost not weight by material type. Unlike the larger companies that registered in 1997 and could begin by producing estimates, companies below the threshold that are to register this year have to produce data that are as accurate as possible straight away.

The type of data collection systems adopted are usually based on the type and size of operation in the particular business division and the information systems that it has in place for storing product-related data. Where good information systems exist for warehousing or manufacturing operations it is often possible to calculate comprehensively the packaging handled by multiplying product weights by annual sales and shipping information. For more service-based operations, where product packaging data are unknown, companies have sought information from suppliers. The usual outcome is a poor response rate from the suppliers and often inaccuracies in the small amount of data provided. The solution to the problem of unknown weights has been to sample physically the packaging but as many companies have large numbers of product lines that are changing all the time this can be an extremely time-consuming and resource-intensive task. Where operations handle large numbers of product lines a common approach adopted has been to assign various product types with a set of generic packaging weights. These generic packaging weights have then been multiplied by annual sales and shipping information. Ready reckoners produced by the DETR and by companies and industry groups were used as a much cruder version of this technique and as an interim measure when the Regulations were introduced. Ready reckoners are no longer an acceptable means with which to calculate a company's obligations.

The next stage is to design and develop an information system that will calculate the company's obligation. This paper presents a template of a spreadsheet which has been designed to calculate a company's obligations and can be applied to any obligated company (Table 3). The spreadsheet comprises of columns of material type (D-J) expressed as one of four data entry sections: packaging supplied (total packaging handled in previous year); packaging exported; packaging exported by a 3<sup>rd</sup> party; and imported packaging (including transit packaging). The final section contains the formulae necessary for the spreadsheet

calculations to yield the company's obligations. All the fields which have a cell location entry (e.g. D4 to J7) are data entry cells. The important point to note is that where two activities are carried out on a certain tonnage of packaging, that tonnage should be entered in both fields, i.e. if 50 tonnes of cardboard packaging is used to repack product and is sold on to an end-user then 50 should be entered in both D6 and D7.

### *Illustration of Worked Example*

If a company:

- manufactures and converts 23,000 tonnes plastic packaging;
- manufactures 2,000 tonnes plastic packaging, 1500 tonnes of which is exported;
- pack/fills and retail/sells 1000 tonnes wood, i.e. transit packaging;
- imports 45 tonnes cardboard and 10 tonnes wood packaging for converting;
- and imports 20 tonnes glass for filling

Then each of the following cells would be input as follows:

Table: Packaging Supplied

H4 = 2,000 + 23,000 (plastic manufactured)

H5 = 23,000 (plastic converted)

I6 = 1000 (wood pack/filled)

I7 = 1000 (wood retail/sold)

D5 = 45 tonnes (imported cardboard converted)

I5 = 10 (imported wood converted)

E6 = 20 (imported glass filled)



Table: Packaging Exported

H9 = 1500 (plastic manufactured for export)

Table: Packaging Imported

D20 = 45 (imported cardboard converted)

I20 = 10 (imported wood converted)

E21 = 20 (imported glass filled)

The manual calculation would be:

Recycling obligation for plastic = [((tonnage supplied - tonnage exported) × manufacturer activity obligation) + (tonnage supplied × convertor activity obligation)] × recycling obligation = [((25000 - 1500) × 0.05) + (23000 × 0.1)] × 0.13 = 3475 × 0.13 = 452 tonnes

Recycling obligation for cardboard = [(tonnage supplied × convertor activity obligation) + (tonnage imported × manufacturer activity obligation)] × recycling obligation = [(45 × 0.1) + (45 × 0.05)] × 0.13 = 6.75 × 0.13 = 1 tonne

Recycling obligation for glass = [(tonnage supplied × packer/filler activity obligation) + (tonnage imported × (convertor activity obligation + manufacturer activity obligation))] × recycling obligation = [(20 × 0.37) + (20 × (0.1 + 0.05))] × 0.13 = 10.4 × 0.13 = 1 tonne

Recycling obligation for wood = [(tonnage supplied × convertor activity obligation) + (tonnage supplied × packer/filler activity obligation) + (tonnage supplied × retailer obligation)] × recycling obligation = [(10 × 0.1) + (10 × 0.37) + (10 × 0.48) + (10 × 0.05)] × 0.13 = 10 × 0.13 = 1 tonne

The recovery obligations are calculated in exactly the same way except that the recycling obligation of 0.13 is replaced by the recovery obligation of 0.45.

Overall recovery obligation =  $\sum$  Individual recovery obligations = 1564 + 3 + 4.5 + 4.5 = 1576 tonnes

This means the company will need to purchase PRNs or PERNs for 452 tonnes plastic, 1 tonne card, 1 tonne glass, and 1 tonne of wood. The remaining recovery obligation of 1121 tonnes ( $1576 - (452+1+1+1)$ ) can be covered by purchasing PRNs/ PERNs for any material type or energy from waste.

This example shows how the spreadsheet calculates the recovery and recycling obligations. The template is a close representation of the data forms to be submitted to the EA, SEPA or Collective Scheme, as required by the Regulations. Therefore, once the spreadsheet has been input, the data are easily transferable to the requisite pro formas.

There are some common areas where erroneous data can occur and they include:

- data from suppliers that can be difficult to check
- incorrect use of units (a common error in any data collection process)
- the inclusion of packaging consumed and wastage (as an end-user of the packaging a company carries no obligation for it)
- the exclusion of importing obligation where using agents (as owners of the packaging a company carries an importers obligation on the packaging)
- the exclusion of secondary activity obligations (e.g. as sellers of products that are repacked a company picks up responsibility for both pack/ filling and selling)
- the exclusion of packaging supplied to 3<sup>rd</sup> party exporters under the threshold test (this data is difficult to obtain)
- the exclusion of reused packaging (this is difficult to prove and should be included if in doubt)
- the use of out-of-date information (often where data is difficult to obtain)

- the inclusion of warehousing data which has been taken out of the Regulations

The best way to ensure accuracy of the data collected is to carry out internal audits to scrutinise the data being produced and to document all procedures and processes used to facilitate this process. The Environment Agency will be continuing to audit obligated companies and a company needs to be able to show that its data is as accurate as possible.

### Driving Environmental Performance

It is currently the case that although PRNs derived from the recovery of a company's waste can be used to offset a company's obligations, reprocessors expect to receive part or all of the market value of the PRN. However, it is unlikely that this will remain the case when considering the planned target rises and the possible abolition of the 'value-added' PRN. Therefore, increasingly companies may plan to recycle their packaging waste, relate this to securing PRNs and implement the necessary systems (Figure 2). The initial stage should be to assess the amount of packaging waste produced at various sites and this can be achieved through a waste measurement audit. Once this has been carried out balers and compactors can be installed at the appropriate locations for the specific materials to be recycled (for example, a site producing mainly expanded polystyrene will need different equipment from a site producing mainly cardboard). Joining collection schemes such as the Save a Cup plastic vending cup recycling scheme can provide useful options for environmentally sound recycling.

As a company's obligations are based on the weight of packaging it uses, it is beneficial to identify and implement strategies for the minimisation of packaging usage. In addition, it may be beneficial for companies to replace certain heavy forms of packaging with lighter

ones but only if they provide the more environmentally sound option. The Packaging (Essential Requirements) Regulations 1998 requires that companies minimise the pack weight and volume to maintain safety, hygiene and consumer acceptance, once the appropriate system has been chosen (DETR, 1999c). Choosing a system without regard for environmental considerations would not be acceptable.

Although there is no requirement under the Regulations to do so, companies should still endeavour to develop policies to purchase packaging that contains recyclate material as part of their environmental programmes. However, an incentive may develop as the demand for PRNs increases and the market for end-use materials softens. The price of recyclate waste is likely to fall significantly and should pose a low cost alternative to virgin packaging materials.

## Discussion

The widespread criticism regarding the complexity of the Regulations is demonstrably well founded. However, the Regulations were designed on the basis of the request by UK industry for the responsibility to be shared throughout the packaging supply chain. The lesson perhaps to be learnt by all parties is not to confuse financial burden with legal obligations. The result of the complexity of the Regulations has been high compliance costs to industry, not from PRN procurement or the costs of direct recovery and recycling of packaging waste but in: the training of staff; the development of existing and/or the implementation of new information systems; and the manpower required to collect data and determine what the recovery obligations should be.

Although there are opportunities for deliberate miscalculation, the majority of companies that have been shown to do the right thing by registering under the Regulations are far more likely to simply be unable to produce accurate data. The opportunity for errors is vast and virtually untraceable for companies themselves let alone the enforcement agencies. The most serious result of this could be prosecutions that are based on the misinterpretation of 'unfeasibility' for 'excuses' by enforcement agencies and poses a real challenge for the agencies' discretion. One solution might be for further regulation that would require bar-coding of packaging by converters. This would go a long way to solving the problem of primary data collection by companies for populating information systems or manual calculations. However, even this has its limitations in terms of traceability where, for example, a package containing fifty smaller packs is opened and each individual package sent out within a different package.

The UK Regulations are in direct contrast to most EU Member States where the legal responsibility lies with those companies specifying and placing packaging on the market. This approach may not be as fair as the UK's approach but it is a great deal simpler for companies to manage and for governments to enforce. In addition, placing the obligation on those that specify and put packaging on the market is advantageous because they have the most direct access to packaging waste and the most opportunity for minimisation and substitution.

At present, the fact that a PRN has a value to it means that those companies that handle a lot of packaging but have no access to packaging waste (because they themselves produce negligible amounts of packaging waste, if any at all) can purchase PRNs and thereby discharge their obligations. If the cost of PRNs were to reflect only an administration charge when issued to the supplier of packaging waste then this would act as a real incentive for

companies that produce packaging waste to recover and recycle it. However, it would be more difficult and possibly more costly for companies with no packaging waste to obtain PRNs. Had the responsibility been put on the specifiers and placers of packaging on to the market then the tradeable permit system would have been far more straightforward. The difference between the tradeable permit system in the US for air pollutants and the PRN system for packaging waste is that in the PRN system there is no direct connection between the permit and the polluter and no 'credits' for environmental protection efforts. The dilemma of whether to attach a value to PRNs or the waste recovered and recycled is complicated by the shared producer responsibility approach.

Furthermore, the UK Government and the European Union are both considering implementing a financing structure based on the PRN or tradeable permit system for the implementation of legislation concerning waste from electrical and electronic equipment. Industry is currently voicing severe misgivings over this approach.

The question here is how can shared producer responsibility and environmental protection be compatible in a free market? Whatever solution the answer to this question provides, it is unlikely that any radical changes will be made to the Regulations in such close proximity to the EU recovery and recycling targets. In addition, the UK Packaging Regulations may be 'a pragmatic and cost-conscious policy which requires minimal state intervention' (Bailey, 1999) but it is an expensive and complex Regulation for industry.

Finally, where economic theory emphasises the efficiency gains to be had by the internalisation of environmental costs it says very little about why externalities exist (Lifset, 1992) and how organisations that have in the past externalised such costs can be convinced to

take responsibility for them and for environmental protection as a whole. Regulations can be an important driver for environmental protection and can ensure that the polluter pays for environmental protection but how that environmental protection can best be achieved is in many cases better achieved by voluntary approaches.

## Conclusions

The UK Packaging Regulations are extremely complex and administratively burdensome for industry to comply with. The increasing pressure of the Regulations on businesses to provide accurate data is based on unrealistic expectations. Furthermore, there is no supporting regulation on suppliers of packaging to provide data to other obligated businesses. Businesses are often simply unable to obtain basic metrics with which to populate their information systems. This not only poses a challenge for enforcement agencies in the application of their discretion to prosecuting firms but also for industry to apply sound methodologies in their compliance.

The application of a sound compliance methodology can enable companies to comply with the Regulations at least cost and to channel valuable resources into the implementation of their environmental programmes for using the most environmentally-sound packaging materials, minimising packaging use, maximising packaging reuse as well as recovering value from packaging waste. The question of whether compliance schemes provide support for environmental programmes within companies or whether more environmentally conscious companies are better off registering individually needs to be addressed.

The financing system implemented under the Regulations, although based on the philosophy of the tradeable permit system, is flawed and is in need of thorough consultation and review. There are possible solutions to the problems of the PRN system but they are in partial conflict with the shared producer responsibility approach. This raises real concerns for the implementation of similar financing systems for shared producer responsibility legislation. Even if an ERN (Electronic and electrical equipment waste Recovery Note) is not implemented as a financing system for the EU Directive on Waste from Electrical and Electronic Equipment, the UK is likely to follow a similar approach in its transposal of the Directive. Unless the problems with the PRN system are resolved, the implementation of similar financing systems for other shared producer responsibility legislation, such as an ERN system, have potential for detrimental effects on particular industry sectors and their perception of environmental regulation. Therefore, it has important implications for the formulation of future environmental legislation as a whole.

## Acknowledgements

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**Table 1.** The UK's Recovery and Recycling Targets

Year	Recovery Target	Recycling Target
1998	38%	7%
1999	43%	10%
2000	45%	13%
2001	52%	16%

**Table 2. Activity Obligation Percentages**

Activity	Obligation Percentages (1997-1999)	Obligation Percentages (2000-)
Raw material manufacturing	6%	5%
Converting	11%	10%
Packing/ filling	36%	37%
Selling/ retailing	47%	48%
Using transit packaging	83%	85%
Importing transit packaging	100%	100%

**Table 3. Spreadsheet Details for Obligation Calculations**

A1	B	C	D	E	F	G	H	I	J
2	Table Name	Activity	Paper	Glass	Aluminium	Steel	Plastic	Wood	Other
3	Packaging supplied								
4		Manufacturer	D4	E4	F4	G4	H4	I4	J4
5		Convertor	D5	E5	F5	G5	H5	I5	J5
6		Packer/ filler	D6	E6	F6	G6	H6	I6	J6
7		Seller	D7	E7	F7	G7	H7	I7	J7
8	Packaging Exported								
9		Manufacturer	D9	E9	F9	G9	H9	I9	J9
10		Convertor	D10	E10	F10	G10	H10	I10	J10
11		Packer/ filler	D11	E11	F11	G11	H11	I11	J11
12		Seller	D12	E12	F12	G12	H12	I12	J12
13	Packaging Exported b 3 <sup>rd</sup> Party								
14		Manufacturer	D14	E14	F14	G14	H14	I14	J14
15		Convertor	D15	E15	F15	G15	H15	I15	J15
16		Packer/ filler	D16	E16	F16	G16	H16	I16	J16
17		Seller	D17	E17	F17	G17	H17	I17	J17
18	Packaging Imported								
19		Manufacturer	D19	E19	F19	G19	H19	I19	J19
20		Convertor	D20	E20	F20	G20	H20	I20	J20
21		Packer/ filler	D21	E21	F21	G21	H21	I21	J21

22		Seller	D22	E22	F22	G22	H22	I22	J22
23		Transit Packaging	D23	E23	F23	G23	H23	I23	J23
24	Calculations								
25		Activity Obligation	=(D4- (D9+D 14)) ×0.05) +(D5- (D10+ D15)) ×0.1)+ D6- (D11+ D16)) ×0.37) +(D7- (D12+ D17)) ×0.48)	=(E4- (E9+E1 4)) ×0.05) +(E5- (E10+E 15)) ×0.1)+ E6- (E11+E 16)) ×0.37) +(E7- (E12+E 17)) ×0.48)	=(F4- (F9+F14) ×0.05)+(F5- (F10+F15)) ×0.1)+(F6- (F11+F16)) ×0.37)+(F7- (F12+F17)) ×0.48)	=(G4- (G9+G14 ) ×0.05)+(G 5- (G10+G1 6)) ×0.1)+(G 6- (G11+G1 7)) ×0.37)+(G 7- (G12+G1 7)) ×0.48)	=(H4- (H9+H14 ) ×0.05)+(H 5- (H10+H1 1) 5)) ×0.1)+(H 6- (H11+H1 1) 6)) ×0.37)+(H 7- (H12+H1 1) 7)) ×0.48)	=(I4- (I9+I14) ) ×0.05)+(I 5- (I10+I15) ) ×0.1)+(I6 ×0.37)+(I 7- (I11+I16) ) ×0.48)	=(J4- (J9+J14) ) ×0.05)+(J5- (J10+J15) ) ×0.1)+(J6- (J11+J16) ) ×0.37)+(J7- (J12+J17) ) ×0.48)
26		Roll-up Import Obligation	=(D20 ×0.05) +(D21 ×0.15) +(D22 ×52)+ D23	=(E20 ×0.05) +(E21 ×0.15) +(E22 ×52)+E 23	=(F20 ×0.05)+(F2 1 ×0.15)+(F2 2 ×52)+F23	=(G20 ×0.05)+(G 21 ×0.15)+(G 22 ×52)+G2 3	=(H20 ×0.05)+(H 21 ×0.15)+(H 22 ×52)+H2 3	=(I20 ×0.05)+(I 21 ×0.15)+(I 22 ×52)+I23	=(J20 ×0.05)+(J21 ×0.15)+(J22 ×52)+J23

27		Recovery Obligations	=SUM(D25:D26) ×0.45	=SUM(E25:E26) ×0.45	=SUM(F25:F26) ×0.45	=SUM(G25:G26) ×0.45	=SUM(H25:H26) ×0.45	=SUM(I25:I26) ×0.45	=SUM(J25:J26) ×0.45
28		Recycling Obligations	=SUM(D25:D26) ×0.13	=SUM(E25:E26) ×0.13	=SUM(F25:F26) ×0.13	=SUM(G25:G26) ×0.13	=SUM(H25:H26) ×0.13	=SUM(I25:I26) ×0.13	=SUM(J25:J26) ×0.13

**Captions**

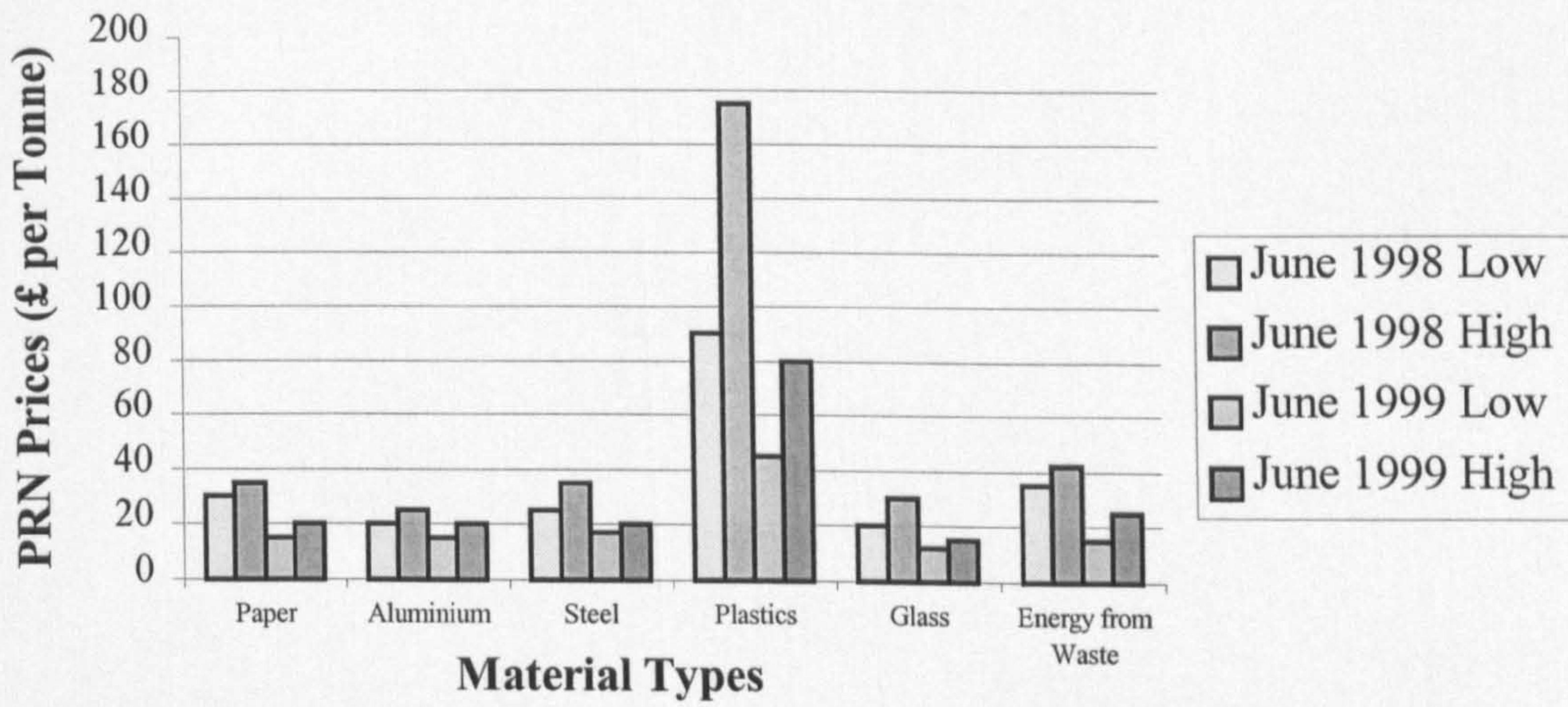
**Figure 1.** The Range of PRN Prices

**Figure 2.** Packaging Recycling and PRN Procurement System



**Figure 1. The Range of PRN Prices**

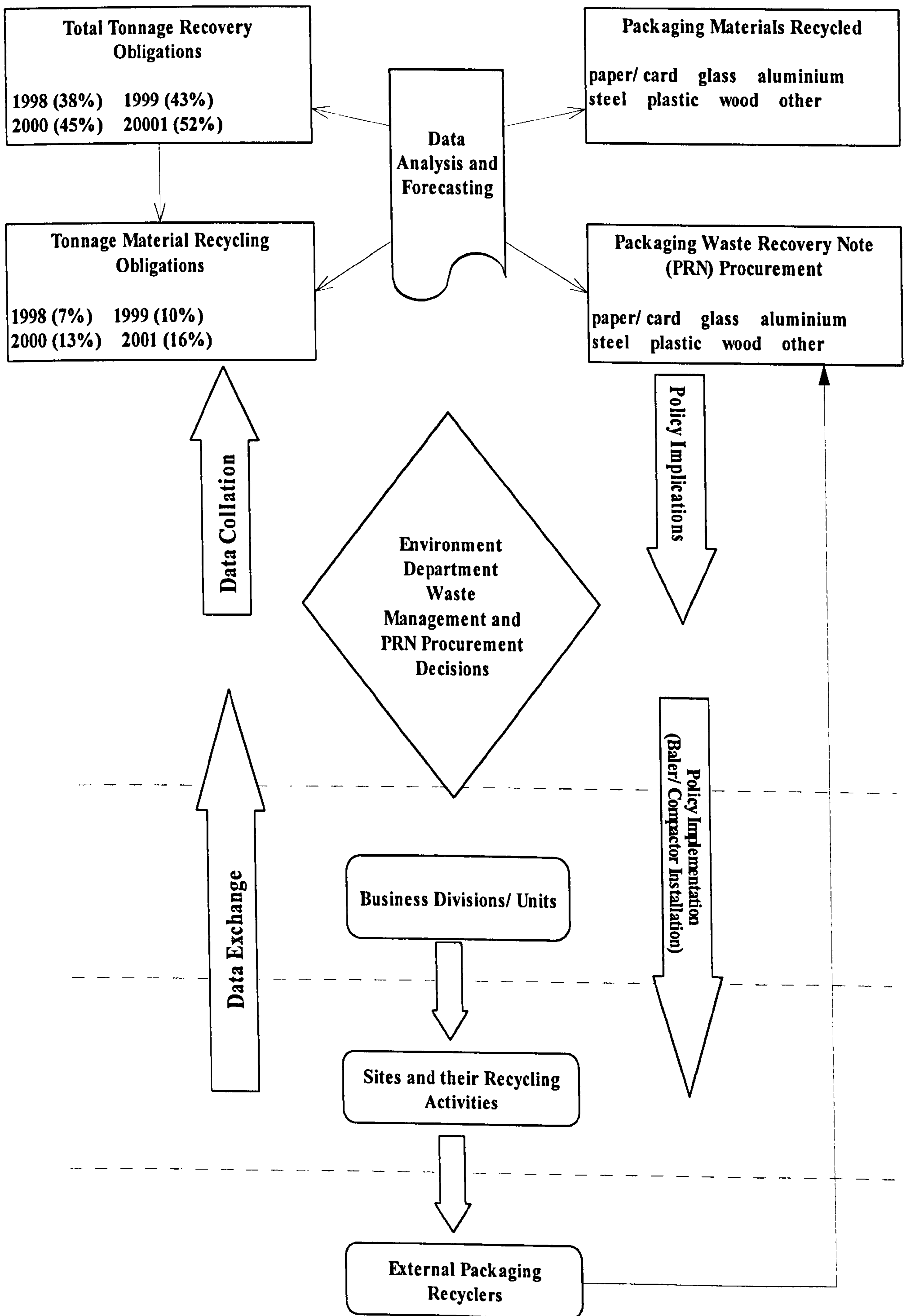
**Figure 1. The Range of PRN Prices**



Adapted from DETR, 1999e

**Figure 2. Packaging Recycling and PRN Procurement System**

**Figure 2 Packaging Recycling and PRN Procurement System**



**Annex 1**

**Appendix 3**

**Paper III**

**A Survey of the Effects of the UK Packaging Regulations on the Environmental Performance of Companies.**

# **A Survey of the Effects of the UK Packaging Regulations on the Environmental Performance of Companies.**

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**Abstract:** This paper presents a survey analysis of the key factors that could determine the effects of the recent packaging legislation on UK companies' environmental performance. The main outcome measures were the perceptions of respondents on the Regulation's effects, the packaging measures employed, and the quantities of: waste produced; packaging consumed/ handled, recycled, and reused; non-packaging recycled; energy consumed; and environmental policy and management status. The main findings were that there has been no overall increase in packaging recycling since the Regulations were introduced and that the Regulations are neither perceived to be driving environmental programmes in companies nor is there any evidence to show that this is the case. The conclusion from this survey is that to date the Regulations appear to have had minimal impact toward the desired ends and only future developments will determine whether they need reform and the implications this has for future environmental legislation be addressed.

**Key words:** Environmental regulation; environmental performance; measures; survey.

**Biographical notes:** Gail Collins was awarded a BSc degree in Applied Chemistry from Kingston University and an MSc in Environmental Pollution Science with Legislation and Management from Brunel University. She has completed a four year Engineering Doctorate (EngD) in conjunction with Corporate Environmental Affairs at ICL plc. and the Centre for Environmental Research at Brunel University. Her research has been in the field of environmental regulation and corporate environmental management.

Dr Sue Grimes is Head of the Centre for Environmental Research at Brunel University, University Reader, and Director of Environmental Masters courses. Both an experienced research supervisor of industrial and academically-based projects and a senior management consultant, Dr Grimes has supervised more than 50 research students studying for PhD and EngD degrees and has over 100 published papers in refereed scientific journals.

Joy Boyce is Head of Corporate Environmental Affairs at ICL (International Computers Ltd.).

## **1. Introduction**

In recent years, packaging has become the focus for environmental regulation. The UK Producer Responsibility Obligations (Packaging and Packaging Waste) Regulations 1997 [1] were introduced in March 1997 to implement the EC Packaging Directive (94/62/EC). The Packaging (Essential Requirements) Regulations 1998 [2] was a further regulatory measure to implement the outstanding articles in the EC Packaging Directive that had been omitted from the Packaging Waste Regulations.

Packaging is a significant proportion of the household and industrial waste streams. It has been estimated that currently the UK uses around 11.7m tonnes of packaging per year and it is likely that between 4.5m and 5m tonnes of this ends up in the 111m tonnes annual

waste stream. The UK recycled about 23% of household and industrial waste in 1996. The Regulations were introduced as part of European Union (EU) policy implementation and a national strategic plan in the UK to reduce the undesirably high level of waste sent to landfill having no value extracted from it [3].

Prior to packaging legislation being introduced, environmental legislation had focused on manufacturers who were perceived to be the heaviest polluters in industry. The packaging legislation, however, has been the first type of environmental legislation to affect all producers of product and services and has marked a turning point in the regulation of industries' environmental impacts. The effectiveness of recent producer responsibility legislation in reducing industries' environmental impacts has been the focus of much attention in recent years. The UK Packaging Waste Regulations has been the first producer responsibility legislation to be implemented in the UK. This paper does not seek to outline the Regulations themselves and detailed analysis of the Regulations forms part of a separate study [4].

It is in this context that we conducted a national survey of companies, registered under the UK Packaging Waste Regulations in order to gain insights into the effects of the regulations on the companies' environmental performance. Furthermore, the study examines environmental performance measures with respect to packaging and the impact of the regulations on the introduction of packaging-related measures. A company can currently comply with the UK Packaging Waste Regulations by registering with the appropriate agency, either the Environment Agency (EA) or the Scottish Environmental Protection Agency (SEPA), or it can join a compliance scheme. This study has looked at the possible relationship between a company's choice of registration route and its environmental performance.



## **2. Methods**

Of the 3783 companies registered under the UK Packaging Waste Regulations in 1998, 1000 were randomly selected for receipt of a survey form. Under the UK Packaging Waste Regulations, a company can either register individually with the respective agency, the Environment Agency (EA) or Scottish Environmental Protection Agency (SEPA), or it can displace its legal liability by joining a collective scheme. Therefore, the sample was stratified to account for the 20 per cent of companies registered with the Environment Agency and 80 per cent registered with collective schemes. Each survey form was accompanied by a covering letter to the Environment Manager that offered a copy of the Survey Report on completion. A reply paid envelope was enclosed.

The survey was divided into six sections as follows:

**(1) Personal details:**

**Job title**

**Level of authority:** Chairman/CEO/MD etc., VP/Dir/Asst/Dep.Dir etc, Senior management, Higher functional, functional, Other.

**Area of responsibility:** Legal/ Finance, Human Resources, Public relations, Environment, IT/ systems, Sales/ Marketing, R&D, Production, Health and Safety, Distribution.

**(2) Company details:**

**Registration status (EA or collective scheme) under the Packaging Waste Regulations and  
name of Collective Scheme**

**Total number of employees:** <1000, 1001-4999 or 5000+

**Approximate turnover in 1999:** <£1m, £1-5m, £5-100m, £100m-£1Bn or £1Bn+

**Based on the following FTSE sector indices, the percentage of company's turnover in each**

sector to the nearest 10%:

Oil & Gas/ Mining/ Chemicals/ Construction & Building Materials/ Forestry & Paper/ Steel & Other Metals/ Aerospace & Defence/ Diversified Industrials/ Electronic & Electrical Equipment/ Engineering & Machinery/ Automobiles/ Household Goods & Textiles/ Beverages/ Food Producers & Processors/ Health/ Packaging/ Personal Care & Household Products/ Pharmaceuticals/ Tobacco/ Distributors/ General Retailers/ Leisure, Entertainment & Hotels/ Media and Photography/ Restaurants, Pubs & Breweries/ Support Services/ Transport/ Food and Drug/ Retailers/ Telecommunication Services/ Electricity/ Gas Distribution/ Water/ Banks/ Insurance/ Life Assurance/ Investment Companies/ Real Estate/ Speciality & Other Finance/ Information Technology Hardware/ Software & Computer Services

### (3) Environmental Measures

Quantity of waste sent to landfill: in 1996/ 1997/ 1998 and 1999

Year in which following measures were introduced:

Packaging Consumption/ Packaging Consumption by material type/ Packaging Reused/ Packaging Reused by material type/ Packaging Recycled/ Packaging Recycled by material type/ Packaging Recyclate Purchased or Used/ Packaging Recyclate Purchased or Used by material type

Measures introduced as a direct result of the Packaging Waste Regulations: yes or no for each measure

Quantity of packaging handled: paper/card, plastics, metal, wood, other in 1996/ 1997/ 1998 and 1999

Quantity of packaging recycled: paper/card, plastics, metal, wood, other in 1996/ 1997/ 1998 and 1999

Quantity of packaging containing recycled material purchased and/ or used: 1996/ 1997/  
1998 and 1999

Quantity of non-packaging material recycled: paper/card, plastics, metal, wood, other in  
1996/ 1997/ 1998 and 1999

#### (4) Environmental Programmes

Environmental Policy in place: yes or no and year introduced.

Accredited environmental management systems (EMS) in place: EMAS or ISO14001 and  
year introduced.

Energy consumption expressed as either kWh/ UP or kWh/ sq ft building in 1996/ 1997/  
1998 and 1999

Extent to which the Packaging Waste Regulations have influenced environmental  
programmes: A great deal/ Quite a lot/ Not very much or Not at all

Responses to statements about the effects of the Packaging Waste Regulations on  
environmental programmes and bottom line.

#### (5) Packaging Consumption Reduction Initiatives

Awareness of the Packaging (Essential Requirements) Regulations: yes or no

Steps taken, if any, to comply with these regulations

Number of initiatives for packaging reuse or minimisation set up in 1996/ 1997/ 1998 and  
1999

Quantities of packaging reused: paper/card, plastics, metal, wood, other in 1996/ 1997/  
1998 and 1999

Replaced certain packaging materials with other lighter or more environmentally sound  
alternatives: Yes/ No

Details of what type of packaging materials were replaced, what materials they were  
replaced with, in what year they were replaced and why.

#### (6) Compliance Schemes

Responses to statements about the effects on environmental programmes of registration status.

Comments on: why a company has chosen its particular registration route/ How the UK

Packaging Waste Regulations have improved the environmental performance of the company/ and in what ways the Regulations have had a negative impact on the environmental performance of the company

Permission for a follow-up telephone call was requested and an opportunity for respondents to request a copy of the survey report was provided. A follow-up letter was sent to generate further responses and follow-up telephone calls were made in order to gain more detailed qualitative data from those respondents who gave their permission. Analysis of completed surveys was performed using the Statistical Package for Social Sciences (SPSS).

### **3. Results**

#### *3.1 Respondents*

A total of 72 completed survey forms were completed and returned by registered companies giving a response rate of 7%. Of the respondents, 18 (25%) were registered individually with the EA and 54 (75%) were registered with collective schemes, 34 (50%) of which were registered with currently the largest collective scheme, Valpak. Therefore, the percentage of respondents registered individually relative to those registered via collective schemes was slightly higher than the 20:80 ratio in the sample and total population.

The first section of the questionnaire, covering respondent details showed that in terms of the respondent's area of responsibility, 52 (29%) had an environmental role and 36 (20%)

had responsibility for health and safety in the organisation. In a tiered management structure where tier 1 refers to a chairman, tier 2 a vice president, tier 3 senior management through to tier 6 which includes either non-executive advisors or other managers, the majority, 29 (40%) of respondents were in tier 3. This was followed by 14 (19%) of respondents in tier 2, (17%) in tier 5 and 9 (13%) in tier 4 positions. A small minority of 3 (4%), only within companies registered with collective schemes, were in tier 1 within their organisation.

The majority of organisations, 57 (76%), had a turnover of £5-100m and 26 (17%) organisations had a turnover of £100m-£1bn. The majority of organisations, 62 (87%), had <1000 employees and 6 (8%) had 1001-4999 employees. There was little difference between collective scheme and individually registered companies in respect of turnover and number of employees. The sample represented a wide distribution of industry sectors with the highest numbers of respondents within food production and processing, mining, electric and electrical equipment and distribution. Differences according to registration status are shown in Figure 1. The sectors that were not represented by the sample included insurance, steel & other metals, leisure, entertainment & hotels, transport, gas distribution, life assurance, water, investment companies, telecommunication services, banks and real estate.

### 3.2 Environmental Measures

When asked whether their organisation had introduced environmental measures concerned with packaging, overall, under 60% did not respond, whilst over 20% said yes and under 20%, no. The specific responses to whether the measures were introduced as a result of the regulations can be seen in table 1. Over 40% of respondents said that their organisations had introduced packaging consumption measures as a result of the

implementation of the regulations. Correspondingly, when asked the dates when the measures were introduced, over 50% of respondents said that their organisation had introduced the measures between 1996 and 1998, the years surrounding the introduction of the regulations. A small number of companies accounting for 6% of the sample introduced measures in earlier or later years ranging from 1977 to 2000 and the remaining 45% did not respond.

The results for all the other environmental measures relating to packaging, which included recycling, recycle purchasing, and reuse measures, were similar in that the majority of respondents did not answer as to whether the measures were introduced due to the introduction of the regulations. However, they were all similar to packaging consumption measures in that the majority of organisations had introduced recycling measures between 1996 and 1998.

When asked if they were aware of the Packaging (Essential Requirements) Regulations 1998, 47% of respondents said yes and 15% said no. This was reflected in the introduction of packaging substitution measures that had been introduced by the respondent's organisations with 65% of packaging substitutions being introduced between 1997 and 1999. The types of packaging material substitution and the reasons for their replacement can be seen in table 2. The predominant material replacements made by collective scheme registrants were for cardboard which was either replaced by lightweight card or plastics mainly as a cost reduction exercise or to introduce the practice of reusability. For the EA individually registered companies the material replacements were far more varied with the predominant reasoning being that of reuse.

None of the results relating to environmental measures showed any significant difference between responses from companies registered via collective schemes or individually with the EA/ SEPA.

### *3.3 Perceptions of the Effects of the Regulations on Environmental Programmes*

When asked whether the Regulations had influenced environmental programmes within their company, the majority of companies, 11 (61%) of EA registered companies and 21 (39%) of collective scheme registered companies, said 'not very much'. The most distinctive difference between registration status was that only companies within collective schemes, 5 (9%), committed to saying that it had influenced their environmental programmes 'a great deal'.

The responses to questions about the influence of the Regulations on environmental programmes and bottom line produced some interesting results. The responses to the first question about environmental effects were simply on the effects of the Regulations, whereas the responses later on in the questionnaire related specifically to the company's registration status. The responses to the two related sets of questions were often different indicating that when questioned about registration route it altered perceptions of the effects of the Regulations on environmental programmes.

To the first set of statements, the majority of companies, overall, perceived that the Regulations have had no effect on their environmental programmes but have significantly affected the company's bottom line. A majority of 45 (63%) disagreed with the statement 'the Regulations have significantly driven environmental programmes'. In relation to registration status, the perception that this was the case was much stronger for those in collective schemes than for those registered with the EA directly. When asked if the

Regulations had not affected environmental programmes, the answers were mixed without a clear majority for any one response with, overall, 38 (53%) agreeing. To the statement 'the Regulations have had a detrimental effect on environmental programmes' the overall majority of 47 (65%), 'disagreed strongly'. As to whether the companies bottom line had been significantly affected, the majority, 34 (63%) of companies in collective schemes agreed. However, companies that were registered individually with the EA gave an equal spread of agree and disagree.

To the second set of statements, the majority of both individually registered, 16 (70%), and compliance scheme, 34 (63%), companies disagreed strongly with the statement, individual registration has significantly driven environmental programmes. Overall, individually registered companies clearly agreed with the statement 'Individual registration has <sup>not had any effect on</sup> significantly driven environmental programmes' whereas collective scheme members were less sure, with only a slight majority of 57% agreeing. Finally, both the collective scheme members and the individual registrants clearly disagreed with the statement 'registration [status] has had a deleterious effect on environmental programmes'.

### *3.4 Environmental Policy and Management*

The majority of respondents, 52 (72%) had introduced an environmental policy statement whilst only 17 (24%) had introduced, either partially or fully, an environmental management system. All but one of these companies either had or were in the process of achieving ISO 14001 certification. The one remaining company had achieved EMAS.

Again the dates of introduction of an environmental policy and management system coincided with the introduction of the packaging regulations as shown in figure 2.

### *3.5 Energy Consumption Measures and Data*



Energy measures were used as a control to register effects on environmental performance aside from packaging and waste measures. Only 10 collective scheme members and 5 EA registered companies had energy consumption measures in place. Of these measures, one collective scheme member measured total energy consumption, 5 companies measured energy per unit space, 6 companies measured energy consumption per unit production and 3 companies measured energy consumption per unit space and per unit production.

The percentage change in energy consumption by the companies that measured energy consumption can be seen in figure 3.

### *3.6 Packaging and Waste Data*

The recycling data collected showed an overall increase in the amount of packaging materials being recycled. However, once these data were adjusted to take into account the amounts of packaging being handled/ used, no overall increase in packaging recycling was observed (see figure 4). The only substantial increase between 1998 and 1999 in packaging recycling as a percentage of packaging handled/ used was plastic packaging. A large quantity of wood recycling (and correspondingly, handling/use) was carried out by companies registered with the EA which is probably due to the large percentage of them being in the electrical and electronic, mining and building and construction sectors. A substantially larger quantity of packaging recycling as a percentage of packaging handled was being carried out by companies registered with the EA compared with members of collective schemes. However, the collective scheme members showed a gradual increase in packaging recycling as a percentage of packaging handled/ used where individually registered companies data were much more random.

The amount of non-packaging recycled peaked in 1998 for most material types but showed a distinct fall off in 1999 especially in materials other than those commonly used for packaging.

Initiatives to reuse or minimise packaging were only introduced by companies in collective schemes and they increased from 2 in 1996 to 9 the following year. Since then the quantity rose to 10 in 1998 and 1999. The average quantity of packaging reused as a percentage of packaging handled increased for wood and paper/ card between 1998 and 1999. Metals showed a big increase in 1999 by companies registered with the EA (figure 5).

The average waste landfilled showed a steady increase from 7200 tonnes in 1996 to approx. 8000 tonnes in 1998 with a 2000 tonne increase to over 10000 tonnes in 1999 for companies registered with the EA. Companies in collective schemes showed a substantial drop in landfilled waste from 14000 tonnes 1996 to 7600 tonnes in 1997 before a steady increase in 1998 and 1999 to 8800 tonnes. An aggregated average of each individual percentage change in landfilled waste is shown in Figure 6.

### *3.7 Comments on the Effect of the Regulations on Environmental Performance*

The majority of respondents commented that they thought the main impact on their companies environmental performance had been one of awareness raising of the packaging quantities involved, environmental regulations, the costs incurred and the future pressures to be expected from environmental regulations. The second area where the packaging Regulations had affected environmental performance was in the area of packaging minimisation and reuse. The main reasoning given for why the Regulations were thought to have had a detrimental effect on environmental performance was in the high cost of

compliance, the complexity of the regulations and the lack of comprehensive guidance, and the time-consuming nature of compliance. The reasoning given for why the Regulations were not perceived to have had any effect on environmental performance was that other factors such as economics, customers, other national legislation, and ISO 14001 were the main drivers.

### *3.8 Choice of Registration Route*

The key reasons given for choosing collective scheme membership as a registration route were to save time, conserve resources and the benefits arising from central administration. Other reasons included: ensuring compliance and off-loading the company's legal liability; and obtaining guidance and legislative interpretation from the schemes. A noteworthy reason given for joining a compliance scheme was that the companies had no direct access to PRN procurement.

Similarly the most common reasoning for registering individually with the EA was to achieve least cost compliance. The reason for changing registration status from collective schemes to the EA was also given as a route to reducing cost. Other reasons given for individually registering centred around the overall confidence of the companies in their ability to comply with the Regulations and to cope with the workload.

## **4. Discussion**

The initial number of responses totalled 55 and after the follow-up letter had been sent a further 17 were completed and returned. The low response rate of 7% was to be expected for two reasons: firstly, the questionnaire was complex in nature and requiring a large amount of quantitative and qualitative data to correlate the perceptions of respondents with

the quantitative data given; and secondly, compliance with the Packaging Waste Regulations is extremely complicated, bureaucratic and time-consuming process and it was thought likely that there would be a certain amount of apathy with regard to another form-filling exercise.

In terms of the sample, the respondents were found to be mostly in senior positions within the organisation with responsibility for the environment and a whole host of other roles. The majority of respondents fell into the £5-100m turnover and <1000 employees categories. The percentage split between registration routes taken by the respondents matches the percentage split in the total population. The fact that there were slightly more respondents that were registered individually with the EA could possible reflect that these people or organisations have more energy, commitment and/or time to devote to environmental issues. The sample represented a wide coverage of different industry sectors.

The main impact of the Regulations has been to stimulate the introduction of a whole range of packaging-related measures within organisations. Although many companies did not say that the majority of measures were introduced as a direct result of the Regulations, the dates that they were introduced coincides directly with the implementation of the Regulations.

Most organisations were aware of the Packaging (Essential Requirements) Regulations 1998 and a substantial number have been introducing initiatives to replace packaging materials. The main difference between EA and collective scheme registered organisations was that the collective scheme registrants seemed to focus on cardboard substitution and were motivated more by cost whilst the EA registered companies were substituting a far

more varied array of packaging materials and were motivated more by reusable alternatives.

The fact that half EA registered companies thought that the Regulations have had a detrimental effect on their environmental programmes, and that half thought they had not implies an ambiguity over this issue that does not exist within collective scheme members. The detrimental effects of the Regulations were clearly cited as time-consuming, high cost of compliance, and the withdrawal of resources away from environmental programmes. The overall response has shown that the Regulations are indeed perceived as burdensome, bureaucratic and costly. They have not significantly affected environmental programmes within companies and the only real perceived difference has been that of awareness raising. There is no evidence to show that the rate of packaging recycling has increased since the Regulations were introduced and this confirms the belief that the recovery and recycling targets introduced by the Regulations have been too low. The fact that Producer Responsibility Note (PRN) prices have been low has previously been explained by the introduction of inadequate targets.

It is important, however, to consider the other factors that may play a large part in the environmental programmes within companies. The fact that the Regulations were perceived by many to have not had an effect on environmental programmes within companies is explained by the emphasis the companies made on the importance of other factors like legislation in other countries, customers, economics and obtaining environmental management systems certifications. Improvements in waste management may also be attributable to other legislation, e.g. landfill tax, and voluntary action driven by factors such as the need to gain marketing differentiation through greener products and to publish sound environmental performance.

The survey shows that although the majority of companies responding have published an environmental policy statement, generally at the time of the introduction of the Regulations, only a few are in the process of or have gained certification for an environmental management system. The fact that only a very small number of companies are measuring their energy consumption, even if they are sophisticated in nature, shows that many respondents' environmental programmes are still in their infancy. This is because energy measures are generally accepted to be one of the most important and easily accessible environmental measures a company can make. In addition, there is little evidence from the data to show that the waste being sent to landfill is being systematically reduced.

Those that perceived that the Regulations had improved their environmental performance were few in number and, although some of them were able to produce sound data to back up their perceptions, the overall results of the survey shows that the Regulations do not inherently drive improvements in environmental programmes nor do they improve environmental performance overall. Overall, with the exception of plastic packaging between 1998 and 1999, the amount of packaging being recycled has not increased in the surveyed organisations.

There is little difference at present between companies that are members of compliance schemes and those registered with the EA in terms of their environmental performance and environmental programmes. EA registered companies appear to have more energy, resources and confidence in respect to complying with the Regulations. However, they handle a lot of wood packaging and it will be these companies that are hardest hit now that

the Regulations include wood packaging under its recovery and recycling targets by the year 2000.

Only collective scheme registrants have had initiatives for the minimisation and reuse of packaging between 1996 and 1999 which suggests that collective schemes promote these initiatives. The amount of wood packaging reused increased in 1998 and 1999 suggesting that companies are preparing for the inclusion of wood under the Regulations the year 2000.

Finally, the majority of respondents decided on their choice of registration route on the grounds of minimising compliance costs. Those that are switching registration route are doing so to reduce costs. The additional benefits of joining a compliance scheme were deemed to be off-loading the legal liability and the attainment of legislative interpretation and guidance. An interesting factor in the data provided by companies was that companies in compliance schemes seemed often less able to provide data. The current consultation on compliance schemes [5] is questioning the rationale behind the compliance scheme fees charged by the EA. Currently the larger the scheme, the less the registrants have to pay, on the basis that larger schemes should be easier to monitor and so incur less of an administrative burden on the EA. However, it is not turning out to be the case that compliance schemes are checking their members' data and the EA is having to deal with more comprehensive audits than the expected sampling audits originally proposed [6].

## **6. Conclusion**

Companies have been encouraged and obligated to implement packaging measures that otherwise would not have been used. The Regulations have raised awareness of

environmental regulations within companies and there has been a substantial number of minimisation, reuse and packaging material substitution initiatives since the Regulations came into force. At present, this survey has shown that the Regulations have not been an important driver of environmental programmes within companies and that there are more significant drivers for organisations such as environmental management system implementation and economic factors. That said, most of the organisations' environmental programmes were in their infancy and decisions appeared to be made more often than not on economic grounds.

The most significant conclusion that can be drawn from this survey is that the Regulations have not caused an increase in recycling yet. It may be that as the targets rise PRN prices will rise and the amount of recycling companies carry out should in theory increase. However, if there are no direct incentives for companies to recycle their own waste then it may simply become a struggle for companies to obtain PRNs. One way in which this could be achieved is for companies to have first refusal on the PRNs associated with the packaging waste that they are recovering and recycling. Only when the targets rise enough to begin to exert pressure on the PRN market, however, will there be the potential for companies to begin to implement environmentally sound programmes with regards to packaging waste. Research needs to be carried out to determine whether the Regulations do in fact have such a desirable effect over the next few years. This is particularly important for the assessment of the implications for future producer responsibility legislation.

## **Acknowledgements**



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**Figure 1** Sectoral Distribution of Respondents According to Registration Status

**Figure 2** Dates of Environmental Policy and EMS Introduction

**Figure 3** Percentage Change in Energy Consumption

**Figure 4** Average Material Recycling as a Percentage of Packaging Material Handled/  
Used

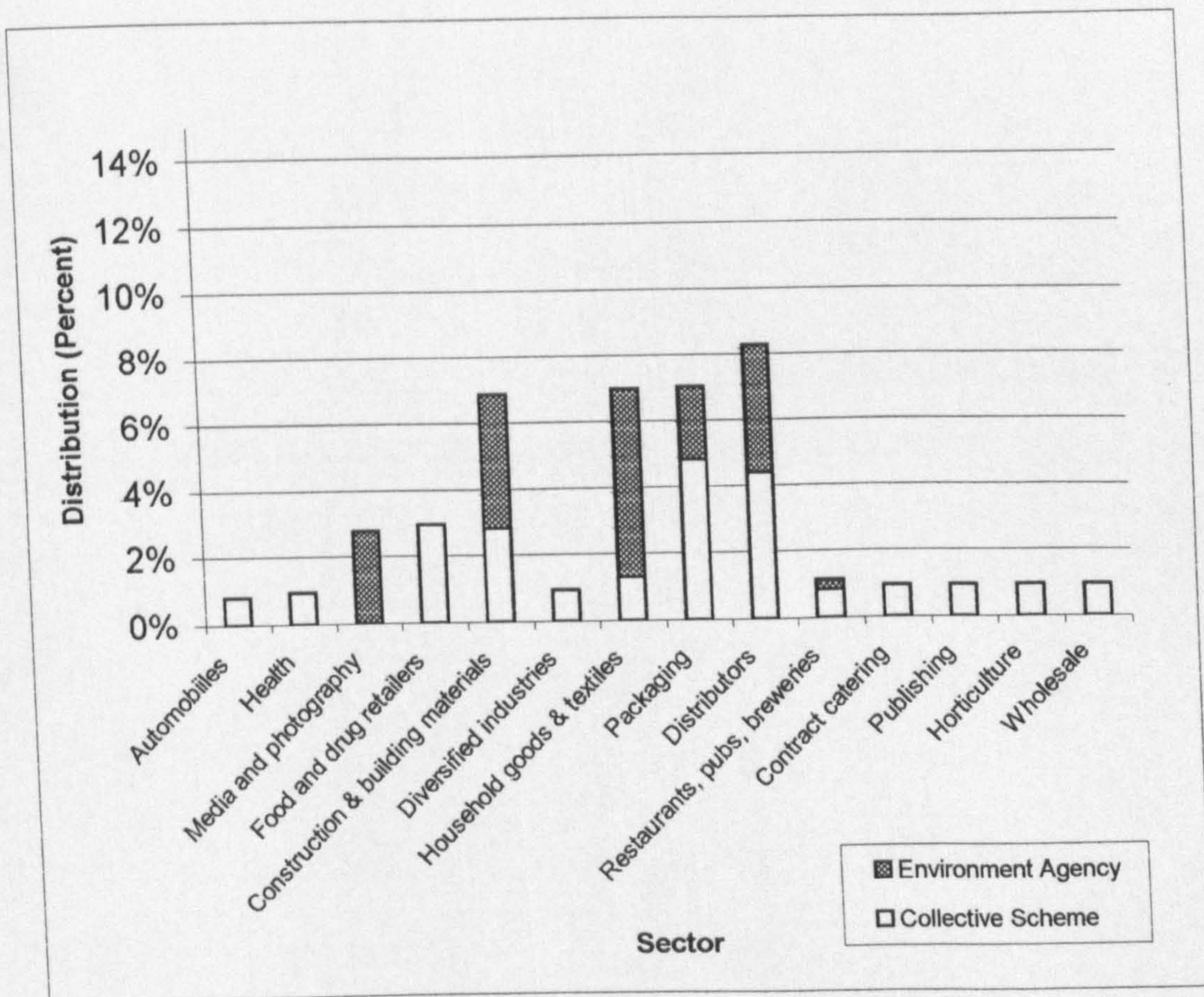
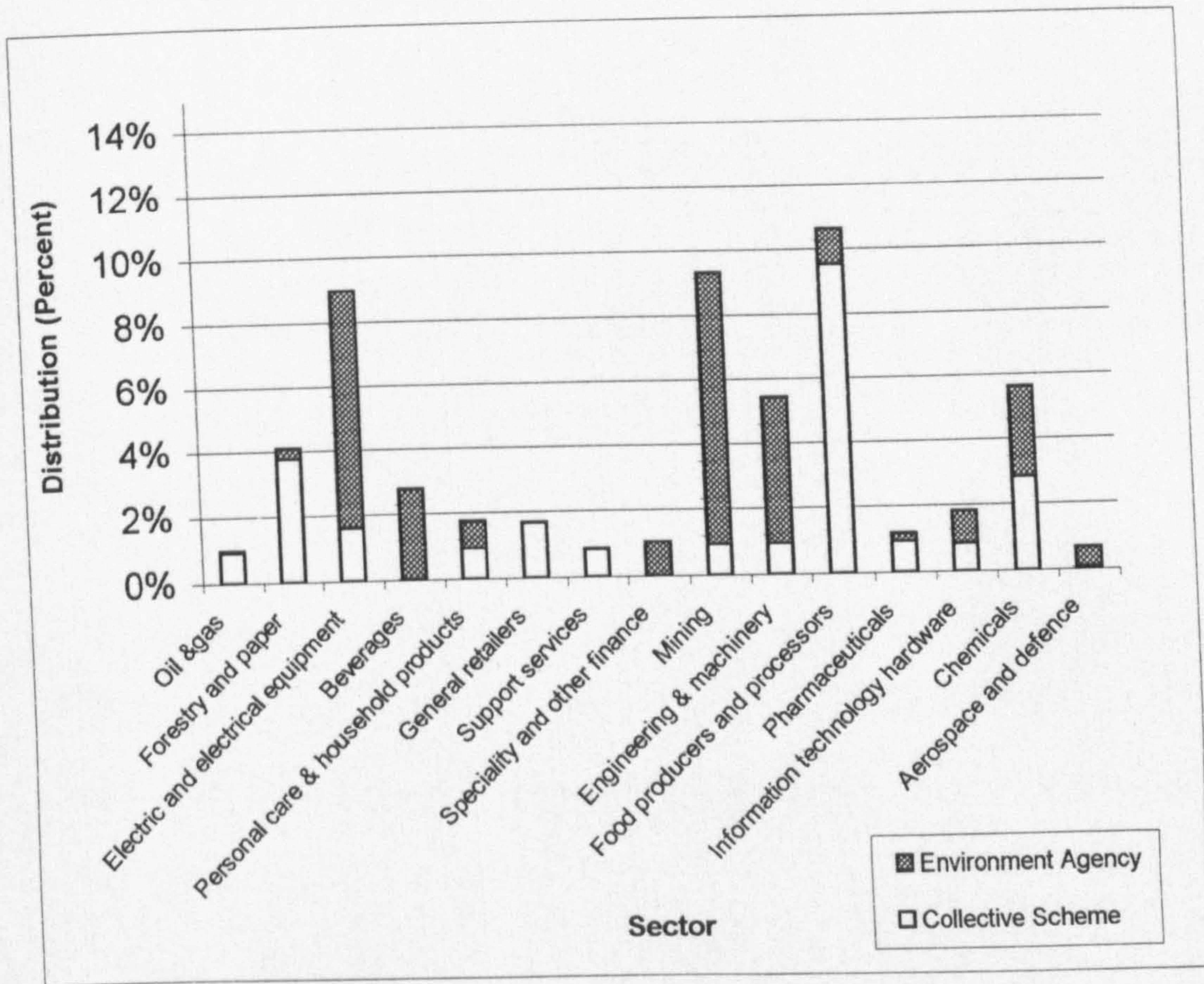
**Figure 5** Packaging Reused as a Percentage of Packaging Handled

**Figure 6** Aggregated Average of Percentage Change in Landfilled Waste

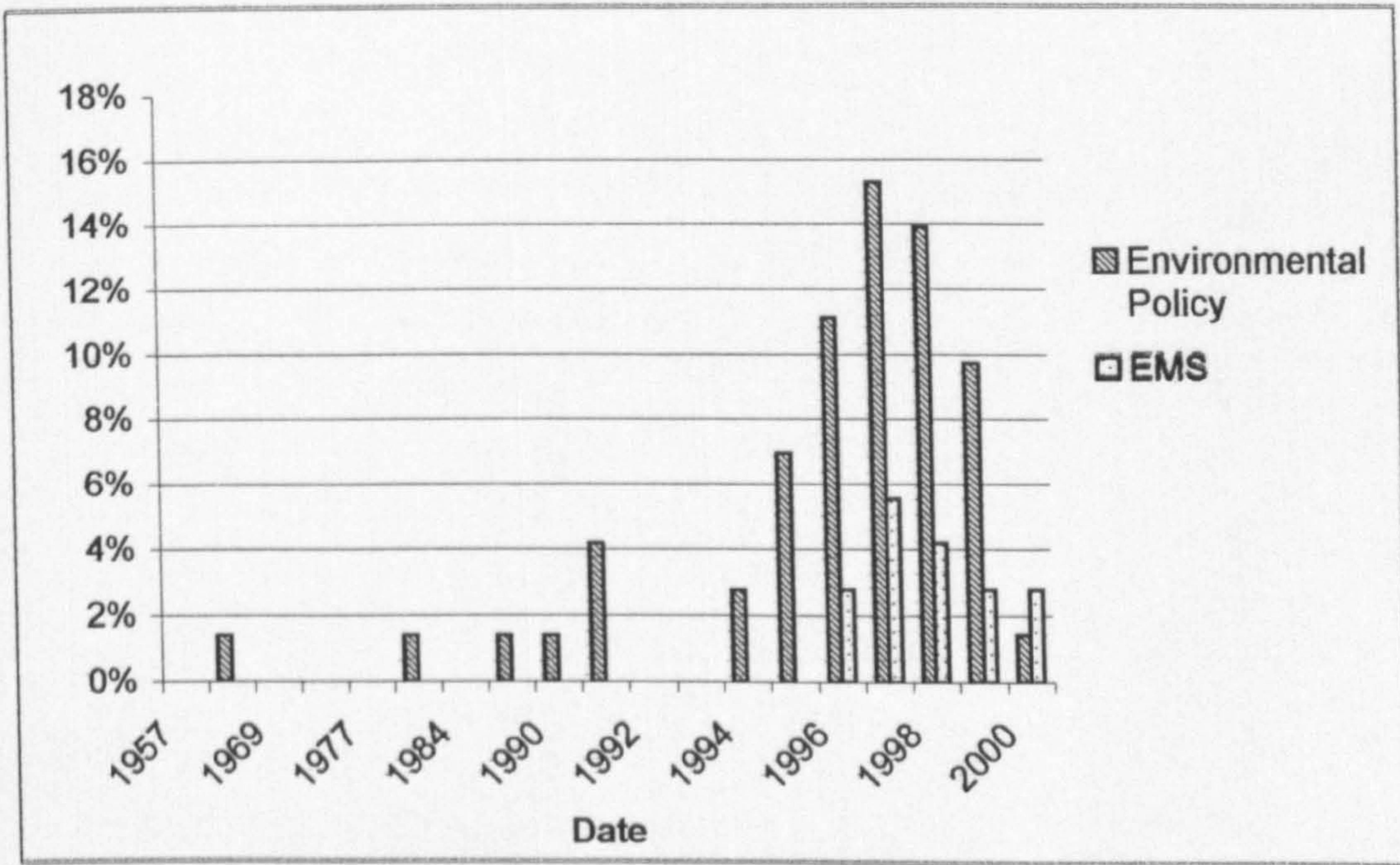
**List of Tables**

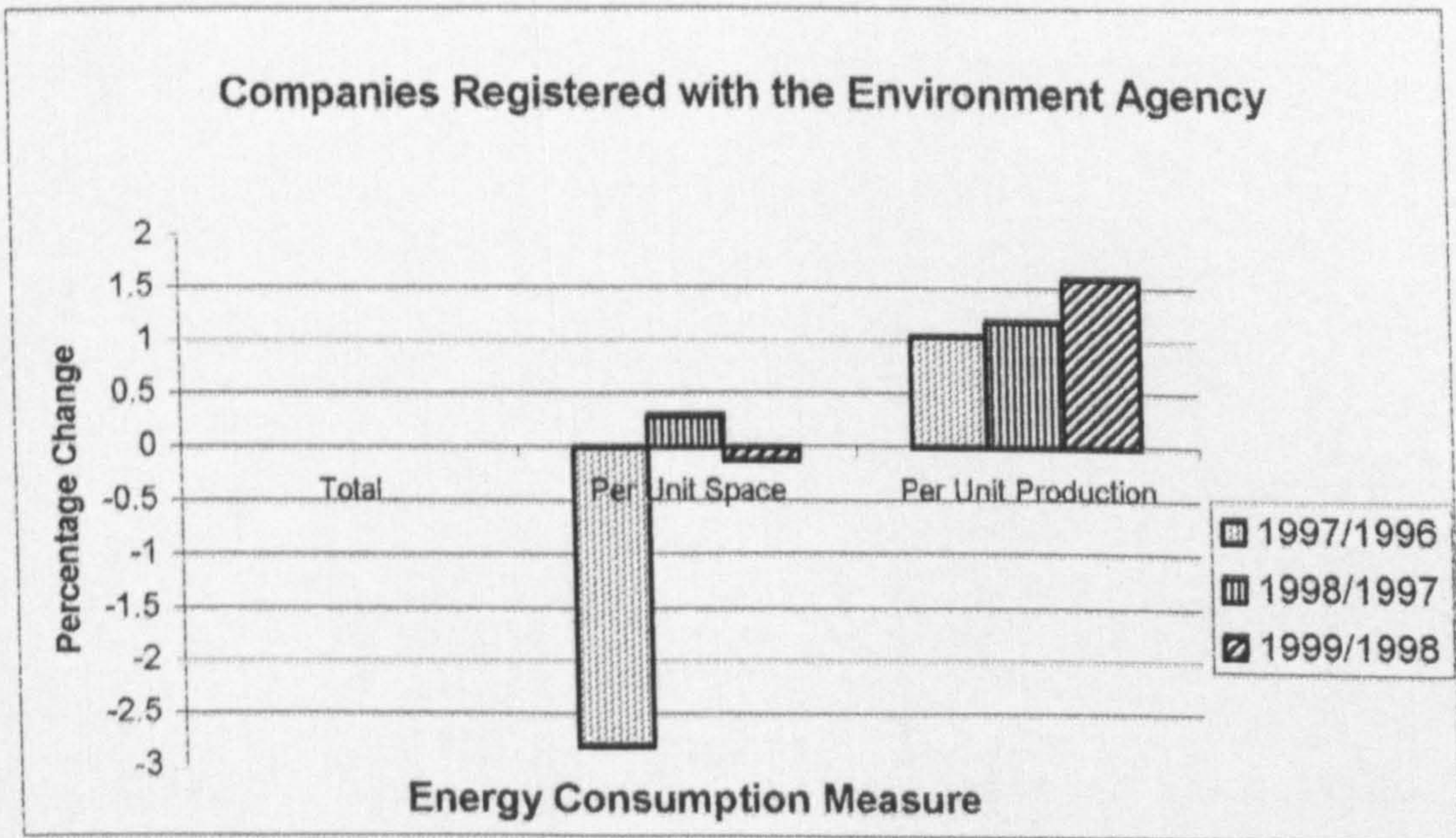
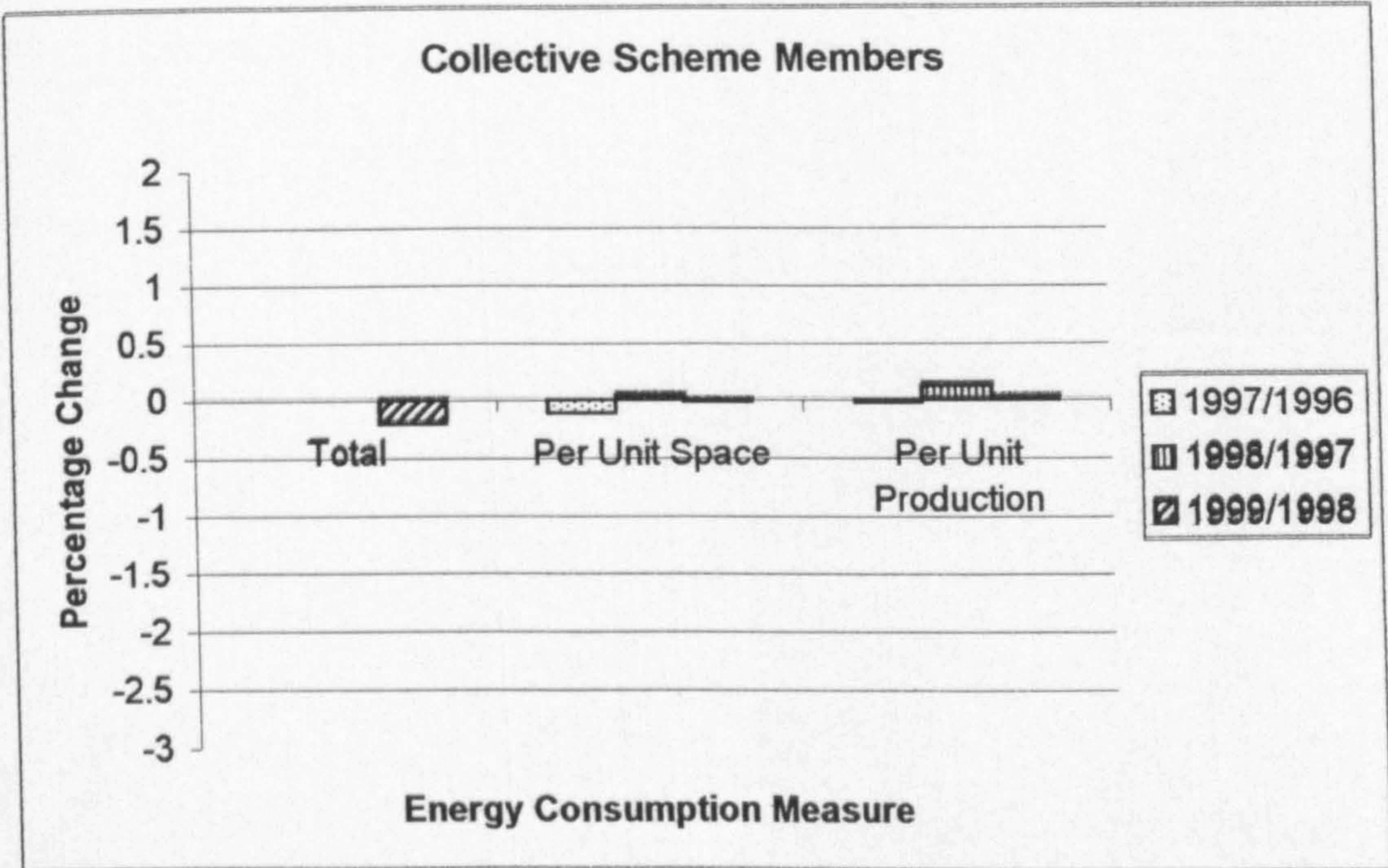
**Table 1** Introduction of Environmental Measures Concerning Packaging

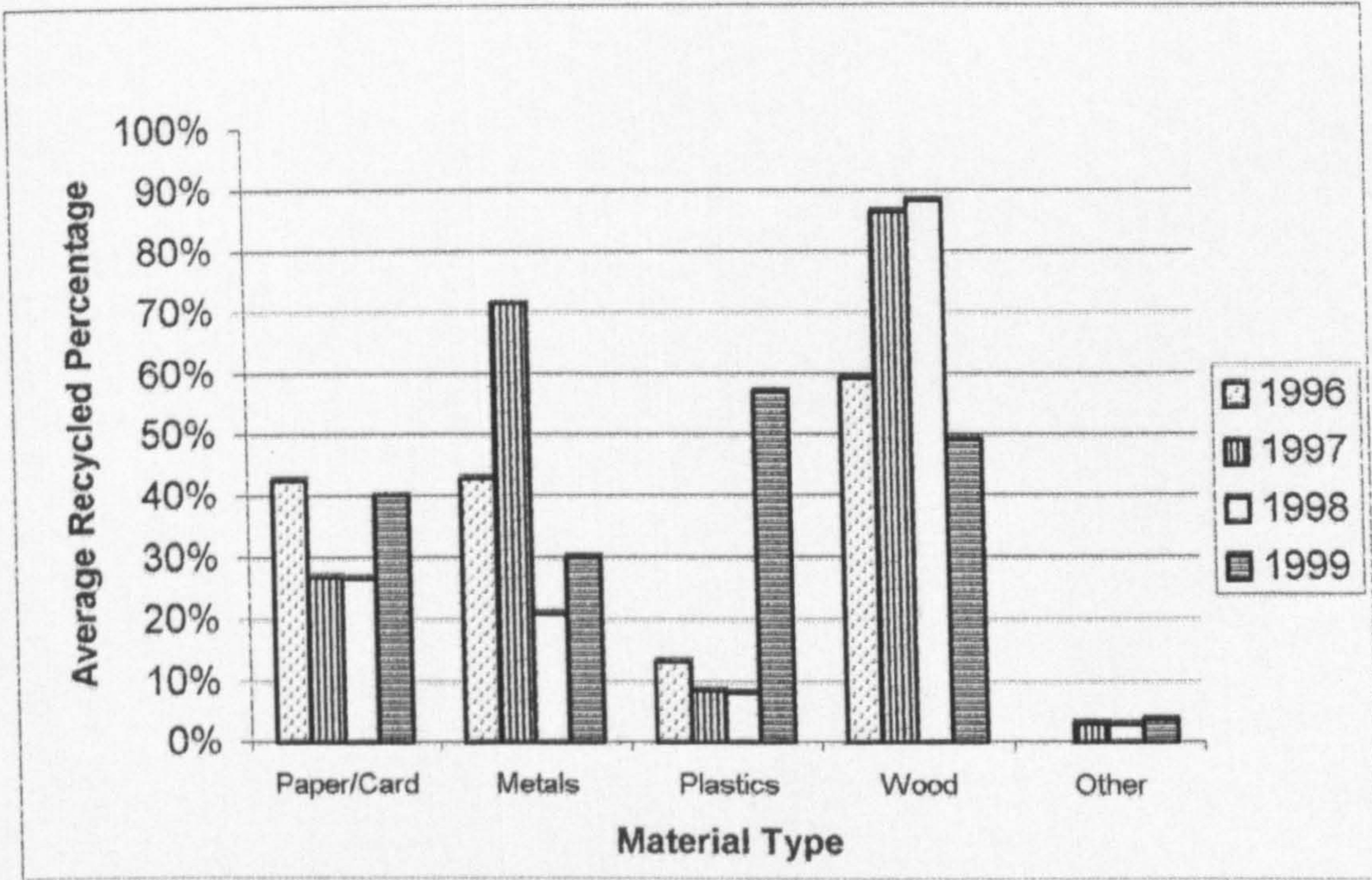
**Table 2** Material Substitutions



Measure	Collective Scheme			Environment Agency			Overall		
	Yes	No	No Answer	Yes	No	No Answer	Yes	No	No Answer
Consumption	24	7	23	7	3	8	31	10	31
Consumption by material type	7	3	8	25	7	22	32	10	30
Reuse	4	4	10	9	11	34	13	15	44
Reuse by material type	5	2	11	8	11	35	13	13	46
Recycling	4	5	9	8	15	31	12	20	40
Recycling by material type	4	6	8	7	10	37	11	16	45
Recyclate purchasing	3	5	10	4	8	42	7	13	52
Recyclate purchasing by material type	3	5	10	5	7	42	8	12	52

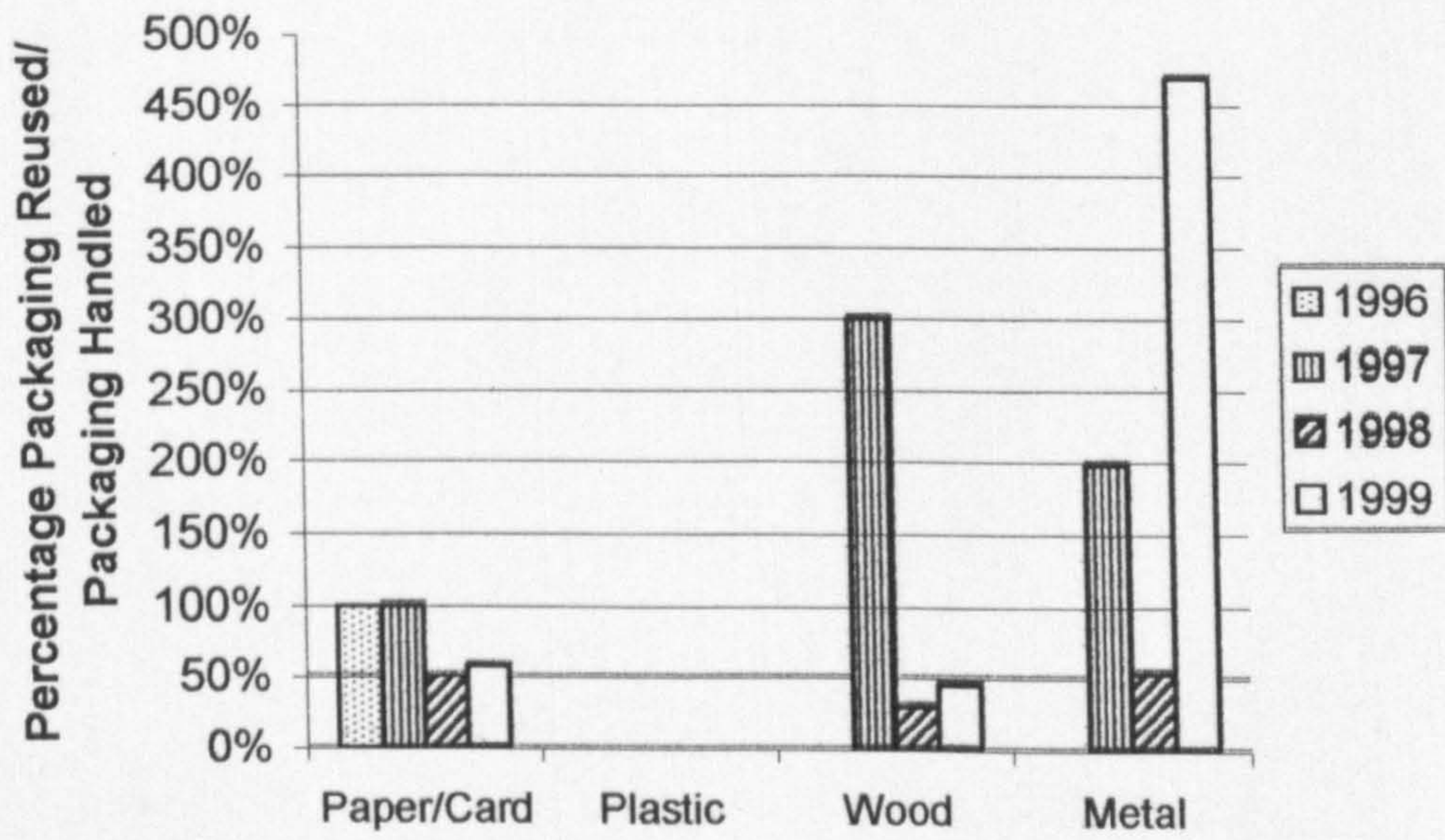




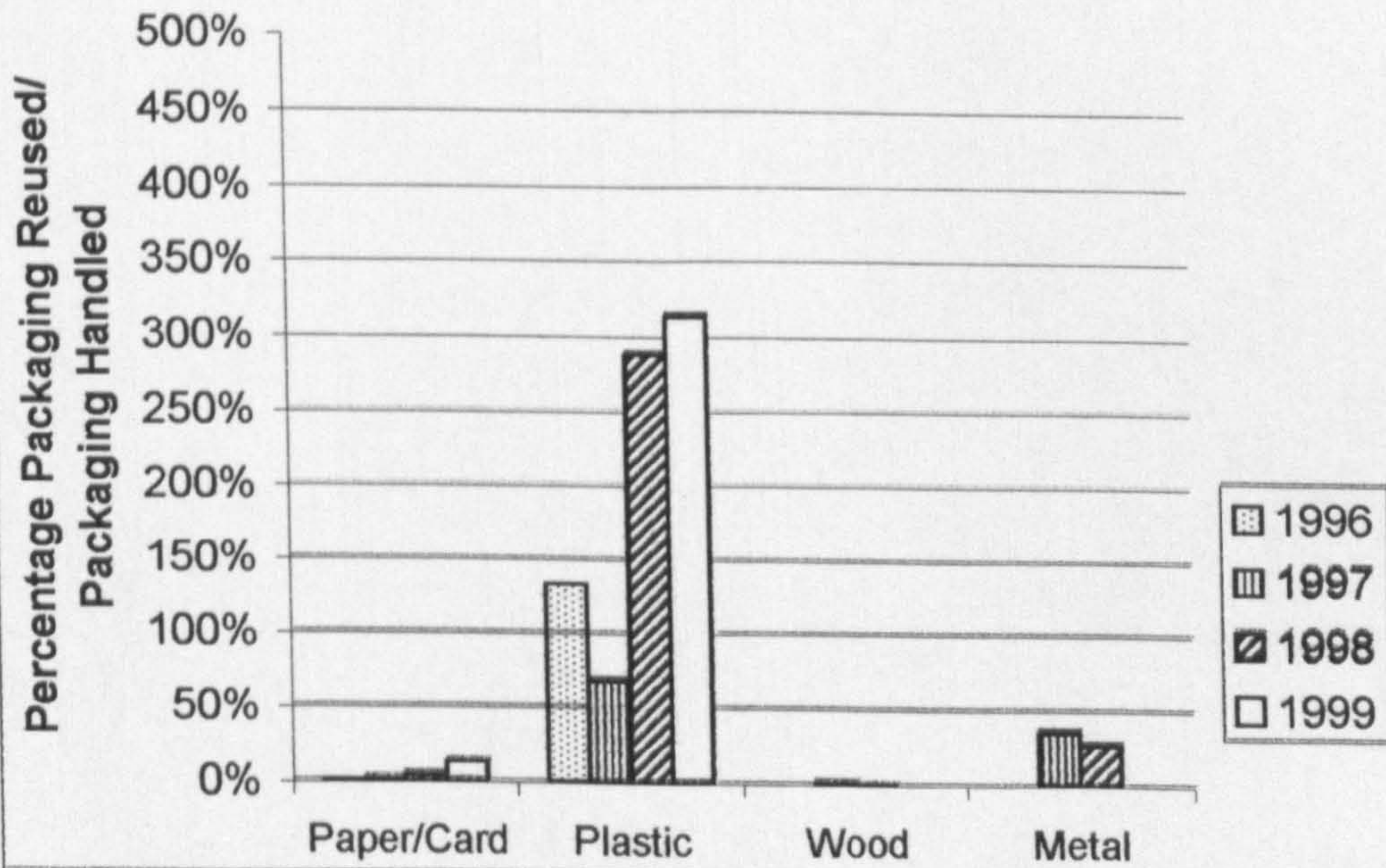


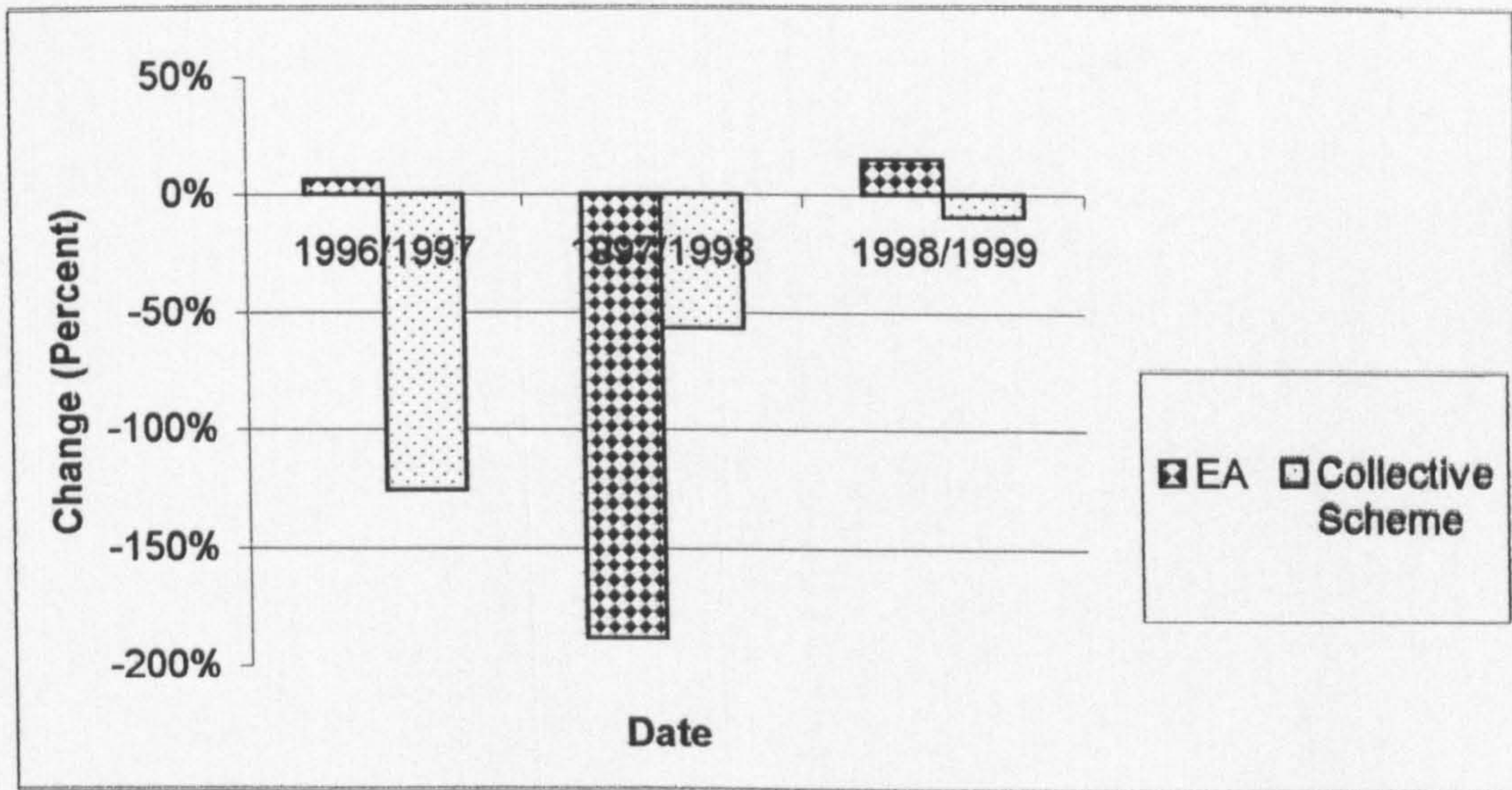


### Companies Registered with the EA



### Collective Schemes





## Collective Scheme Members

Original Material	Replacement Material	Reason for Replacement
Cardboard	stretch wrap plastic lightweight card lighter card applied differently recycled card  polypropylene returnable plastics  plastic trays Stronger cardboard	Lower cost Weight improvement Improved protective packaging Cheaper, environmentally friendly reusable Lower costs, meet obligation cheaper Lower cost, better protection
Polystyrene	Recycled plastic  Paper	better environmental practice operational/ cost effective and customer preference
Polyprop film	Polyprop film 20µ (thinner) returnable plastics	Reduced costs  reusable
Misc:		
Aluminium	metalised film	Supplier decision
Fabricated timber-based cases	Purpose-bought cardboard boxes	reduction in weight and labour costs
steel drum	plastic IBC Bulk tank	Economy Economy
paper sack and plastic bottle	paper sack	reduction of waste/ cost. Ease of application by end-user
plastic	card	Ease of recyclability
plywood boxes	polypropylene	reusable

## Environment Agency Registrants

Original Material	Replacement Material	Reason for Replacement
EPS	Card	part of Japanese continuous improvement programme
PVC	PET	Only on certain lines due to manufacturing change.
PE	Card	part of Japanese continuous improvement programme
cardboard cartons	polypropylene	Able to reuse again and again for storage
Shrink-wrap and card	PVC Blister	Recyclability
wood cases	metal reusable	economic
plastic bags	shrink wrapping	uses less material more economical
plywood boxes	polypropylene	Able to reuse again and again for storage
200ltr barrels	1000ltr IBCs	cheaper
Shrink wrap	thinner shrink wrap	reduce costs
steel	plastic	cost/weight
pallets	steel totes	cost-savings and environmental improvements through reuse

## Annex 2

# ISO 14001 Documentation for Performance Measures

**Annex 2**

**Appendix 1**

**Environmental Performance Indicators Manual**

**TITLE:** Environmental Performance Indicators Manual

**AUTHOR:** Gail Collins

**DOCUMENT STATUS:** Draft

**SUMMARY:** This document defines ICL's environmental performance indicators based on the environmental aspects relevant to its activities

**AUTHORISED BY:**

Head of Corporate Environmental Affairs Joy Boyce Signature Date

Process Owner: Joy Boyce

Distribution:

Issue	Date	Reason for change
1		Draft

## Scope

This document lists the environmental performance indicators necessary for ICL to evaluate its environmental performance. These measures enable ICL to evaluate its environmental performance and overall progress against environmental objectives and targets.

The following table has been constructed on the basis of the previous table in appendix 1 utilising the guidance notes from ISO 14031<sup>1</sup> and integrating the information from the feasibility study data on environmental performance indicators for ICL<sup>2</sup>. Environmental condition indicators (ECIs) have not been included because the data is not only difficult or impossible to obtain but I think more relevant to the environmental performance evaluation of geographical areas rather than companies.

Environmental Aspect	Environmental Impact	Environmental Performance Indicators	
		Operational Performance Indicators	Management Performance Indicators
Energy Use	Natural Resource Depletion	kWh % change kWh/ employee kWh/ m <sup>2</sup>	cost (including climate change levy) cost of energy efficiency initiative surveys cost of energy efficiency technologies
	Global Warming	tCO <sub>2</sub> tCO <sub>2</sub> / m <sup>2</sup> tCO <sub>2</sub> equivalents	
	Acidification Smog	t SO <sub>x</sub> t NO <sub>x</sub> , particulates	
Transport	Natural Resource Depletion	business miles travelled (road and air) fuel consumption litres t CO <sub>2</sub> t NO <sub>x</sub> t SO <sub>x</sub> particulates no. videoconferences plus mileage and emissions saved fleet fuel efficiency miles/ litre no. of vehicles in fleet % age vehicles with catalytic convertors no. of deliveries/ collections from suppliers	



Environmental Aspect	Environmental Impact	Environmental Performance Indicators	
		Operational Performance Indicators	Management Performance Indicators
Water	Natural Resource Use	m <sup>3</sup> m <sup>3</sup> /employee	cost cost of water conservation technologies
Waste	Landfill disposal	t t/ employee t electrical and electronic waste t/ Sales	cost (including landfill levy)
Virgin Material Use	Natural Resource Depletion	t paper purchased t plastic cups purchased no. laser printer consumables purchased	cost
Recycling	Natural Resource Conservation	t packaging recycled (plastic card wood) t plastic cups recycled t paper recycled units laser printer consumables recycled t electrical and electronic equipment recovered for recycling, reuse and refurbishment (includes batteries) t CD ROMs recycled	cost of recycling cost of compactors/ bailers cost of waste audits cost of storage facilities
Indirect environmental aspects - suppliers	various	no. of consumables purchased containing recyclate	no. of dfe products (disassembly hazardous substance elimination, low energy consumption, recyclate content) no. of ICL Approved Recyclers no. of partnerships for asset recovery (product and consumables) no. of suppliers queried on environmental issues no. of suppliers that have (environmental policy EMS and/or certification)
EMS			no. sites internally audited (until ISO 14001 group certification) no. internal auditors trained cost of EMS implementation
Environmental Incidents		no. environmental incidents	no. warnings/ fines/ penalties cost of compliance
Community Relations		commuter patterns (% by car motorbike walk bike train bus)	no. of commuter transport surveys no. of press releases on environment no. of CERs produced no. of enquiries cost of employee transport surveys and employee travel initiatives no. of environmental group/ organisational memberships

**Annex 2**

**Appendix 2**

**Environmental Performance Measurement Procedures**

**TITLE:** Environmental Performance Measurement Procedures

**AUTHOR:** Gail Collins

**DOCUMENT STATUS:** Draft

**SUMMARY:** This document defines the procedures necessary to measure ICL's environmental performance

**AUTHORISED BY:**

Head of Corporate Environmental Affairs Joy Boyce Signature Date.

Process Owner: Joy Boyce,

Distribution:

Issue	Date	Reason for change
1		Draft

## **DOCUMENT CONTROL**

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<b>3. FLOWCHART</b>	<b>11</b>
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### *Changes from previous issue*

This is the first draft issue of the document

### *Referenced documents*

The following documents are referred to in the text thus, [n], or are associated with this document.

[1] The Environmental Performance Indicators Manual

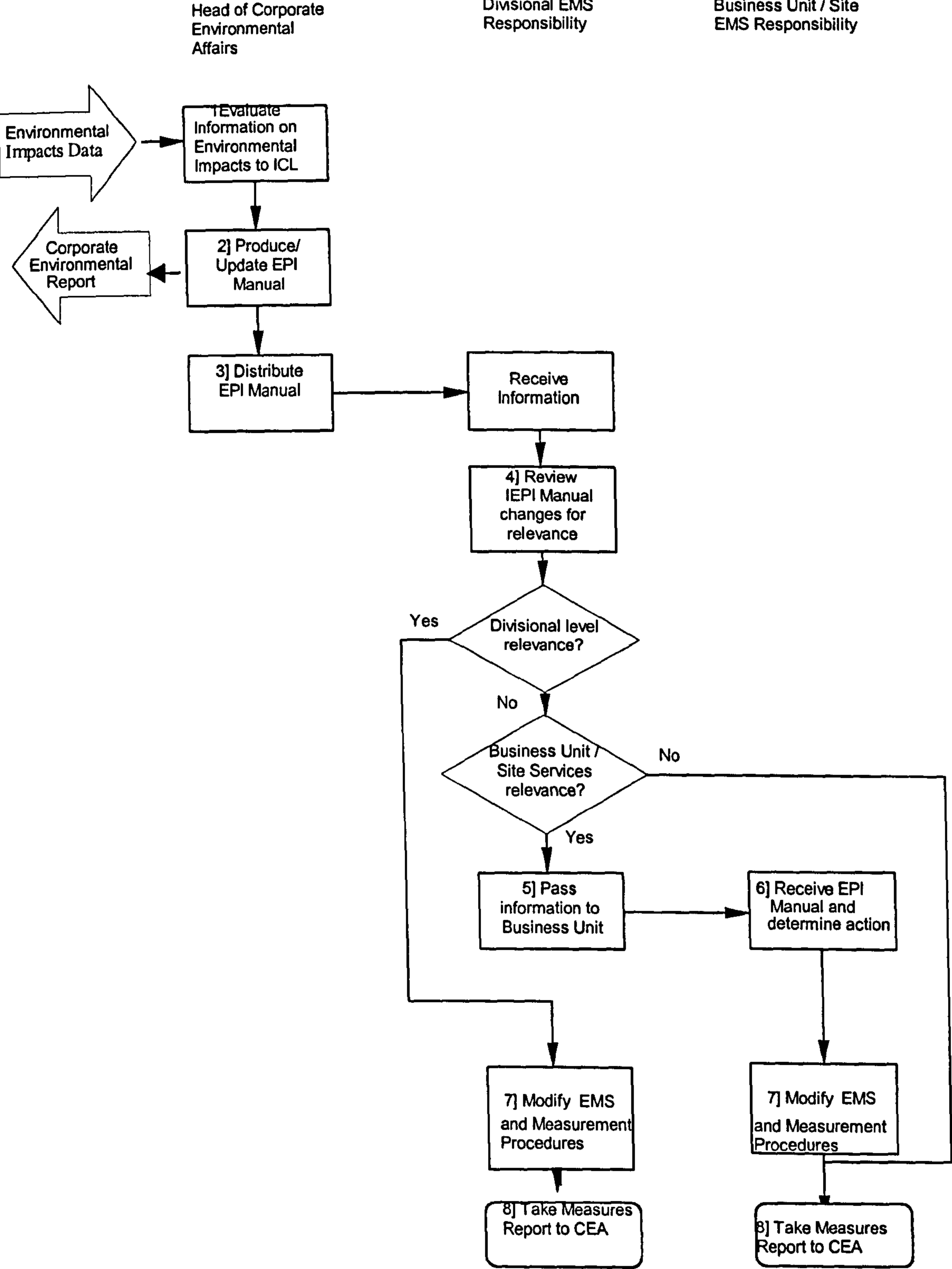
### *Change Control*

This document is subject to the change control process applicable to Procedures.

## **INTRODUCTION**

ISO14001 requires that the management system ensures continuous improvement in environmental performance. This manual outlines the procedure necessary for the identification and measurement of ICL's Environmental Performance. In order to satisfy the ISO 14001 requirement that companies have to assess their environmental impacts, an environmental performance indicators manual has been set up to include all environmental aspects that are relevant to ICL's activities <sup>[1]</sup>.

FLOWCHART



## PROCESS DESCRIPTION

Ref	Explanation	Records	Work Instruction
1	Corporate Environmental Affairs regularly assesses ICL's business activities and information on EPIs		
2	Corporate Environmental Affairs create and update EPI manual	Document	Document Creation
3	Environmental Affairs distributes EPI manual to specified distribution list via appropriate media.	Distribution record	Distribution list
4	Business Division reviews EPIs to determine action necessary. Contacting Corporate Environmental Affairs for guidance as necessary.		
5	The Business Division may opt to either filter the EPI manual and forward only that considered necessary to all relevant business units or distribute to all designated recipients within the Division		
6	Business Units receive bulletin and determine any necessary action from Corporate Environmental Affairs		
7	Update if necessary the relevant documentation and take action as prescribed within the local Environmental Management System	Change controls for EMS	
8	Take relevant measures and report to CEA	Electronic data record	Data collation

## CURRENT DATA MEASUREMENT PROCESSES

Data is collected quarterly from site facilities departments across all UK sites via electronic forms in Microsoft Outlook and includes:

- Energy consumption data for oil, gas and electricity

- Recycling data for paper, plastic cups, cardboard, laser printer consumables, and cans

- Videoconferencing data is collected from V.C.Bookings via email

- Business mileage data from Sue Carpenter via excel spreadsheets

- Personnel Data monthly via spreadsheets from HR

- WEEE data from Out-turn reports

- Sq. footage building space from ICL properties

**Annex 2**

**Appendix 3**

**Business Mileage Data and  
Videoconferencing Mileage Saved Sample Data**



Site	1993			1994			1995			1996			1997			1998			1999			
	Oil	Gas	Elect	Oil	Gas	Elect	Oil	Gas	Elect	Oil	Gas	Elect	Oil	Gas	Elect	Oil	Gas	Elect	Oil	Gas	Elect	
BIR03			1392365			1428097			389210			1508139			1334685			526755				
BRA01		52450	3055570		38132	1228587		811549	271342		2212871		1097376		1502779		1502779					
BRS06		35253	850420		412222	862460		234330.5	3753		76358		27107		10737		10737					
BSN01		47670	4171270		39196	4277613		30220	15272		2248080		20586		721290		721290					
ELS01		542535	157081		874323	96276		405597	187306		509392		347547									
FCY03		647919	245491		502404	267452		286270	16360		135606		14932		316051		316051					
FEL01	115000	227807	10933874	92000	169153	11237795	75000	211854	172462	116000	2975124	8707925	116000	2975124	8707925	115000	324600	889635	58000	142604	4557556	998887
FEL05			1143585		71571	1143585		99208	82178		498339		7656		8512		8512				482497	998887
KID01		18104055	23319568		19190205	23984232		19700711													452183	1097814
LON11	85000																					
MAN01																						
MAN05		5295229	21665945		5727824	21545911		5096216	5082960		22427330		1655722		2836961		2836961				4269756	19742220
MAN12			2600000			2140000					1760939											
NEW05			450679			542766					477145											
REAxx																						
SLH01																						
SLH06		32859	3509620		11180	112943		1285309	13055		586920		19667		773709		773709				395401	266758
STEO4					42007	2219910		369096	4761805		1004850		916754		275542		275542				956491	567920
TAP01	28200	835628	383120	20000	823476	371978		158454	737718		3448947		337979		337979		337979				1218211	2446874
TECH01		109867	761254		870324	794337		827416	1626455		8906440		912705		2085712		2085712				5362833	8367733
WAK01			1057706			794337		1341297	932419		34360											
WAR04						464051			739313		813678											
WIN01		46704	2416220		36728	2239900		30874	35749		693271		916684		205029		205029				132562	925359
WSR01		3547431	366153		3868337	368598		3730870	4228732		3381842		3745651		3996663		3996663				463611	448818
Total	228200	29845407	75943971	197000	34006127	84109393	177800	35010578	274914	18906879	5972599	199000	14380404	51368615	200000	13057585	42235700	58000	16404808	63968188		
oil '93 2	94 3	95 3		Oil:	Rate 94/93	Rate 95/94	Rate 96/95	Rate 97/96	Rate 98/97	Rate 99/98	Oil:	Rate 96/95	Rate 97/96	Rate 98/97	Rate 99/98	Oil:	Rate 98/97	Rate 99/98	Oil:	Rate 99/98	Oil:	Rate 99/98
elec. '93 16	94 21	95 21		Gas:	Rate 94/93	Rate 95/94	Rate 96/95	Rate 97/96	Rate 98/97	Rate 99/98	Gas:	Rate 96/95	Rate 97/96	Rate 98/97	Rate 99/98	Gas:	Rate 98/97	Rate 99/98	Gas:	Rate 99/98	Gas:	Rate 99/98
gas '93 13	94 16	95 16		Elec:	Rate 94/93	Rate 95/94	Rate 96/95	Rate 97/96	Rate 98/97	Rate 99/98	Elec:	Rate 96/95	Rate 97/96	Rate 98/97	Rate 99/98	Elec:	Rate 98/97	Rate 99/98	Elec:	Rate 99/98	Elec:	Rate 99/98

Totals (KWH)

Gas	1996	18906879	59772599	CCL.21	£165,227	CCL.15	£118,019
Electricity	1997	14380404	51368615		£138,073		£98,624
	1998	13057585	42235700		£116,116		£82,940



CO2 emissions calculated by:  
 Gas 1.18kg CO2  
 Oil 1.53kg CO2  
 Oil 1.28kg CO2  
 Oil 1.18kg CO2

60% boiler efficiency  
 60% boiler efficiency

CO2 emissions calculated by:

Gas  
 Oil  
 Oil

60% boiler efficiency

CO2 emissions calculated by:  
 Gas  
 Oil  
 Oil  
 Oil

60% boiler efficiency  
 60% boiler efficiency  
 60% boiler efficiency

CO2  
 1kg Net = 180  
 (1kg Net = 180g CO2)

1999 Energy Consumption / Payment	Energy Use kWh	Estimated CO2 per kWh	Estimated CO2 per kWh
SE03	52754	198	10444
SE04	2288	32	73216
SE01	1443461	4117	5941117
SE02	130066	202	262733
FE01	228968	1448	331368
FE02	1481364	529	783660
FE03	154897	628	97075
FE04	24811974	1787	44281111
FE05	248724	984	244444
FE06	949282	974	924444
FE07	17793	528	9288
FE08	316536	481	152066
FE09	1484568	177	262733
FE10	82339	168	13833
FE11	78289	176	13777
FE12	718737	2812	2021111
FE13	737768	1498	1104444

CO2 Emissions Equivalent per 100 sq. Footage

SE03	7494.1528	27812.684
SE04	2715.6228	1813.19459
SE01	186448.165	72796.3344
SE02	197825.4722	73268.8739
FE01	659851.9394	244819.1898
FE02	173281.1387	64178.19953
FE03	184444.0758	68823.89185
FE04	3487715.267	1143298.347
FE05	3829.62048	14884.8224
FE06	101248.042	374622.8664
FE07	18647.8872	31279.81148
FE08	34480.7814	148246.3457
FE09	1128781.66	489179.9528
FE10	111919.179	48858.8552
FE11	96344.74808	31983.24075
FE12	64485.9553	27794.6862

Total CO2 Equivalent Emissions

SE03	7494.1528	27812.684
SE04	2715.6228	1813.19459
SE01	186448.165	72796.3344
SE02	197825.4722	73268.8739
FE01	659851.9394	244819.1898
FE02	173281.1387	64178.19953
FE03	184444.0758	68823.89185
FE04	3487715.267	1143298.347
FE05	3829.62048	14884.8224
FE06	101248.042	374622.8664
FE07	18647.8872	31279.81148
FE08	34480.7814	148246.3457
FE09	1128781.66	489179.9528
FE10	111919.179	48858.8552
FE11	96344.74808	31983.24075
FE12	64485.9553	27794.6862

lbt lbt Cod	Sep-99	Oct-99	Nov-99	Dec-99
0001	2919250	2550569	3284715	2364148
0004	326828	262666	329057	279806
0006	54127	28437	57581	74286
0009	174675	177643	155268	207350
0011	161252	119120	196129	165623
0016	439066	365945	240378	5262
0019	3872	6921	2743	4232
0022	176614	138173	172956	155248
0023	104230	112430	110857	122881
0029	23334	49869	39315	51117
0033	19130	12892	22101	27853
0035	10291	6485	13879	48377
0039	111892	66999	119484	84562
0045	988132	1100699	1156744	1058457
0066	2099	0	1960	1401
0122	13848	21606	14998	39930
0169	54579	47545	59772	58261
0872	98432	83513	102777	75258
0873			24	0
0885			1003	
0892	346	324	615	
0899	19134	14587	24112	16168
0991	113803	126027	166822	120053
Total	5851338	5328884	6273290	4960273

iclmiles

lbt lbt Cod	Jan-00	Feb-00	Mar-00	Apr-00	May-00	Jun-00	Jul-00	Aug-00	Sep-00	Oct-00	Nov-00	Dec-00
0001	3178014	2508056	3623820	2664953	3042727	2788583	2659748	2877649	2458502	2861530	2888979	2155219
0004	286177	247059	329721	231424	137946	138117	117091	140362	118160	90077	142212	85813
0006	46081	53153	49432	61160	41406	59625	54571	46756	46226	65181	50501	67384
0009	178705	144346	213697	160204	156078	155382	148722	81845	5207	35030	19311	11392
0011	200343	168156	281713	183361	193017	216187	181270	205972	133005	208192	188607	270926
0015				0	10985	41732	32169	35996	24363	21535	26858	21814
0016	5848	7079	13090	0	3221	4249						
0019	3940	1763	13565	6893	2210	5619	8196	7296	660	5883	0	4188
0022	182362	167477	266745	2279	274343	262430	6161	1452	2727	733	6865	271605
0023	133159	152867	239562	221590	307750	325640	212295	215497	216128	230533	266637	259917
0025		320										
0029	47755	47067	58776	305465	41164	48651	281267	338998	245683	270235	241083	36744
0033	30028	44661	74041	41516	28206	43630	39364	60093	35379	57958	58235	42955
0035	35955	30103	44274	42678	27703	41876	34639	60375	23644	55823	65006	26327
0039	108068	88829	172185	25892	98539	107325	26697	31924	34207	27398	25067	67003
0045	1015266	950708		97920	919150	932309	75239	114538	60561	88605	86856	22072
0066		1219										
0099			1269829			470	926768	358233	56829	88987	57411	779965
0122	23585	51071	35012	893194	46309	51855	43129	726731	890424	855879	877170	38214
0169	54924	45136	66724	29112	111366	61752	54146	51755	45947	50714	57891	28991
0872	113167	86507	114315	66806	98156	67844	70973	59825	37708	43883	30255	93992
0873	124	136	166	67292	304	298	86	91031	69641	59906	88361	272
0876				605	7133	9922	10323	384	0	539	404	17265
0879								21141	14748	13695	18662	8215
0881												21649
0883	0											
0899	14726	16396	20049	12143	19935	21055	14750	15309	17707	9222	22087	12176
0991	95642	63166	83876	67693	64698	33112	36347	44618	39487	25626	59888	39284
	2575855	4875275	7007178	5218797	5668993	5454341	5033951	5587780	4613713	5203964	5315177	4420243

Bus Mileage 2000

videoconf. roadmiles saved

Date	From	To	nbr People		Mileage return	Road Miles
			From	To		
1-Sep-99	ste04	war08	3	3	374	1122
2-Sep-99	man05	ste14	3	3	360	1080
2-Sep-99	brawm07	war04	3	3	412	1236
2-Sep-99	brawm07	man05	3	3	398	1194
3-Sep-99	man27	rea24	3	3	400	1200
3-Sep-99	man01	ste04	3	3	360	1080
3-Sep-99	kid01	man01	3	3	108	324
3-Sep-99	usa20	usa04	3	3	154	462
3-Sep-99	usa04	usa20	3	3	154	462
6-Sep-99	brawm07	man05	3	3	398	1194
6-Sep-99	man27	rea24	3	3	400	1200
7-Sep-99	man01	ste04	3	3	360	1080
7-Sep-99	kid01	man01	3	3	108	324
8-Sep-99	usa04	usa20	3	3	154	462
8-Sep-99	gla23	man27	3	3	440	1320
8-Sep-99	usa04	usa20	3	3	154	462
8-Sep-99	brawm07	man27	3	3	398	1194
8-Sep-99	man05	slh06	3	3	390	1170
8-Sep-99	brawm07	kid01	3	3	338	1014
8-Sep-99	brafj01	man05	3	3	398	1194
8-Sep-99	brafj01	ste04	3	3	126	378
8-Sep-99	brawm07	man27	3	3	398	1194
9-Sep-99	bir03	brawm07	3	3	220	660
9-Sep-99	brafj01	man05	3	3	398	1194
9-Sep-99	lon72	man27	3	3	398	1194
10-Sep-99	kid01	slh06	3	3	320	960
13-Sep-99	brafj01	man05	3	3	398	1194
13-Sep-99	slh06	man05	3	3	390	1170
14-Sep-99	man05	slh06	3	3	390	1170
14-Sep-99	man01	ste04	3	3	360	1080
14-Sep-99	man05	ste04	3	3	360	1080
14-Sep-99	man05	slh06	3	3	390	1170
15-Sep-99	ste04	kid01	3	3	304	912
15-Sep-99	brafj01	man05	3	3	398	1194
15-Sep-99	gla23	man23	3	3	440	1320
15-Sep-99	brafj01	man05	3	3	398	1194
15-Sep-99	brafj01	ste04	3	3	126	378
15-Sep-99	brawm07	man05	3	3	398	1194
16-Sep-99	usa04	usa20	3	3	154	462
17-Sep-99	enf01	man05	3	3	406	1218
17-Sep-99	brafj01	sol02	3	3	220	660
17-Sep-99	brafj01	ste04	3	3	126	378
20-Sep-99	kid01	slh06	3	3	320	960
20-Sep-99	brawm07	man27	3	3	398	1194
20-Sep-99	man05	slh06	3	3	390	1170
21-Sep-99	brafj01	man05	3	3	398	1194
21-Sep-99	man01	ste04	3	3	360	1080
21-Sep-99	kid01	man01	3	3	108	324
21-Sep-99	kid01	ste04	3	3	304	912
22-Sep-99	gla13	man23	3	3	440	1320
22-Sep-99	man27	brawm07	3	3	398	1194
23-Sep-99	brawm07	kid01	3	3	338	1014
24-Sep-99	brawm07	sol02	3	3	220	660
24-Sep-99	enf01	lsa02	3	3	508	1524
24-Sep-99	brawm07	ste04	3	3	126	378
27-Sep-99	kid01	brawm07	3	3	338	1014
27-Sep-99	kid01	man27	3	3	108	324
27-Sep-99	kid01	brawm07	3	3	338	1014
27-Sep-99	kid01	man27	3	3	108	324
27-Sep-99	man05	slh06	3	3	390	1170
28-Sep-99	usa04	usa20	3	3	154	462
28-Sep-99	man05	ste04	3	3	360	1080
28-Sep-99	kid01	man01	3	3	108	324
28-Sep-99	man27	brawm07	3	3	398	1194
29-Sep-99	gla13	man23	3	3	440	1320
29-Sep-99	enf01	man05	3	3	406	1218
30-Sep-99	man05	ste04	3	3	360	1080
30-Sep-99	usa04	usa20	3	3	154	462

Date	From	To	nbr People		Mileage return	CO2 not emitted
			From	To		
1-Sep-99	fin17	brafj01	3	3	2268	6804
1-Sep-99	japan	man05	3	3	12440	37320
1-Sep-99	japan	man05	3	3	12440	37320
1-Sep-99	fin14	brafj01	3	3	2268	6804
1-Sep-99	usa04	reado	3	3	11034	33102
2-Sep-99	usa04	usa24	3	3	2348	7044
2-Sep-99	ire11	man05	3	3	648	1944
2-Sep-99	usa24	rea24	3	3	9494	28482
2-Sep-99	usa24	usa77	3	3	2748	8244
2-Sep-99	fin17	brafj01	3	3	2268	6804
2-Sep-99	japan	man05	3	3	12440	37320
2-Sep-99	swe20	war08	3	3	1776	5328
2-Sep-99	brafj01	ire11	3	3	648	1944
2-Sep-99	japan	man05	3	3	12440	37320
2-Sep-99	tokyo	slh06	3	3	12440	37320
2-Sep-99	japan	man05	3	3	12440	37320
2-Sep-99	japan	man05	3	3	12440	37320
3-Sep-99	usa60	usa31	3	3	1506	4518
6-Sep-99	usa60	usa04	3	3	4852	14556
6-Sep-99	usa04	usa60	3	3	4852	14556
6-Sep-99	slh06	usa24	3	3	9494	28482
6-Sep-99	read0	usa24	3	3	9494	28482
3-Sep-99	japan	usa04	3	3	11180	33540
3-Sep-99	usa20	usa21	3	3	4546	13638
3-Sep-99	usa20	usa24	3	3	2416	7248
3-Sep-99	usa04	slh06	3	3	11034	33102
3-Sep-99	usa04	usa21	3	3	4520	13560
3-Sep-99	slh06	usa02	3	3	10782	32346
3-Sep-99	japan	man05	3	3	12440	37320
6-Sep-99	japan	man05	3	3	12440	37320
6-Sep-99	usa60	usa04	3	3	4852	14556
7-Sep-99	usa60	usa31	3	3	1506	4518
7-Sep-99	usa04	usa60	3	3	4852	14556
7-Sep-99	slh06	usa24	3	3	9494	28482
7-Sep-99	japan	kid01	3	3	12440	37320
7-Sep-99	read0	usa24	3	3	9494	28482
7-Sep-99	japan	usa04	3	3	11180	33540
7-Sep-99	usa04	usa21	3	3	4520	13560
8-Sep-99	usa04	usa24	3	3	2348	7044
8-Sep-99	usa04	slh06	3	3	11034	33102
8-Sep-99	usa04	usa21	3	3	4520	13560
8-Sep-99	slh06	usa02	3	3	10782	32346
8-Sep-99	usa24	usa77	3	3	2748	8244
8-Sep-99	usa24	rea24	3	3	9494	28482
8-Sep-99	fin17	brafj01	3	3	2268	6804
8-Sep-99	man05	japan	3	3	12440	37320
8-Sep-99	slh06	japan	3	3	12440	37320
8-Sep-99	usa04	read0	3	3	11034	33102
9-Sep-99	usa04	usa24	3	3	2348	7044
9-Sep-99	brafj01	swe20	3	3	1776	5328
9-Sep-99	usa24	rea24	3	3	9494	28482
9-Sep-99	usa24	usa77	3	3	2748	8244
9-Sep-99	fin17	brawm07	3	3	2268	6804
9-Sep-99	ire11	kid01	3	3	648	1944
9-Sep-99	japan	man05	3	3	12440	37320
9-Sep-99	brawm07	fin17	3	3	2268	6804
9-Sep-99	japan	slh06	3	3	12440	37320
9-Sep-99	ire11	brawm07	3	3	648	1944
10-Sep-99	ire11	brafj01	3	3	648	1944
10-Sep-99	ire11	brawm07	3	3	648	1944
10-Sep-99	japan	lon49	3	3	12440	37320
10-Sep-99	usa02	usa04	3	3	834	2502
13-Sep-99	fin01	ste04	3	3	2268	6804
13-Sep-99	slh06	usa02	3	3	10782	32346
13-Sep-99	ita16	slh06	3	3	1794	5382
13-Sep-99	fin11	slh06	3	3	2263	6789
13-Sep-99	fin11	slh06	3	3	2263	6789
13-Sep-99	ire11	man05	3	3	648	1944

14-Sep-99	ste04	usa04	3	3	11034	33102
14-Sep-99	usa02	usa24	3	3	2882	8646
14-Sep-99	usa02	usa77	3	3	3520	10560
14-Sep-99	fin11	slh06	3	3	2263	6789
14-Sep-99	brawm07	ire11	3	3	648	1944
14-Sep-99	japan	usa04	3	3	11180	33540
14-Sep-99	usa02	usa24	3	3	2882	8646
15-Sep-99	ste04	usa20	3	3	10970	32910
15-Sep-99	rea24	usa24	3	3	9494	28482
15-Sep-99	toronto	kid01	3	3	684601	2053803
15-Sep-99	jamica	brawm07	3	3	9372	28116
15-Sep-99	fin17	brafj01	3	3	2268	6804
15-Sep-99	brawm07	swe20	3	3	1776	5328
15-Sep-99	usa24	usa04	3	3	2348	7044
16-Sep-99	usa24	usa77	3	3	2748	8244
16-Sep-99	usa24	usa20	3	3	2416	7248
16-Sep-99	read0	usa04	3	3	11034	33102
16-Sep-99	rea24	usa24	3	3	9494	28482
16-Sep-99	fin17	brafj01	3	3	2268	6804
16-Sep-99	fin17	brafj01	3	3	2268	6804
16-Sep-99	usa04	japan	3	3	11180	33540
16-Sep-99	usa04	usa74	3	3	2368	7104
17-Sep-99	toronto	kid01	3	3	684601	2053803
17-Sep-99	dublin	brawm07	3	3	576	1728
17-Sep-99	brawm07	usa24	3	3	9494	28482
20-Sep-99	ire11	man05	3	3	648	1944
20-Sep-99	swe20	rea24	3	3	1776	5328
20-Sep-99	ire11	brawm07	3	3	648	1944
20-Sep-99	slh06	usa24	3	3	9494	28482
21-Sep-99	ire09	brawm07	3	3	576	1728
21-Sep-99	japan	kid01	3	3	12440	37320
21-Sep-99	fin11	slh06	3	3	2263	6789
21-Sep-99	edi06	read0	3	3	838	2514
21-Sep-99	japan	usa04	3	3	11180	33540
21-Sep-99	man27	ire11	3	3	648	1944
22-Sep-99	read0	usa24	3	3	9494	28482
22-Sep-99	edi06	read0	3	3	838	2514
22-Sep-99	japan	slh06	3	3	12440	37320
22-Sep-99	ire11	brawm07	3	3	648	1944
22-Sep-99	japan	brafj01	3	3	12440	37320
22-Sep-99	japan	usa04	3	3	11180	33540
22-Sep-99	usa04	usa77	3	3	4856	14568
23-Sep-99	fin17	brafj01	3	3	2268	6804
23-Sep-99	fin17	brafj01	3	3	2268	6804
23-Sep-99	rea24	usa24	3	3	9494	28482
24-Sep-99	siemans	brafj01	3	3	594	1782
24-Sep-99	swe20	den01	3	3	654	1962
27-Sep-99	swe20	brafj01	3	3	1776	5328
27-Sep-99	usa24	usa60	3	3	2744	8232
27-Sep-99	usa04	usa02	3	3	834	2502
28-Sep-99	usa04	usa24	3	3	2348	7044
28-Sep-99	usa04	usa77	3	3	4856	14568
28-Sep-99	usa24	usa77	3	3	2748	8244
28-Sep-99	usa24	rea24	3	3	9494	28482
28-Sep-99	man27	ire11	3	3	648	1944
28-Sep-99	fin17	brafj01	3	3	2268	6804
29-Sep-99	ire11	brawm07	3	3	648	1944
29-Sep-99	fin17	brafj01	3	3	2268	6804
29-Sep-99	japan	man05	3	3	12440	37320
29-Sep-99	japan	usa04	3	3	11180	33540
29-Sep-99	usa04	usa74	3	3	2368	7104
30-Sep-99	read0	usa24	3	3	9494	28482
30-Sep-99	rea24	usa24	3	3	9494	28482
30-Sep-99	fin17	brafj01	3	3	2268	6804
30-Sep-99	fin11	slh06	3	3	2263	6789
30-Sep-99	fin17	brafj01	3	3	2268	6804
30-Sep-99	usa04	japan	3	3	11180	33540
30-Sep-99	ire11	brawm07	3	3	648	1944



monthly

**Number of Conferences**

1995														
	Jan.	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	1995	
<b>Sites</b>														
bra02					53	42	40	38	52	30	44	49	35	383
kid01					46	47	42	34	36	34	44	40	39	362
lon11					12	12	6	3	5	9	3	7	6	63
man01					13	13	28	15	18	19	19	21	15	161
man05					36	32	34	22	28	29	26	24	18	249
ste04					30	21	31	27	21	21	23	22	16	212
usa02					30	23	24	21	31	19	22	21	13	204
usa04					5	5	4	9	14	3	9	5	1	55
usa20					3	2	7	10	3	6	11	6	6	54
usa24					33	22	18	20	23	14	20	24	9	183
ire09					7	6	1	5	3	3	3	4	1	33
<b>Total</b>					268	223	235	204	234	187	224	223	159	1959

1996													
	Jan.	Feb.	March	April	May	June	July	August	Sept	Oct	Nov	Dec	Total
<b>Sites</b>													
bra02	40	45	38	39	36	29	32	12	17	32	40	30	390
kid01	45	40	38	45	58	45	54	45	57	49	48	41	565
lon11	9	10	9	14	12	6	5	5	5	7	4	8	94
man01	27		16	22	26	20	39	35	40	33	26	24	308
man05	26	25	25	17	21	20	18	13	29	34	38	19	285
ste04	17	9	17	8	16	11	21	10	15	15	12	14	165
usa02	20	19	18	14	17	16	12	6	12	19	16	14	183
usa04	3	7	5	4	5	0	3	0	2	2	0	1	32
usa20	14	12	11	12	18	16	27	19	25	20	19	21	214
usa24	20	20	18	14	14	14	17	8	11	21	13	19	189
ire09	6	10	6	10	5	5	10	6	5	1	7	6	77
<b>Total</b>	227	234	221	199	228	205	238	159	280	233	223	197	2644

1997													
	Jan	Feb	March	Apr	May	June	July	August	Sept	Oct	Nov	Dec	Total
<b>Sites</b>													
bra02	21	30	36	28	28	24	5	7	18	20	22	14	253
kid01	40	37	38	32	29	24	15	14	19	8	11	13	280
lon11	5	2	2	10	11	8	16	1	2	8	7	10	82
man01	23	24	21	19	19	19	14	15	17	11	9	15	206
man05	24	20	18	22	18	23	21	10	20	19	17	8	220
rea24									3	8	14	17	
ste04	14	12	10	12	13	21	12	14	22	14	12	10	166
usa02	13	14	11	9	7	7	1	6	3	2	7	4	84
usa04	3	5	1	4	11	5	7	3	13	6	10	68	
usa20	16	8	10	7	6	7	5	3	6	3	2	5	78
usa24	14	22	18	17	17	10	9	7	6	5	8	11	144
ire09	6	2	4	1	3	2	1	1	1	1			20
<b>Total</b>	179	176	169	161	162	150	98	85	119	112	115	117	1643

1998													
	Jan	Feb	March	Apr	May	June	July	August	Sept	Oct	Nov	Dec	Total
<b>Sites</b>													
bra01	12	26	13										
kid01	17	15	18										
lon11	6	6	3										
man01	10	12	12										
man05	15	13	21										
rea24	12	13	22										
ste04	12	10	11										
usa02	0	1	0										
usa04	8	1	10										
usa20	0	3	4										
usa24	6	7	11										
usa77	4	1	5										
ire09	0	1	0										
<b>Total</b>	98	108	130										

**Analysis of Conferences**

1995														
Countries	Jan.	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	Total	
UK-UK					48	44	48	34	35	33	36	42	29	349
UK-US					15	11	15	15	21	17	16	16	13	139

monthly

UK-IRE09	1	6	1	4	3	3	3	4	1	26
ire09-fuj										
UK-Fujitsu	24	21	24	13	23	20	13	22	14	174
USA-Fujitsu										
UK-Swe/Fin	15	15	15	10	8	2	17	18	18	118
US-US	15	17	15	16	21	10	14	13	7	128
UK-Other	14	8	14	10	11	6	11	2	12	88
Multipoint	9	8	9	10	10	12	14	10	11	93

Total: 1115

Countries	1996 Jan.	Feb.	March	April	May	June	July	August	Sept	Oct	Nov	Dec	Total
UK-UK	36	34	30	33	34	37	42	32	41	38	38	29	324
UK-US	6	14	13	12	14	13	19	17	23	17	17	12	144
UK-IRE09	6	10	0	3	10	2	4	1	2	1	3	3	29
ire09-fuj			6	6	4	3	5	5	2	0	4	3	
UK-Fujitsu	13	12	18	13	12	7	10	5	11	12	19	11	100
USA-Fujitsu										1	0	0	
UK-Swe/Fin	18	12	20	22	12	11	7	3	11	18	15	11	110
US-US	13	16	13	9	16	14	12	0	9	10	8	12	90
UK-Other	15	13	13	10	13	10	14	10	20	18	15	11	121
Multipoint	17	13	11	13	13	7	17	10	9	21	13	16	119
<b>Total</b>				121	124	104	130	89	128	136	132	108	1037

Countries	1997 Jan	Feb	March	Apr	May	June	July	August	Sept	Oct	Nov	Dec	Total
UK-UK	27	27	24	24	28	29	21	18	26	18	19	12	195
UK-US	9	8	14	14	9	6	10	1	9	7	11	12	79
UK-IRE09	2	0	0	0	0	0				1		12	1
ire09-fuj	5	2	4	1	3	2		1					
UK-Fujitsu	19	16	25	24	20	23	21	12	12	21	12	12	157
USA-Fujitsu	1	1	1	3	4	3	1	3		7	5	8	
USA-Other									1	1			
UK-Swe/Fin	8	11	15	15	9	7	3	2	14	17	23	14	104
US-US	10	9	8	5	9	3	2	6	1		1	1	28
UK-Other	13	5	6	7	6	9	6	8	9	4	5	15	69
Multipoint	14	20	11	10	12	10	1	4	5	6	5	10	63
<b>Total</b>	108	99	108	103	100	92	65	55	77	81	81	84	696

Countries	1998 Jan	Feb	March	Apr	May	June	July	August	Sept	Oct	Nov	Dec	Total
UK-UK	19	17	16										
UK-US	7	6	13										
UK-IRE09	0	1	0										
UK-Fujitsu	12	13	17										
USA-Fujitsu	8	8	6										
USA-Other	0	0	1										
UK-Swe/Fin	8	13	9										
US-US	0	2	3										
UK-Other	15	20	22										
Multipoint	5	8	8										
<b>Total</b>	74	87	94										
<b>Total</b>													

SUMMARY		EMISSIONS (g/ mile)						
		CO	NOx	HC	CO	NOx	HC	
<b>Date</b>	<b>Number of miles saved</b>	<b>Number of journeys saved</b>	<b>Date</b>	<b>Number of miles saved</b>	<b>Number of journeys saved</b>	<b>CO</b>	<b>NOx</b>	<b>HC</b>
Monthly			Quarterly					
sept. '94	2550	91						
oct. '94	22288	80						
nov. '94	21450	80						
dec. '94	14778	55	Q4 '94	58516	215	5178666	198954.4	479831.2
jan. '95	13380	154						
feb. '95	11738	46						
mar. '95	7530	30	Q1 '95	32648	230	2889348	111003.2	267713.6
april '95	4736	23						
may '95	13284	53						
june '95	13298	52		31318	128	2771643	106481.2	256807.6
july '95	10742	44						
aug. '95	11410	48						
sept. '95	12144	51		34296	143	3035196	116606.4	281227.2
oct. '95	12112	55						
nov. '95	11326	52						
dec. '95	11124	42		34562	149	3058737	117510.8	283408.4
jan. '96	13270	55						
feb. '96	11746	52						
mar. '96	8956	52		33972	159	3006522	115504.8	278570.4
april '96	8806	46						
may '96	13944	64						
june '96	10952	50		33702	160	2982627	114586.8	276356.4

Videoconferencing data

Date	Mileage Saved	CO <sub>2</sub> Emissions Saved (Tonnages)*
<b>1994</b>		
Q1		
Q2		
Q3		
Q4	218320	33.84
<b>Annual Total</b>	<b>218320</b>	<b>33.84</b>
<b>1995</b>		
Q1	85722	13.29
Q2	93954	14.56
Q3	102888	15.95
Q4	103686	16.07
<b>Annual Total</b>	<b>386250</b>	<b>59.87</b>
<b>1996</b>		
Q1	101916	15.80
Q2	101106	15.67
Q3	76350	11.83
Q4	89937	13.94
<b>Annual Total</b>	<b>369309</b>	<b>57.24</b>
<b>1997</b>		
Q1	24918	3.86
Q2	70230	10.89
Q3	57384	8.89
Q4	50514	7.83
<b>Annual Total</b>	<b>203046</b>	<b>31.47</b>
<b>1998</b>		
Q1	54576	8.46
Q2	55605	8.62
Q3	46038	7.14
Q4	66180	10.26
<b>Annual Total</b>	<b>222399</b>	<b>34.47</b>
<b>1999</b>		
Q1	68184	10.57
Q2	91716	14.22
Q3	160032	24.80
Q4	131532	20.39
<b>Annual Total</b>	<b>451464</b>	<b>69.98</b>

**Note:**

\* This figure is based on a CO<sub>2</sub> emission of 250g per km  
 Source: Volvo Website (<http://www.volvo.co.uk>)

## Annex 3

### Survey Data

**Annex 3**

**Appendix 1**

**Codesheet for Survey Data**

**UK PACKAGING REGULATIONS AND COMPANY ENVIRONMENTAL  
PERFORMANCE SURVEY**

**Section 1: PERSONAL DETAILS**

- 1a) Job title (please state) 0 No answer 1 \_\_\_\_\_
- 1b) Level of authority (please tick) 0 No answer
- |                        |                              |
|------------------------|------------------------------|
| 1 Chairman/ CEO/MD etc | 2 VP/Dir/Asst/Dep.Dir etc    |
| 3 Senior management    | 4 Higher functional          |
| 5 Functional           | 6 Other (please state) _____ |
- 1c) Area(s) of responsibility (please tick)
- |                        |                       |
|------------------------|-----------------------|
| 1 Legal/Finance        | 32 Sales/ Marketing   |
| 2 Human Resources      | 64 R&D                |
| 4 Public Relations     | 128 Production        |
| 8 Environment          | 256 Health and Safety |
| 16 IT/systems/ quality | 512 Distribution      |

**Section 2: COMPANY DETAILS**

2a) Is your company registered individually with the Environment Agency or with a collective scheme under the UK Producer Responsibility Obligation (Packaging and Packaging Waste) Regulations 1997?

- 0 No answer  
1 Environment Agency  
2 Collective Scheme                      Name of Collective Scheme: \_\_\_\_\_

2b) Total number of employees in your company? No.Emp

0 No answer	1 <1000	2 1001-4999	3 5000+
-------------	---------	-------------	---------

2c) What was the approximate turnover of your company in 1999? Turn99

0 No answer	1 <£1m	2 £1-5m	3 £5-100m
4 £100m - £1Bn	5 £1Bn+		

2d) Based on the following FTSE sector indices, please give the percentage of your company's turnover in each sector to the nearest 10%  
 Sect--

Oil & Gas	aa %	Mining	ak %	Chemicals	au %	Construction & Building Materials	be %
Forestry & Paper	ab %	Steel & Other Metals	al %	Aerospace & Defence	av %	Diversified Industrials	bf %
Electronic & Electrical Equipment	ac %	Engineering & Machinery	am %	Automobiles	aw %	Household Goods & Textiles	bg %
Beverages	ad %	Food Producers & Processors	an %	Health	ax %	Packaging	bh %
Personal Care & Household Products	ae %	Pharmaceuticals	ao %	Tobacco	ay %	Distributors	bi %
General Retailers	af %	Leisure, Entertainment & Hotels	ap %	Media and Photography	az %	Restaurants, Pubs & Breweries	bj%
Support Services	ag %	Transport	aq %	Food and Drug Retailers	ba %	Telecommunication Services	bk %
Electricity	ah %	Gas Distribution	ar %	Water	bb %	Banks	bl%
Insurance	ai %	Life Assurance	as %	Investment Companies	bc %	Real Estate	bm %
Speciality & Other Finance	aj %	Information Technology Hardware	at %	Software & Computer Services	bd %	Sectbn (specify)	bn %

### Section 3: ENVIRONMENTAL MEASURES

3.1 How much waste did your company send to landfill in the following years:

	1996	1997	1998	1999
Waste to landfill (Tonnes / 10 <sup>3</sup> kg)	LandfA	LandfB	LandfC	LandfD

3.2 In what year did your company introduce the following measures? Were the measures introduced as a direct result of the UK Producer Responsibility Obligations (Packaging and Packaging Waste) Regulations 1997?

Years:

MeasAA Packaging Consumption

MeasAB Packaging Consumption by material type

MeasAC Packaging Reused

MeasAD Packaging Reused by material type

MeasAE Packaging Recycled

MeasAF Packaging Recycled by material type

MeasAG Packaging Recyclate Purchased/ Used

MeasAH Packaging Recyclate Purchased/ Used by material type

Years: 1995 5 1996 6 1997 7 1998 8 1999 9 2000 00

0 No answer



Yes/No:

MeasBA Packaging Consumption

MeasBB Packaging Consumption by material type

MeasBC Packaging Reused

MeasBD Packaging Reused by material type

MeasBE Packaging Recycled

MeasBF Packaging Recycled by material type

MeasBG Packaging Recyclate Purchased/ Used

MeasBH Packaging Recyclate Purchased/ Used by material type

0 No answer    Yes 1                  No 2

3.3 How much packaging has your company handled in the following years:

Packaging handled (Tonnes)	1996	1997	1998	1999
Cardboard/ Paper	CardA	CardB	CardC	CardD
Plastic	PlasA	PlasB	PlasC	PlasD
Metal	MetA	MetB	MetC	MetD
Wood	WoodA	WoodB	WoodC	WoodD
Other	OthA	OthB	OthC	OthD

Other (Specify) \_\_\_\_\_

3.4 How much packaging did your company recycle in the following years:

Packaging Recycled (Tonnes)	1996	1997	1998	1999
Cardboard/ Paper	RcardA	RcardB	RcardC	RcardD
Plastic	RplasA	RplasB	RplasC	RplasD
Metal	RmetA	RmetB	RmetC	RmetD
Wood	RwoodA	RwoodB	RwoodC	RwoodD
Other	RothA	RothB	RothC	RothD

Other (specify) \_\_\_\_\_

3.5 How much packaging containing recycled material has your company purchased and/ or used over the following years:

	1996	1997	1998	1999
Packaging containing recycled material (Tonnes)	PrecA	PrecB	PrecC	PrecD

3.6 How much non-packaging material did your company recycle in the following years:

Non-packaging Recycled (Tonnes)	1996	1997	1998	1999
Cardboard/ Paper	NonPcardA	NonPcardB	NonPcardC	NonPcardD
Plastic	NonPplasA	NonPplasB	NonPplasC	NonPplasD
Metal	NonPmetA	NonPmetB	NonPmetC	NonPmetD

Wood	NonPwoodA	NonPwoodB	NonPwoodC	NonPwoodD
Other	NonPothA	NonPothB	NonPothC	NonPothD

Other (specify) \_\_\_\_\_

**Section 4: ENVIRONMENTAL PROGRAMMES**

4.1 Does your company have an Environmental Policy? EnvP  
 No answer 0 Yes 1 No 2

4.2 If so, in what year was it introduced? EnvPDate  
 1995 5 1996 6 1997 7 1998 8 1999 9 2000 00

4.3 Does your company have either of the following formal accredited environmental management systems (EMS) in place? EMS  
 No answer 0 EMAS 1 ISO14001 2 Partial 3

4.4 If so, in what year did your company develop its EMS? EMS Year  
 1995 5 1996 6 1997 7 1998 8 1999 9 2000 00

4.5 What was your company's energy consumption over the following years expressed as either KWh/ UP or kWh/ sq ft building

Energy Consumption	1996	1997	1998	1999
KWh/ sq ft	EnSpA	EnSpB	EnSpC	EnSpD
KWh/ UP	EnPA	EnPB	EnPC	EnPD

4.6 To what extent did the UK Producer Responsibility Obligations (Packaging and Packaging Waste) Regulations 1997 influence environmental programmes in your company?  
 InfEnvP  
 No answer 0  
 A great deal 4 Quite a lot 3 Not very much 2 Not at all 1

4.7 Please indicate against each of the following statements the ways in which the UK Producer Responsibility Obligations (Packaging and Packaging Waste) Regulations 1997 have influenced your company?

	Disagree	Agree	Agree	Disagree
	No answer 0	Strongly 2	Slightly 1	Strongly 2
			-1	-2
a) The regulations have significantly driven environmental programmes within my company				DriEP
b) The regulations have not affected environmental programmes within my company				NilDriEP
c) The regulations have had a detrimental effect on environmental programmes within my company				NegDriEP
d) The regulations have significantly affected my company's bottom line				NegCost

**Section 5 PACKAGING CONSUMPTION REDUCTION INITIATIVES**

5.1 Are you aware of the Packaging (Essential Requirements) Regulations? EssReq  
 No answer 0 Yes 1 No 2

5.2 What steps have you had to take, if any, to comply with these regulations? EssReqProg

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5.3 How many initiatives for packaging reuse or minimisation have been set up in the following years:

	1996	1997	1998	1999
No. of initiatives	Reu/MinA	Reu/MinB	Reu/MinC	Reu/MinD

5.4 How much packaging was reused in your company in the following years:

Packaging Reused (Tonnes)	1996	1997	1998	1999
Cardboard/ Paper	ReuCardA	ReuCardB	ReuCardC	ReuCardD
Plastic	ReuPlasA	ReuPlasB	ReuPlasC	ReuPlasD
Metal	ReuMetA	ReuMetB	ReuMetC	ReuMetD
Wood	ReuWoodA	ReuWoodB	ReuWoodC	ReuWoodD
Other	ReuOthA	ReuOthB	ReuOthC	ReuOthD

Other (specify) \_\_\_\_\_

5.5 Has your company replaced certain packaging materials with other lighter or more environmentally sound alternatives? EnvPackRep  
 No answer 0 Yes 1 No 2

5.6 If so, please give details of what type of packaging materials were replaced, what materials they were replaced with, in what year they were replaced and why:

Original packaging material	Replacement material	Year	Reason for change
MatRepOld	MatRepNew	MatRepDate 5 1995, 6 1996 etc.. and 00 for 2000	MatRepReas
In order...			

**Section 6: COMPLIANCE SCHEMES**

6.1 Please indicate against the following statements to what extent your company's form of registration has affected your environmental programmes.

6.1.1 Joining a compliance scheme:

	Agree		Agree		Disagree
Disagree	Strongly		Slightly		Strongly
No answer 0	2		1	-1	-2
a) has significantly driven environmental programmes within my company	CollDriEP				
b) has not had any affect on environmental programmes within my company	CollNilDriEP				
c) has had a deleterious effect on environmental programmes within my company	CollNegDriEP				

6.1.2 Individually registering with

	Agree		Agree		Disagree
Disagree	Strongly		Slightly		Strongly
the Environment Agency:	2		1	-1	-2
No answer 0					
d) has significantly driven environmental programmes within my company	IndDriEP				
e) has not had any affect on environmental programmes within my company	IndNilDriEP				
f) has had a deleterious effect on environmental programmes within my company	IndNegDriEP				

6.2 Please explain why your company has chosen its particular registration route (either to join a compliance scheme or register individually with the Environment Agency)  
 EA/Collreas

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6.3 Please describe in what ways the UK Producer Responsibility Obligations (Packaging and Packaging Waste) Regulations 1997 have improved the environmental performance of your company: ImprEPreas

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6.4 Please describe in what ways the UK Producer Responsibility Obligations (Packaging and Packaging Waste) Regulations 1997 have had a negative impact on the environmental performance of your company: WorsEPreas

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**Annex 3**

**Appendix 2**

**Table of Survey Response Data, Analysis Calculations and Sample Formulae**

SamNo	JobT	Auth	Authspec	AreaRes	CollEA	Collsch	NoEmp	Turn99	Sectaa	Sectab	Sectac
1	Chief Executive	1		1023	2	Paperpak	1	3			
2	Director	2		1	2		1	3			
3	Compliance Advisor	4		264	2	Valpak	1	3			
4	Environmental Technologist	5		8	2	Valpak	1	4			
5	Technical Executive	3		8	2	Valpak	1	3		100	
6	Head of Safety and Approvals	3		9	1		1	4			65
7	Technical Manager	3		76	2	Valpak	1	3			
8	Admin Manager	3		266	2	Valpak	1	3			
9	Quality and Safety Manager	5		264	2	Valpak	1	3			
10	Marketing Services Director	3		44	2	Paperpak	1	4		100	
11	Assistant Managing Director	2		264	2	Biffpak	3	5			
12	Safety, Health, Environment and Quality Officer	4		264	2	Pennine-pack	1	3			20
13	Manager, Publicity and Environmental	5		12	2	Valpak	1	3			
14	Technical Director	2		0	2	Valpak	1	3			
15	Environmental Manager	5		264	1		1	3			100
16	Director	2		282	1		1	3			
17	Quality, H + S, Environment and Transport Manager	4		776	1		1	2			
18	Financial Controller	3		1	2	Biffpak	1	3			
19	Group Q.A. Manager	3		264	2	Valpak	1	3			
20	Manager Environmental Services	3		8	2		2	4			
21	Company Accountant	3		19	2	Valpak	1	3			
22	Safety/ Environment Manager	5		264	2	Valpak	1	3			
23	Director - Quality Systems	2		16	2	Paperpak	1	3			
24	Personnel manager, Health + Safety, Environmental advisor	3		266	1		1	3			
25	HS + E manager	3		264	1		1	3			
26	Technical Manager	3		72	2	Valpak	1	3			100
27	Safety, Health + Environment Officer	4		264	2	Valpak	1	3			
28	Continuous improvement manager	3		512	2	Valpak	2	4			
29	HSE Manager	6	Manager	264	2	Valpak	1	4			
30	Distribution + Logistics Director	2		810	2	Valpak	1	3			
31	Corporate Development Officer	5		264	1		1	3			
32	Director - operations	2		536	2	Valpak	1	3			
33	Operations director	2		128	1		1	3			
34	Site manager	4		264	1		1	3			
35	Group Environmental and Quality Auditor	6	Advisory	24	2	Properpak	3	4			
36	Director - purchasing	2		392	1		0	3			10
37	Director + general manager	3		414	1		1	3			

SamNo	JobT	Auth	Authspec	AreaRes	CollEA	Collsch	NoEmp	Turn99	Sectaa	Sectab	Sectac
38	Environmental Advisor	4		8	2	Valpak	2	4	100		
39	HSEQ Manager	3		268	2	Valpak	1	3			
40	Group Buyer	3		136	2	Valpak	1	3			
41	Product Stewardship Manager	3		256	1		2	4	2	2	
42	Technical Director	2		892	2	Valpak	1	3			
43	Seeds Manager	3		32	2	Valpak	1	3			
44	Technical and Development Manager	3		200	2	Paperpak	1	3		100	
45	Project Manager	3		40	2	Valpak	1	3			
46	Year in Industry Student	5		8	2	Valpak	1	4			
47	Purchasing manager	3		136	2	Valpak	1	3			
48	Admin Manager	5		52	2	Paper Collect	1	3			
49	Assets Manager	4		267	2	Properpak	1	3			
50	H + S Manager	0		256	1		1	3			
51	Operations Director	2		1023	2	Valpak	1	3			10
52	Operations director	3		0	2	Biffpak	1	3			
53	Company Secretary	3		25	2	Valpak	1	3			
54	Quality Systems Manager	3		24	2	Valpak	1	3			
55	Project Brewer	4		256	2	Valpak	1	3			
56	Production Director	2		128	2	Paperpak	1	3			
57	Operations Manager	3		928	2	Valpak	1	2			
58	Chief Executive	1		283	2	Biffpak	1	3			
59	Sales	0		40	1		1	3			
60	Trading Director	2		800	2	Valpak	2	3			
61	Operations Director	2		906	2	Valpak	1	3			
62	QHSE and TPT Manager	3		776	2	Biffpak from 2000	1	2			
63	Environmental Coordinator	5		8	1		3	5			100
64	Health and Safety and Environment Manager	3		264	1		2	3			
65	Quality and Environment Manager	4		264	2	Cleanapak	1	4			
66	Logistics Supervisor	0		512	1		1	4			
67	Packaging waste co-ordinator	5		8	2	Valpak	1	3			
68	MD	1		679	2	Paperpak	1	3		100	
69	Group H + S Manager	3		256	2	Packwaste	1	3			
70	Health and Safety and Environment Officer	5		264	2	Valpak	1	3			39
71	Systems Manager	5		136	1		1	3			
72	Operations Manager	3		384	2	Valpak	1	3			









SamNo	Sectaw	Sectax	Sectay	Sectaz	Sectba	Sectbb	Sectbc	Sectbd	Sectbe	Sectbf	Sectbg	Sectbh	Sectbi	Sectbj	Sectbk	Sectbl	Sectbm	Sectbn
38																		
39																		
40																		
41											5							5
42													100					
43													100					
44																		
45		100																
46																		
47																		
48													100					
49								10										
50																		
51			10		70						10							
52																		100
53											100							
54																		
55												10		90				
56									100									
57												100						
58																		30
59									60			40						
60					45						28							
61									100									
62																		
63																		
64											100							
65																		
66													100					
67													100					
68																		
69												100						
70			15															
71													46					
72												20	40					



SamNo	Sectbn(spec)	LandfA	LandfB	LandfC	LandfD	MeasAA	MeasAB	MeasAC	MeasAD	MeasAE	MeasAF	MeasAG	MeasAH	MeasBA	MeasBB	MeasBC
38						7	7	7	7	7	7	7	7	1	1	2
39		650	700	750	1407	6	6	0	0	0	0	0	0	1	1	0
40			200	230		2	7	0	0	2	2	0	0	2	1	0
41	Agrochem					0	0	0	0	0	0	0	0	0	0	0
42						7	7	0	0	0	0	0	0	1	1	0
43						0	0	0	0	0	0	0	0	0	0	0
44						0	0	0	0	0	0	0	0	0	0	0
45		10	10	10	10	7	0	0	0	0	0	0	0	1	0	0
46		1105	1196	1284	1035	0	0	0	0	0	0	0	0	0	0	0
47						0	0	0	0	0	0	0	0	0	0	0
48						6	6	7	0	0	0	0	0	1	1	1
49						8	8	0	0	0	0	0	0	1	1	2
50			230	250	250	7	7	0	0	0	0	0	0	1	1	0
51				33.36	22.65	7	7	80	80	80	80	0	0	1	1	2
52	Publisher	200	200	100	70	8	0	8	0	9	0	0	0	1	2	1
53		15	12	2	10	8	8	0	0	8	0	0	0	1	1	0
54		8416	2358	2411	2141	7	7	0	0	7	7	0	0	0	0	2
55				120	120	0	0	0	0	0	0	0	0	0	0	0
56		0	0	0	0	8	2000	0	0	0	0	0	0	1	1	0
57		0	0	0	0	7	7	0	0	0	0	0	0	1	1	0
58	Agrochem	0	0	0	0	0	7	0	0	0	0	0	0	0	1	0
59		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60						0	0	0	0	85	0	0	0	0	0	0
61		38	39	41	42	7	7	7	7	85	7	7	7	1	1	1
62					73	6	6	7	7	8	8	8	8	1	1	1
63				1471		0	0	0	0	0	0	0	0	2	2	2
64						6	6	0	0	2	2	0	0	1	1	0
65																
66						0	0	0	0	0	0	0	0	0	0	0
67				440		0	0	0	0	0	0	0	0	0	0	0
68						0	0	0	0	0	0	0	9	0	0	0
69		50	48	43	52	8	8	8	8	8	8	8	8	2	1	2
70			18.6	12.11	10.49	1997	1997			1997	1997			2	2	0
71				119	376	0	0	1998	0	0	0	0	0	0	0	2
72		0	0	0	0	1997	1997	0	0	0	0	0	0	1	1	0

SamNo	MeasBD	MeasBE	MeasBF	MeasBG	MeasBH	CardA	CardB	CardC	CardD	PlasA	PlasB	PlasC	PlasD	MetA	MetB	MetC	MetD	WoodA	WoodB
1	0	0	0	0	0	430	338	369											6
2	0	0	0	0	0	253	275	231		33	28		81						
3	0	0	0	0	0		72	59				46	53			96	78		
4																			
5	1	1	1	0	0	263	266	263			88	65	67		7	5	5		297
6	2	2	2	2	2	1886	3558	4049		1233	521	717	1004			2	6	500	
7	1	1	1	1	1	3	3	2			129	127	126						
8	0	0	0	0	0														
9	1	0	0	0	0	71	62	67		5	5	4	3					110	88
10	0	0	0	0	0		3387	3080				307	288			68	43		
11	0	0	0	0	0														
12	2	2	2	0	0			6					18				24		
13	1	2	0	0	0	114	60	130		67	7	11	12				1	142	97
14	2	2	2	2	2		68	22				34	113			30	41		
15	1	2	2	2	2	205	285			34	45								
16	0	0	0	1	1	43	48	54		14	31	16	8	49	52	40	71		
17	1	1	1	1	1	32	42	54		3	4	2	3	0	0	0	0	0	0.5
18	0	0	0	0	0		60				600	520							
19	1	1	1	1	1	635	746	413		2097	2823	2894	3205						
20	2	2	2	2	2														
21	0	0	0	0	0			213					93				26		
22	0	0	0	0	0	81	81	75		72	69	74	68	482	463	481	445	76	76
23	0	2					3300	3800											
24	0	0	0	0	0	1	1	1		1	1	1	1	1	1	1	1		
25	1	1	1	2	2		12	12							5	5.25	5		19
26	2	1	1	0	0			53					42				73		
27	0	2	0	2	0		37	62			3	3	17			6	17		
28	0	0	0	0	0	1060	952	923		254	256	279	302	2055	2058	2244	2339		
29	0	0	0	0	0		290	172			595	540	690						1200
30	2	2	0	0	0	45	50	80		3	4	4	5					1	1
31	1	1	1	1	1		117	164				37	16			0	0		
32	0	0	0	0	0														
33	0	0	2	0	0														
34	1	1	1	2	2						13	13			86	400			79
35	2	2	2	0	0														
36	0	0	0	0	0					25	25	25	25					3000	3336
37	0	0	0	0	0					25	30	30	30					410	430

SamNo	MeasBD	MeasBE	MeasBF	MeasBG	MeasBH	CardA	CardB	CardC	CardD	PlasA	PlasB	PlasC	PlasD	MetA	MetB	MetC	MetD	WoodA	WoodB
38	2	2	2	2	2	444	287.703			1070	1503.809				720	666.143			
39	0	0	0	0	0	230	240	278		40	41	54		21	25	33			479
40	0	2	2	0	0	143	435			125	166								
41	0	0	0	0	0														
42	0	0	0	0	0	200	200	220	200	200	200	220	208	0	0	0	0	0	180
43	0	0	0	0	0														
44	0	0	0	0	0	12000	15500	16000	14000	24.6	71.7	32.8	28.7	2.8	3.7	3.8	3.3	204	264
45	0	0	0	0	0	50	50	50	50	15	15	15	15	0	0	0	0	0	0
46	0	0	0	0	0														
47	0	0	0	0	0	814	577	538	453	243	221	205	227	102	103	78	84		
48	0	0	0	0	0	48	40	41											
49	2	2	2	2	2		316	87				75	10			0	0		
50	0	0	0	0	0	40	34	20	31	7	7	6	9	47	36	44	32	321	254
51	2	2	2	2	2		410	450	450			176	188			98	105		
52	2	1	2	2	2	40	40	45	40	2	2	2	2					40	40
53	0	1	0	0	0		232	100				0	0			0	0		
54	2	0	0	2	2	409	386	447	447	32	40	40	51		116	122	107		924
55	0	0	0	0	0	28	38	44	44	9	9	13			25	22	23		10
56	0	0	0	0	0		221	249											
57	0	0	0	0	0					100	1100	1300	1400						
58	0	0	0	0	0	514	535	353	353	0	280	292	340		113	118	160		5
59	0	0	0	0	0														35000
60	0	2	0	0	0	509	569	612	612	326	365	457			233	268	296		1
61	1	2	1	1	1	188	207	224	226	99	138	160	155					632	664
62	1	1	1	1	1	32	37	42	54	3	4	2	3	0	0	0	0	0	0.5
63	2	2	2	2	2			3000					450				70		
64	0	2	2	0	0														
65																			
66	0	0	0	0	0	278	297	618	618	109	109	28	19		19	19	17		
67	0	0	0	0	0		598	895	895			290	426						
68	0	0	0	0	1			66											
69	1	2	2	2	2														
70	0	1	1	0	0	285	257	206	239	3	4	7	7				1		158
71	0	2	2	0	0			360	360				102						
72	0	0	0	0	0	351	243	208	283	68	93	109	123					4	30









SamNo	RwoodA	RwoodB	RwoodC	RwoodD	RothA	RothB	RothC	RothD	Rothspec	PrecA	PrecB	PrecC	PrecD	NonPcardA	NonPcardB	NonPcardC
38						13	12									
39	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0
40											32	36				
41																
42																
43																
44										0	0	0	0			
45	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0
46																
47	0	0	0	0	0	0	0	0		45	45	45	45			
48																
49																
50				72.5												5
51										0	0	0	0			
52	20	20	40	40						0	0	0	0	0	0	0
53	0	0	0	0	0	0	0	0						0	0	0
54		0	0	0							103	116	92			
55				10				43 glass			1000	1000	1125			
56																
57	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0
58	0	0	0	0	0	0	0	0						0	0	0
59	0	0	0	0	0	0	0	0						0	0	0
60														0	0	0
61	218	224	220	226												
62	0	1	1	2	0	0	0	0						0	0	0
63			342	292												342
64															2	2
65															150	165
66										0	0	0	0			
67																
68				200												
69																
70			11	96						285	252	193	215			
71																
72	0	0	0	0	0	0	0	0		150	100	100	150	0	0	0





SamNo	NonPwoodD	NonPoThA	NonPoThB	NonPoThC	NonPoThD	NonPoThSpec	EnvP	EnvPDate	EMS	EMS Year	EnkwhC	EnkwhD	EnSpA
1							1	9	0	0			
2							1	8	0	0			
3					79	Waste ink/ solvent	1	8	2	7			
4							1	7	0	0		6447291	
5							1	7	0	0			
6							1	00	2	00			18.88
7							1	8	2	8	1265674	1051933	
8							1	9	0	0			
9							1	4	0	0			
10							1	6	1	2			
11							1	8	0	0			
12							1	7	0	0			
13							1	4	2	0			
14	0	0	0	0	0		2						
15							1	6					
16							2						
17	0	0	0	0.6	0.75	rubber	1	7	3	3			292861
18							0		0	0			
19							1	8	0	0			
20							1						
21							2		0	0			
22							1	1	0	0			
23							1	9	0	0			
24							1	9	0	0			
25							2		3	3			
26							1	6	2	8			36.3
27							1	8	2	9			
28							1	5					
29							1	1					
30							1	8					
31	0	0	0	0	0		1	6	2	6			2939679.2
32	0	0	0	0	0		1	5					
33							1	6					
34							1	9					
35							1	1					
36							1	90					
37		4500	8000	7700	4300	used sand	1	6					

SamNo	NonPwoodD	NonPoThA	NonPoThB	NonPoThC	NonPoThD	NonPoThSpec	EnvP	EnvPDate	EMS	EMS Year	EnkwhD	EnSpA
38						waste oil (quantity unknown)	1	85	3			
39	0	0	0	0	0		1	5	2	8		
40							1	7				
41							1	8				
42							1	6				
43							0					
44							1	66				
45	0	0	0	0	0		2					
46							1	7				
47							1	7				
48							2					
49							2					
50							2					
51							1	7				
52	0	0	0	0	0		1	8				
53	0	0	0	0	0		2					
54			6261	3980	3192	carbon waste for composting	1	6	2	6		
55							2					
56							1	7				
57	0	0	0	0	0		2					
58	0	0	0	0	0		2					
59	0	0	0	0	0		2					
60	0	0	0	0	0		2					
61							3		3			
62	0	0	0	0.6	0.75	rubber	1	7	3			292861
63				25		glass	1	80	1 and 2	7		
64	80						2					
65							1	5				
66							2					
67							1	9	3 00			
68	200						1	9				
69							1	7	1	7		
70							1	1995	2	1999		
71							1	1998				
72	0	0	0	0	0		2					

SamNo	EnSpB	EnSpC	EnSpD	EnPA	EnPB	EnPC	EnPD	InfEnvP	DriEP	NiIDriEP	NegDriEP	NegCost	EssReq
1								1	-2	-2	-2	1	0
2		6428000	6528547			1756855	1779543	1	-2	2	-2	-2	0
3								2	-2	-1	-2	-1	1
4								3	1	-2	-2	-1	
5								2	-2	2	-2	1	1
6	20.21	20.19	20.23					2	-2	-1	-1	-1	2
7								2	1	1	-2	-2	0
8								2	-2	2	-2	-1	1
9				2.9	2.6	3	2.5	2	-2	-1	-2	-1	1
10								1	-2	2	-2	-2	1
11								2	-2	-2	-2	1	0
12								2	1	-1	-2	1	1
13								4	2	-2	-2	-2	1
14								1	-2	2	2	2	1
15								3	1	-2	-2	2	0
16								1	0	2	-2	2	0
17	286015	283234	244658	239330	269565	391784	627687	3	2	-2	-2	1	1
18								0	0	0	0	0	0
19								2	-2	2	-2	2	1
20								1	-2	2	-2	1	0
21								1	-2	-2	-1	-1	2
22								2	-2	2	-2	-1	0
23								1	-2	2	-2	1	1
24								2	1	1	-2	-1	0
25								2	-1	1	-1	1	0
26	30.2	34.1	36.4					4	2	-2	-2	-1	2
27								2	-2	2	-2	-1	2
28								1	-2	2	-2	-2	1
29								1	-2	2	-2	1	1
30								3	1	-1	-1	1	2
31	311686.2	3008624.2	2474037.6					3	2	-2	-2	1	1
32								2	-1	-1	-2	2	0
33								3	1	-1	-2	-2	1
34								1	-2	2	-1	1	0
35								2	-1	-1	-2	1	1
36								2	-1	1	-2	1	2
37								2	-1	1	-2	1	0



SamNo	EnSpB	EnSpC	EnSpD	EnPA	EnPB	EnPC	EnPD	InfEnvP	DiriEP	NIIDriEP	NegDiriEP	NegCost	EssReq
38								2	-2	1	-2	-2	1
39								2	-1	2	-1	1	1
40								3	1	-1	-2	1	1
41								2	-2	-1	1	-1	1
42								3	1	-1	-2	1	0
43								0	0	0	0	0	0
44								2	-1	1	-2	-2	1
45								2	-1	1	3	1	1
46								2	1	-1	-1	-1	0
47								1	-2	2	-2	1	0
48								0	-2	2	1	1	1
49								1	-2	2	-1	-1	2
50							1437936	1	-2	2	-2	2	2
51								4	2	-2	-2	1	0
52								4	1	-1	-2	2	
53								2	1	-1	-1	1	1
54					362	378	355	2	-1	1	-1	1	1
55								3	-1	1	-1	1	0
56							700	1	-1	1	-2	1	1
57								1	-2	2	0	2	1
58				6500000	6225940	6553621	6721663	2	-1	1	-1	1	2
59								2	1	-1	-2	-1	2
60								3	1	-1	-1	2	2
61								3	1	1	-2	-2	0
62	286015	283234	244658	239330	269565	391784	627687	3	2	-2	-2	1	1
63				25000	24000	22000		2	-1	1	-2	-1	1
64								2	-1	2	-2	-2	1
65		8.4	8.9					2	-2	-1	-1	1	1
66								2	-1	2	-2	-2	0
67								3	1	-2	-1	2	1
68								4	-2	0	0	2	0
69								3	2	-2	-2	2	1
70		20.96	20.69					3	1	-1	-2	1	0
71								2	-1	1	1	-1	0
72								1	-1	1	-1	1	1

SamNo	EssReqProg	ReuMinA
1	Minimalised packaging quantities and unit weights pre 1996	0
2		0
3	Purchase of compliant alternative packaging	
4		
5	Checked on suppliers of packaging materials	0
6	Devise simple technical file format for supplying factories (mostly in FarEast)	0
7		
8	A general approach to reducing packaging	
9	Ensured all suppliers and packaging comply with requirements regarding heavy metal content and packaging	0
10	Where appropriate, to reduce transit packaging if possible, without prejudicing product quality	
11		0
12	None	
13	Set up a database of all the company's products and codes with weights of packaging	0
14	As importer we are limited to action taken by our suppliers worldwide	0
15	We have reduced some packaging. Reuse cartons where possible. Ensure heavy metal limits O.K. Keep records	
16	We do not supply the end user but still have to purchase PRNs in a show of complying	
17	Nothing in great detail	1
18		
19	No purchases of materials having heavy metals being made. All packaging is recoverable and/or reusable.	
20		
21		
22	Contacted our suppliers for confirmation that packaging meets regulations	
23	none	
24	we have minimised packaging and re-used packaging as much as possible. We have done so for many years	
25		
26		1
27		
28	Part of purchasing procedures	
29	none	
30		0
31	Yes, we have segregated cardboard and plastic sent to recycle and purchased PRNs to meet our obligation	
32	joined Valpak	0
33	On-going	
34	Increased use of re-usable containers	0
35	Yes, we meet the legal requirements. Good management is practised. Due to 'levy-taxation' some areas have become economically viable.	
36	none	
37		

SamNo	EssReqProg	ReuMinA
38	Yes, we have assessed our compliance and made no changes	
39	Yes, none to date	
40	Reduced corrugated via recycled plastic containers	0
41	Reporting to the EA	0
42	none	1
43		
44	Yes, no steps needed - fully compliant	
45	Yes - none, we import medical devices (sterile) and how we pack these is covered by CE Regulation	0
46	none	0
47		
48	We monitor all use of packaging waste and reuse where possible and dispose through correct channels the remainder	1
49		0
50	No, none	
51		
52	Introduction of recycling policy	0
53	none so far	10
54	Obtained compliance statements from suppliers and where necessary obtained analytical data	0
55	Balance % recycle with packaging performance	
56	yes	
57	yes, Joined Vaipak	0
58	none	0
59		
60		
61		1
62	nothing in great detail	1
63	Our packaging meets the criteria specified - all heavy metals have been eliminated	
64	Not able to reuse packaging very much	
65	Our parent company supplies 100% of the packaging we handle. They comply with the EU Directive	
66		0
67	none yet	0
68		
69	We have an action plan and it complies with this legislation	0
70	none	
71	To recycle rather than reuse and to use returnable cartons for bulk stock	
72		





SamNo	ReuMetD	ReuWoodA	ReuWoodB	ReuWoodC	ReuWoodD	ReuOthA	ReuOthB	ReuOthC	ReuOthD	EnvPRep	MatRepO
1		38	36	26	29					2	
2										0	
3										1	
4											
5	0	20	50	50	60					1	Cardboard
6										1	EPS
7										1	Polystyrene
8										1	Polystyrene chips
9										1	Fabricated timber-based cases
10										1	
11										0	
12										2	
13					86					1	Cardboard
14	0	0	0	0	0	0	0	0	0	1	Aluminium
15										1	PVC
16										2	
17	0	1	1.5	1.5	3	0	0	0	0	1	cardboard cartons
18										0	
19		320	400	460	539					2	
20										2	
21										2	
22										1	cardboard
23										2	
24		1	1	1	1					2	
25										1	wood cases
26				25						1	
27										1	boxes
28										1	polystyrene infill
29										2	
30	0	3	4	5	10					2	
31										1	plastic bags
32	0	0	0	0	0	0	0	0	0	2	
33										2	
34										1	200ltr barrels
35										1	Cardboard
36										2	
37										1	Shrink wrap

SamNo	ReuMetD	ReuWoodA	ReuWoodB	ReuWoodC	ReuWoodD	ReuOthA	ReuOthB	ReuOthC	ReuOthD	EnvPRep	MatRepO
38										1	steel drum
39	5									2	
40										1	Polyprop film 25mp
41										2	
42		180	180	180	180					1	plastic
43										0	
44										2	
45	0	0	0	0	0	0	0	0	0	2	
46	0	0	0	0	0	0	0	0	0	1	bags
47										2	
48										2	
49										2	
50										2	
51										2	
52		20	20	40	40					1	cardboard
53	0	0	0	0	0	0	0	0	0	2	
54										2	
55										0	
56										2	
57	0	0	0	0	0	0	0	0	0	2	
58	0	0	0	0	0	0	0	0	0	2	
59										1	steel
60										2	
61		218	224	220	226					1	paper sack and plastic bottle
62	0	1	1.5	1.5	3	0	0	0	0	1	cardboard cartons
63	328			772	474					1	pallets
64										2	
65										1	plastic
66										2	
67	0	0	0	0	0	0	0	0	0	2	
68	0				0				0	2	
69										2	
70										2	
71										2	
72	0	0	0	0	0	0	0	0	0	1	corrugated

SamNo	MatRep01	MatRepN	MatRepN1	MatRepD	MatRepD1	MatRepR
1						
2						
3						
4						
5		stretch wrap plastic		8		lower cost
6	PE	Card	Card	6	6	part of Japanes continuous improvement programme
7		Recycled plastic		8		better environmental practice
8	Cardboard	Paper	lightweight card	4	4	handling
9		Purpose-bought cardboard boxes		9		reduction in weight and labour costs
10				0		cost savings
11				0		
12				0		
13		lighter card applied differently		OO		Original product not protecting product sufficiently
14		metalised film		7		change to material by producer, Denmark
15	Skinwrap and card	PET	PVC Blister	8	9	Only on certain lines due to manufacturing change.
16						
17	plywood boxes	polypropylene	polypropylene	8	8	Able to reuse again and again for storage
18						
19						
20						
21						
22		cardboard		9		lighter and more compact grade
23						
24						
25		metal reusable		1		economic
26						
27	boxes	recycled card	plastic trays	9	8	cheaper and more env. Friendly
28		paper		8		operational/ cost effective and customer preference
29						
30						
31		shrink wrapping		9		uses less material more economical
32						
33						
34		1000ltr IBCs		7		cheaper
35		Cardboard		6		stronger material lower cost
36						
37		thinner shrink wrap		8		reduce costs



SamNo	MatRepO1	MatRepN	MatRepN1	MatRepD	MatRepD1	MatRepR
38	steel drum	plastic IBC	Bulk tank	8	8	economy
39						
40		Polyprop film 20mp		7		cost of reduction of packaging
41						
42	plastic	plastic	plastic	6	9	returnables
43						
44						
45						
46		bulk		9		cost savings
47						
48						
49						
50						
51						
52		cardboard		9		lighter weight
53						
54						
55						
56						
57						
58						
59		plastic		8		costweight
60						
61		paper sack		7		reduction of waste/ cost. Ease of application by end-user
62	plywood boxes	polypropylene	polypropylene	8	8	able to reuse again and again
63		steel totes		90		cost-savings and environmental improvements through reuse
64						
65	plastic	card	card	9	8	single material to be used to ease recyclability
66						
67						
68						
69						
70						
71						
72	polyprop	returnable plastics	lighter polyprop			reduce cost and obligation

SamNo	MatRepR1	CDrEP	CNiDrEP	CNeDrEP	IDrEP	INiDrEP	INeDrEP
1		-2	2	-2			
2		-2	2	-2			
3		-1	-1	-1			
4							
5		1	-1	-1			
6	part of Japanes continuous improvement programme				-2	-1	-1
7		1	-1	-2			
8	lighter spec.	-2	2	0			
9		-2	2	-2			
10		-1	1	-2			
11		-1	-1	-2			
12		1	-1	-2			
13		1	-1	-1			
14		-2	2	2			
15	Recyclability				-1	1	-2
16					-2	2	0
17	Able to reuse again and again for storage				2	-2	-1
18		0	1	0			
19		-2	2	-2			
20		-2	2	-2			
21		-2	-2	-1			
22		-2	2	0			
23		-2	2	-2		2	-2
24						-1	1
25		1	-1	-1	-1	1	-1
26		-1	-1	1			
27	cheaper	-2	2	-1			
28		-2	2	-2			
29		-2	2	-2			
30		1	-1	-1			
31					2	-2	-1
32		-2	2	-2	-2	2	-2
33		1	1	-1	1	1	-1
34					-2	2	-1
35		-2	2	-2	-2	2	-2
36					-1	1	-1
37					-1	1	-1

SamNo	MatRepR1	CDrEP	CNiDrEP	CNeDrEP	IDrEP	INiDrEP	INeDrEP
38	economy	-2	1	-2			
39		-2	2	-2			
40		1	-1	-2			
41					1	-2	-2
42	returnables	1	-1	-1			
43		-2	1	-1	-2	1	-2
44		-2	2	-2	-2	2	-2
45		3	2	-1			
46		-1	1	-1			
47		-2	2	1			
48		-2	2	1			
49		-2	2	-1			
50					-2	2	-2
51		2	-2	-2			
52		1	-1	-2			
53		1	-1	-1			
54		1	-1	-1			
55		-1	1	-1		2	
56		-1	1	-2			
57		-2	2	-2			
58		1	1	-1	1	1	-1
59					1	-1	-1
60		1	-1	-1			
61		1	-1	-2			
62	able to reuse again and again	-1	-1	-2			
63					-1	1	-2
64					-2	1	-2
65	single material to be used to ease recyclability	-2	1	-1			
66		-1	-1	0	-1	-1	-1
67		1	-1	-1			
68		-2	2	0		1	
69		2	-2	-2			
70		1	-1	-2			
71					1	-1	-2
72	reduce cost and obligation	1	-1	1			

SamNo	ICreas
1	Joining a scheme means I devote less time in ensuring compliance leaving someone else with more skill than I in purchasing PRNs
2	To minimise paperwork and time
3	To ease a very onerous task of doubtful use
4	To ensure that by using an organisation they can interpret all legislation from Brussels, on behalf of Sara Lee
5	To ensure legal compliance
6	Initially owing to non-cooperation of waste recyclers. Then on economic grounds
7	Convenience of management of system. Ease of maintaining awareness of new legislation and its compliance
8	Compliance scheme is simpler route
9	Feel unable to devote the time for acquire PRNs etc. to prove compliance on van
10	As an importing supplier we have an "obligation" but no direct access to waste. It is therefore easier to join a scheme and let them purchase PRNs for us
11	
12	To support local green business link via pennine-pack compliance scheme
13	For the guidance, information and help given by collective scheme
14	Most popular and most vocal at time of achieving compliance to this "stealth tax"
15	We are a small company and can cope with the work load at present
16	Cheaper
17	Having completed an in depth waste minimisation programme between Mar 93 + May 99, we felt confident in being able to comply direct with EA. The costs were also
18	it is simpler and saves time
19	Less hassle
20	Too complex to collect packaging
21	Less time consuming
22	To concentrate on our core business
23	To eliminate the need to obtain PRNs
24	Our parent group has a number of company's which puts all individual companies in scope and each company therefore has to register, or join a compliance scheme de
25	Because the company was instructed by the parent company to do so.
26	lack of resource
27	ease, hassle free
28	ease of administration and offload of legal compliance
29	ease of compliance
30	The knowledge of the Regulations and the safety net of the compliance scheme
31	Board decision to register individually thought it would be fairly easy for the company to handle its own waste
32	Only one with credibility when we needed one
33	Cost
34	Compliance scheme fees were significantly higher than the cost of registering individually
35	Lowest cost - financially and in resources
36	We chose individual registration to have control and gain knowledge of the situation - found out that it was not achieving its stated aims - just red tape!
37	Thought to be less expensive

SamNo	ICreas
38	We are considering individual registration for 2001 as we believe the cost saving to be considerable.
39	Lack of resources to pursue individual compliance
40	Awareness and protection (expert guidance)
41	Keeping costs down, but we will change this year - joining a scheme to address workload problems
42	Valpak - cost, ease of compliance
43	
44	looked for best value registration. Our mill is US based therefore cannot recycle from UK
45	We are too small to do otherwise
46	easier to fulfil in terms of labour
47	
48	Because papco was set up purely for paper merchants - which we are so it made sense to go with them
49	The Environment Agency refused to accept registration and pointed us towards compliance scheme
50	Compliance scheme is more expensive and the tonnages probably do not lend themselves to a scheme
51	Joined valpak for there professional knowledge
52	To ease the administrative burden
53	For reassurance that we would comply
54	packaging is only a relatively small part of our operation and we decided to go for the simplest option
55	Compliance scheme able to fulfill our obligation cheaper than we could
56	Joining the compliance scheme means less paperwork
57	It seemed to be an effective way we could discharge our obligations through this minefield of legislation
58	Logistics and best use of staff time
59	cost of PRNs/ more control
60	Compliance scheme ensured we were legal initially and gave guidance regarding regulations. It was also difficult to obtain PRNs
61	Convenience Ease of compliance Legally 'covered'
62	Initially (1996-98) with EA. Now registered with biffpack due to the remainder of our group
63	Xerox recovers much of its own packaging waste. Data still has to be provided to a compliance scheme and as we are already recovering waste it's easier to register ind
64	Best value for company
65	Joining a scheme has eased the compliance burden (administrative) and reduced costs (cost of PRNs)
66	
67	Valpak was chosen because it has the most established compliance scheme - this is under review
68	Compliance scheme: 1. Its required 2. Least cost
69	The scheme we have opted for gives us a greater degree of control over our packaging
70	We believed a compliance scheme would simplify the paperwork and leave us reasonably free to get on with our business
71	I have inherited waste regulations and it's a follow-on from previous years
72	cost and convenience

SamNo	DrEPreas
1	All transit packaging had been recycled direct from site prior to new regs being implemented. No improvement noticed.
2	No - we always recycled cardboard
3	Awareness
4	They have made employees more aware of environmental legislation - i.e. that it actually exists
5	Greater awareness of packaging waste problem
6	They have not, other than in making us aware of the quantities involved
7	Simply as a starting point indicating things to come. Generally made my company aware that for us not to start developing environmental good practices will hit the bottom
8	Increased awareness, lower packaging costs
9	Only in terms of us now have a measure of packaging usage to base any future actions on
10	It hasn't!
11	
12	Made the company more aware of costs involved in poor environmental management/ performance
13	Less packaging now used. A different type of pallet is now to be introduced with European supplier
14	None at all. The costs imposed have hardened the company attitude to excessive red tape
15	Made us more aware of waste and waste packaging. Types and sizes of packaging for new products is always a consideration
16	None
17	More emphasis placed on the company, particularly as part of the group has achieved ISO 14001 Company now looks closer at environmental issues.
18	It hasn't. We were already using recycled materials in our packaging.
19	none
20	
21	
22	
23	None
24	very little
25	Awareness
26	waste segregation recycling where possible/ practical
27	no noticeable improvement
28	in no way
29	they have not
30	It has focused thought on minimising packaging
31	Have reduced the amount of packaging bought in by re-using it wherever possible. Less waste has also been sent to landfill
32	N/a
33	Waste including packaging is now becoming a lost leader i.e. it has a negative rather than positive effect on the bottom line
34	Not at all. it is viewed as a financial and administrative burden. Any change in our packaging has been driven by economics or by customer requirements
35	Due to the taxation element some projects have become economically viable. We aim to balance cost of disposal by income
36	
37	none

SamNo	DrEPreas
38	Don't believe they have done anything other than make us aware of the tonnage involved
39	To date - minimal impact
40	Introduced awareness of recycling and thought process on choice of packaging material
41	none
42	none apart from awareness
43	
44	None - US legislation driven - except minimisation where we look at pallet wrapping etc.
45	not at all
46	more focus on waste minimisation
47	
48	I don't think it has
49	They haven't
50	The regulations have made no difference to environmental performance
51	we are now more conscious of our responsibility. Hence 2 sites are accredited reprocessors
52	We now recycling most of our cardboard and separate from the landfill waste
53	No significant improvement
54	hardly at all
55	
56	
57	Has made no difference
58	It has had little effect other than to create an enormous amount of extra work and cost
59	they haven't yet!
60	Forced us to become more aware of packaging
61	The company has a very proactive attitude generally to the environment. ISO 14001 probably has more effect on our policies to improve our enviro. Performance
62	more emphasis. Part of the group have achieved ISO 14001. Company/ Group now looks closer at environmental issues
63	We have had environmental/ recovery programs in place for a number of years - so the processes have been in place prior to the introduction of the regulations
64	Very little difference, we already separated cardboard
65	No significant effect
66	
67	Made us more aware of environmental and waste issues - currently developing waste management/ minimisation programme
68	none
69	The legislation has forced the issue and made compliance with environmental measures and policies compulsory
70	We do now consider how we can re-use reduce and recycle packaging materials, but this is now something we have to do as part of our commitment to ISO14001
71	Made company more aware of packaging/ waste figures
72	none

SamNo	NeEPreas
1	No negative impact. I see it purely as a form of taxation. I don't react any differently... I just have to pay to prove that my packaging is recycled ..which it always has.
2	Additional form filling and fees
3	Time wasting! (perhaps consuming a better word!)
4	They have slowed the progression of some facets of the business
5	None
6	They have not yet, but may soon as cost of purchase of PRNs is fixed, but as value of recyclables is going down, it will soon be cheaper to landfill than separate and recy
7	None
8	None
9	None, really, though time spent in gathering information may have been used in other ways to improve environmental performance
10	It is "neutral" from our standpoint
11	Time consuming data collection and processing
12	None specific to environmental performance
13	Too time consuming
14	By costing us money the policy has become a point of contention within the company
15	Cost of compliance and lack of good clear instruction on how to comply. Lack of knowledge from (supposedly) people in the know, EA, DTI etc.
16	Lot of management time filling in forms that even our local environment agency officer had never seen and wasn't sure of. Cost to the company. We wholesale and are
17	They have not had a negative response
18	Collation of info takes time + costs money - resources which could be better used improving the use of recycled materials
19	none
20	Increased beurocracy
21	
22	
23	none
24	It is just additional paper, administration and taxation
25	Registration fees economic
26	none
27	no noticeable effect
28	no impact other than beurocracy
29	just added cost to bottom line. We have not been able to find anybody who is prepared to take our packaging waste for recycling
30	The recycling of cardboard and paper has become almost impossible in this area
31	It has proved to be quite expensive, which means there has been less money available to spend on other environmental projects
32	N/a we don't produce, we don't pack. We import and sell on - all packaging goes on to the customer beyond our control
33	See above
34	Negligible impact
35	Increased our costs
36	Cost in £p and time spent on pointless, wasteful beurocracy. Another tax on a benign industry - timber/ wood is good and infinitely renewable resource!
37	more administration



SamNo	NeEPreas
38	Large administration cost. Initial year 1 compliance cost £25,000 in tax but involved 20-25 man days to assemble data. In year 3 this has fallen to 10 days full time equiv
39	minimal impact
40	?
41	none
42	none
43	
44	none except cost burden. Why are virgin paperboard mills penalised when they are managed in a sustainable way and are more environmentally friendly than recycled?
45	none other than annual fee is additional cost
46	none
47	
48	we have been concerned about the end-users and how they will react to any more legislation and had problems deciding how to collect waste from them
49	They are too complex and difficult to understand. They do not take proper account of reused packaging - hence there is no incentive to take account of them.
50	Only in administration, registration and waste disposal costs
51	Increased cost burden to monitor and control. After initial set up costs
52	not at all
53	No significant influence
54	cost us more revenue
55	
56	
57	Again, no difference
58	It has not had any impact on this company's environmental performance
59	they haven't
60	Cost of obligation - difficult to obtain and produce and maintain data plus cost of data capture systems and resources
61	The level of recycling has meant waste disposal companies unable/unwilling to recycle our cardboard waste. Too much material available, price for recycled material re
62	They have not had a negative response
63	No negative impact on environmental performance - but the complexity of the UK regulations means that the administrative workload has increased. The UK seems to h
64	N/a
65	Increased administrative burden and is seen as just another form of taxation.
66	
67	Financial outlay to valpak and consultant
68	
69	none
70	There is no negative impact on our environmental performance
71	We have to recycle rather than reuse materials such as boxes to meet companies obligations
72	none



30	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
91											2	4			
	System														
	Missing														
	Total										54	100			

	A	B	C	D	E	F	G	H	I	J	K	L	M
93	MEASBE												
94	Valid	9	9	66	66	90		Valid	No answer	29	54	54	56
95	Yes	4	4	22	22	72		Yes	Yes	6	16	16	71
96	No	5	5	26	26	100		No	No	18	28	28	100
97	Total	18	18	100	100			Missing	Total	52	96	100	
98								Total	System	2	4		
99										64	100		
100								Collective Scheme					
101	No answer	EA	58	54	No answer	EA	44	EA	63				
102	Yes	22	22	16	16	72		Yes	13				
103	No	26	26	26	26	100		No	19				
104	Total							Missing					
105								Total					
106	MEASBF							Collective Scheme					
107	Valid	8	8	44	44	44		Valid	No answer	34	63	67	67
108	Yes	4	4	22	22	67		Yes	Yes	7	13	14	80
109	No	6	6	33	33	100		No	No	10	18	20	100
110	Total	16	16	100	100			Missing	Total	51	94	100	
111								Total	System	3	6		
112										64	100		
113								EA					
114	MEASBG							EA	72				
115	Valid	10	10	64	64	66		Valid	No answer	38	72	76	76
116	Yes	3	3	17	17	72		Yes	Yes	4	7	8	84
117	No	5	5	26	26	100		No	No	6	16	16	100
118	Total	16	16	100	100			Missing	Total	51	94	100	
119								Total	System	3	6		
120										64	100		
121								EA					
122								Collective Scheme					
123	MEASBH							EA	66				
124	Valid	10	10	64	64	66		Valid	No answer	38	72	76	76
125	Yes	3	3	17	17	72		Yes	Yes	4	7	8	84
126	No	5	5	26	26	100		No	No	6	16	16	100
127	Total	18	18	100	100			Missing	Total	51	94	100	
128								Total	System	3	6		
129										64	100		
130	MEASBI							EA	24				
131	Valid	4	4	4	4	4		Valid	No answer	38	72	76	76
132	Yes	74	74	74	74	74		Yes	Yes	6	9	10	66
133	No	20	20	20	20	100		No	No	7	13	14	100
134	Total	33	33	100	100			Missing	Total	51	94	100	
135								Total	System	3	6		
136										64	100		
137								EA					
138	MEASBJ							EA	6				
139	Valid	2	2	2	2	2		Valid	No answer	2	4	4	4
140	Yes	74	74	74	74	74		Yes	Yes	40	74	74	78
141	No	20	20	20	20	100		No	No	11	20	20	100
142	Total	33	33	100	100			Missing	Total	54	100	100	
143								Total	System	1	2	2	
144										64	100		
145	MEASBK							EA					
146	Valid	12	12	67	67	67		Valid	No answer	2	4	4	4
147	Yes	6	6	33	33	100		Yes	Yes	40	74	74	78
148	No	18	18	100	100			No	No	11	20	20	100
149	Total							Missing	Total	54	100	100	
150								Total	System	1	2	2	
151										64	100		
152	MEASBL							EA					
153	Valid	1	1	6	6	20		Valid	No answer	13	24	24	50
154	Yes	2	2	11	11	40		Yes	Yes	1	2	4	54
155	No	2	2	11	11	60		No	No	9	15	31	64
156	Total	6	6	40	40	100		Missing	Total	26	46	100	
157								Total	System	28	52	100	
158	MEASBM							EA					
159	Valid	3	3	17	17	20		Valid	No answer	13	24	24	50
160	Yes	11	11	61	61	78		Yes	Yes	1	2	4	54
161	No	4	4	22	22	100		No	No	9	15	31	64
162	Total	16	16	100	100			Missing	Total	26	46	100	
163								Total	System	28	52	100	
164	MEASBN							EA					
165	Valid	3	3	17	17	17		Valid	No answer	3	6	6	6
166	Yes	11	11	61	61	78		Yes	Yes	14	26	26	31
167	No	4	4	22	22	100		No	No	21	39	39	70
168	Total	16	16	100	100			Missing	Total	11	20	20	81
169								Total	System	5	9	9	100
170										64	100		
171	MEASBO							EA					
172	Valid	6	6	26	26	26		Valid	No answer	3	6	6	6
173	Yes	17	17	39	39	44		Yes	Yes	14	26	26	31
174	No	61	61	20	20	6		No	No	21	39	39	70
175	Total	22	22	100	100			Missing	Total	11	20	20	81
176								Total	System	5	9	9	100
177										64	100		

	A	B	C	D	E	F	G	H	I	J	K	L	M
			Frequency	Percent	Valid Percent	Cumulative Percent				Frequency	Percent	Valid Percent	Cumulative Percent
179 DRIEP													
180 Valid			22	4	22	22	Valid			24	44	44	44
181 Disagree strongly		Disagree strongly	38	7	39	61	Disagree strongly			10	19	19	19
182 Disagree slightly		Disagree slightly	6	1	6	67	Disagree slightly			19	38	57	63
183 No answer		No answer	22	4	22	69	No answer			4	4	4	67
184 Agree slightly		Agree slightly	11	2	11	100	Agree slightly			12	24	24	91
185 Agree strongly		Agree strongly	100	18	100		Agree strongly			8	17	41	100
186 Total		Total					Total			84	100	100	
187 EA		EA					Collective Scheme			EA			Collective Scheme
188 No answer		No answer	6	0	6		No answer			No answer	0	0	4
189 Disagree strongly		Disagree strongly	17	3	17		Disagree strongly			Disagree I	17	17	15
190 Disagree slightly		Disagree slightly	22	4	22		Disagree slightly			Disagree I	33	33	19
191 Agree slightly		Agree slightly	19	3	19		Agree slightly			Agree sld	33	33	46
192 Agree strongly		Agree strongly	31	6	31		Agree strongly			Agree stro	17	17	17
193 Total		Total					Total			7	7	7	4
194 NLDREP													
195 Valid			17	3	17	17	Valid			10	19	19	19
196 Disagree strongly		Disagree strongly	22	4	22	39	Disagree strongly			14	26	26	44
197 Disagree slightly		Disagree slightly	33	6	33	72	Disagree slightly			3	6	6	60
198 No answer		No answer	29	5	29	100	No answer			10	19	19	80
199 Agree slightly		Agree slightly	100	18	100		Agree slightly			17	31	31	100
200 Total		Total					Total			64	100	100	
201 NEGOREP													
202 Valid			72	13	72	72	Valid			34	63	64	64
203 Disagree strongly		Disagree strongly	17	3	17	89	Disagree strongly			13	24	26	89
204 Disagree slightly		Disagree slightly	11	2	11	100	Disagree slightly			4	7	8	96
205 No answer		No answer	100	18	100		No answer			1	2	2	98
206 Agree slightly		Agree slightly					Agree slightly			1	2	2	100
207 Total		Total					Total			63	98	100	
208 EA		EA					EA						
209 No answer		No answer	0	0	0		No answer			0	0	0	0
210 Yes		Yes	60	11	60	48	Yes			31	62	62	98
211 No		No	60	11	60		No			13	25	25	100
212 NEGOCOST													
213 Valid			17	3	17	17	Valid			9	16	16	16
214 Disagree strongly		Disagree strongly	33	6	33	50	Disagree strongly			10	19	19	33
215 Disagree slightly		Disagree slightly	33	6	33	83	Disagree slightly			2	4	4	37
216 No answer		No answer	17	3	17	100	No answer			26	48	48	83
217 Agree slightly		Agree slightly	100	18	100		Agree slightly			9	17	17	100
218 Total		Total					Total			64	100	100	
219 EA		EA					EA						
220 No answer		No answer	0	0	0		No answer			0	0	0	0
221 Yes		Yes	60	11	60	41	Yes			44	84	84	100
222 No		No	60	11	60		No			33	62	62	98
223 ENMPREP													
224 Valid			50	9	50	50	Valid			6	9	9	9
225 Yes		Yes	50	9	50	100	Yes			22	41	42	61
226 No		No	100	18	100		No			28	48	49	100
227 Total		Total					Total			53	99	100	
228 EA		EA					EA			1	2	2	2
229 No answer		No answer	0	0	0		No answer			64	100	100	
230 Yes		Yes	60	11	60		Yes						
231 No		No	60	11	60		No						
232 ESSREQ													
233 Valid			44	8	44	44	Valid			17	31	33	33
234 No answer		No answer	33	6	33	78	No answer			28	52	64	87
235 Yes		Yes	22	4	22	100	Yes			7	13	13	100
236 No		No	100	18	100		No			62	96	96	100
237 Total		Total					Total			2	4	4	4
238 EA		EA					EA			54	100	100	
239 No answer		No answer	0	0	0		No answer			17	31	33	33
240 Yes		Yes	60	11	60		Yes			28	52	64	87
241 No		No	60	11	60		No			7	13	13	100
242 Total		Total					Total			62	96	96	100
243 EA		EA					EA			2	4	4	4
244 No answer		No answer	0	0	0		No answer			54	100	100	
245 Yes		Yes	60	11	60		Yes						
246 No		No	60	11	60		No						
247 Total		Total					Total						

	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD
37															
38	No answer	EA	Collective Scheme	41 Unknown	50	41 Unknown	sc	EA	Collective Scheme	70 Unknown	EA	Collective Scheme	74 Unknown	EA	Collective Scheme
39		50	2 1996	2 1996	22	13 1995		0	0	2 1995	0	0	2 1992	2 1992	61
40	1974	0	15 1997	15 1997	28	31 1996		11	11	4 1996	6	6	2 1996	2 1996	6
41	1980	0	26 1998	9 1997	0	9 1997		22	22	4 1998	22	13	13 1997	13 1997	11
42	1992	0	13 1974	0	0	2 1998		6	6	2 1998	6	2	2 1998	2 1998	17
43	1996	22	2 1980	2 1980	0	2 1969		0	0	2 1969	0	0	2 1999	2 1999	0
44	1997	28	2 2000	2 1977	0	2 1977		0	0	2 1977	0	0	2 1957	2 1957	0
45	1998	0		2 1980	0	2 1980		0	0	4 1980	0	0	4 1980	4 1980	0
46	MEASAA			MEASAA		MEASAA							1984	1984	0
47	MEASAA			MEASAA		MEASAA							1985	1985	0
48	Valid	Unknown	Frequency	Percent	Valid Percent	Cumulative Percent		Valid	Valid	Unknown	Frequency Percent	37	2	2	
49	1974	Unknown	9	50	50	50		1992	1992	1	20	37	2	2	
50	1996	1996	4	22	22	72		1996	1996	8	8	15	15	15	
51	1997	1997	5	28	28	100		1997	1997	14	14	26	26	26	
52	Total	Total	18	100	100			1998	1998	7	7	13	13	13	
53								1974	1974	1	1	2	2	2	
54								1980	1980	1	1	2	2	2	
55	MEASAB							Total	Total	52	52	96	96	96	
56	Valid	Unknown	Frequency	Percent	Valid Percent	Cumulative Percent		Missing Total	Missing Total	2	2	4	4	4	
57	1974	Unknown	9	50	50	50				54	54	100	100	100	
58	1996	1996	4	22	22	72		MEASAB	MEASAB	Unknown	Frequency Percent	37	38	38	
59	1997	1997	5	28	28	100		Valid	Valid	1996	7	13	13	52	
60	Total	Total	18	100	100					1997	17	31	31	85	
61										1998	5	9	9	94	
62										1974	1	2	2	96	
63	MEASAC									1980	1	2	2	98	
64	Valid	Unknown	Frequency	Percent	Valid Percent	Cumulative Percent		MEASAC	MEASAC	2000	1	2	2	100	
65	1974	Unknown	11	61	61	61		Valid	Valid	Total	52	96	96	100	
66	1996	1996	2	11	11	72				Total	2	4	4	100	
67	1997	1997	4	22	22	100				System	2	4	4		
68	1998	1998	1	6	6					Unknown	20	37	37		
69	Total	Total	18	100	100					1996	7	13	13	52	
70										1997	17	31	31	85	
71										1998	5	9	9	94	
72										1974	1	2	2	96	
73	MEASAD									1980	1	2	2	98	
74	Valid	Unknown	Frequency	Percent	Valid Percent	Cumulative Percent		MEASAD	MEASAD	2000	1	2	2	100	
75	1974	Unknown	12	67	67	67		Valid	Valid	Total	50	93	93	100	
76	1996	1996	1	6	6	72				System	4	7	7		
77	1997	1997	4	22	22	100				Unknown	34	63	63	68	
78	1998	1998	1	6	6					1995	1	2	2	70	
79	Total	Total	18	100	100					1996	2	4	4	74	
80										1997	7	13	13	88	
81	MEASAE									1998	2	4	4	92	
82	Valid	Unknown	Frequency	Percent	Valid Percent	Cumulative Percent		MEASAE	MEASAE	1969	1	2	2	94	
83	1974	Unknown	11	61	61	61		Valid	Valid	1977	1	2	2	96	
84	1996	1996	1	6	6	72				1980	2	4	4	98	
85	1997	1997	1	6	6					Total	50	93	93	100	
86	1998	1998	2	11	11	83				System	4	7	7		
87	Total	Total	3	17	17	100				Unknown	36	67	67	72	
88										1995	1	2	2	74	
89										1996	1	2	2	76	
90										1997	7	13	13	90	
91	MEASAF									1998	1	2	2	92	
92	Valid	Unknown	Frequency	Percent	Valid Percent	Cumulative Percent		MEASAF	MEASAF	1969	1	2	2	94	
93	1974	Unknown	10	56	56	56		Valid	Valid	1977	1	2	2	96	
94	1996	1996	1	6	6	61				1980	2	4	4	98	
95	1997	1997	1	6	6					Total	50	93	93	100	
96	1998	1998	2	11	11	78				System	4	7	7		
97	Total	Total	3	17	17	100				Unknown	36	67	67	72	
98										1995	1	2	2	74	
99										1996	1	2	2	76	
100										1997	7	13	13	90	

	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC
103															
104		MEASAG													
105		Valid	Unknown	Frequency	Percent	Valid Percent	Cumulative Percent				Unknown	Frequency	Percent	Valid Percent	Cumulative Percent
106			1995	1	13	72	72				1992	1	31	57	61
107			1996	1	13	6	6				1996	2	2	2	2
108			1997	2	11	6	6				1997	4	4	4	4
109			1998	1	11	6	6				1998	5	5	10	10
110			Total	18	100	100	100				1999	2	6	10	10
111											1999	1	2	2	2
112		MEASAH									1997	1	2	2	2
113		Valid	Unknown	Frequency	Percent	Valid Percent	Cumulative Percent				1998	1	2	2	2
114			1995	1	13	72	72				1998	1	2	2	2
115			1996	1	13	6	6				Total	51	94	100	100
116			1997	2	11	6	6				System	3	6	100	
117			1998	1	11	6	6								
118			Total	18	100	100	100								
119															
120															
121															
122			af	EA	56										
123			EA	EA	75	Unknown									
124		No answer	1992	2	2	1995		Collective Scheme	0						
125		1996	1996	4	4	6	6	Collective Scheme	0						
126		1997	1997	11	11	6	6	Collective Scheme	0						
127		1998	1998	17	17	6	6	Collective Scheme	0						
128		1999	1999	6	6	6	6	Collective Scheme	0						
129		1999	1999	0	0	6	6	Collective Scheme	0						
130		1999	1999	0	0	6	6	Collective Scheme	0						
131		1999	1999	0	0	6	6	Collective Scheme	0						
132								Collective Scheme	0						
133			sh	EA	72		EA	Collective Scheme	0						
134		Unknown	EA	EA	87		EA	Collective Scheme	0						
135		1995	1995	6	6	1990	1990	Collective Scheme	0						
136		1996	1996	6	6	6	6	Collective Scheme	0						
137		1997	1997	11	11	6	6	Collective Scheme	0						
138		1998	1998	6	6	6	6	Collective Scheme	0						
139		1998	1998	6	6	6	6	Collective Scheme	0						
140		1999	1999	0	0	6	6	Collective Scheme	0						
141								Collective Scheme	0						
142								Collective Scheme	0						
143								Collective Scheme	0						
144								Collective Scheme	0						
145								Collective Scheme	0						
146								Collective Scheme	0						
147		ENVPDATE													
148		Valid	Unknown	Frequency	Percent	Valid Percent	Cumulative Percent				Unknown	Frequency	Percent	Valid Percent	Cumulative Percent
149			1996	1	33	33	33				1996	1	60	66	66
150			1996	4	12	6	6				1996	2	2	2	2
151			1997	1	6	6	6				1997	3	6	6	6
152			1998	1	6	6	6				1997	4	7	8	8
153			1998	1	6	6	6				1998	2	4	4	4
154			1999	2	11	6	6				Total	50	93	100	100
155			Total	18	100	100	100				System	4	7	100	
156															
157															
158															
159															
160															
161															
162		EMS YEAR													
163		Valid	Unknown	Frequency	Percent	Valid Percent	Cumulative Percent				Unknown	Frequency	Percent	Valid Percent	Cumulative Percent
164			1996	15	63	63	63				1996	1	2	2	2
165			1997	1	6	6	6				1996	2	4	5	5
166			2000	1	6	6	6				1996	5	9	13	13
167			Total	18	100	100	100				Total	39	72	100	100
168											System	15	28	36	36
169															
170															
171															
172		EMS Year	EA	EA	83		EA	Collective Scheme	17						
173		No answer	1996	6	6	6	6	Collective Scheme	17						
174		1996	1996	6	6	6	6	Collective Scheme	17						
175		1997	1997	6	6	6	6	Collective Scheme	17						
176		1998	1998	0	0	6	6	Collective Scheme	17						
177		1998	1998	0	0	6	6	Collective Scheme	17						
178		2000	2000	6	6	6	6	Collective Scheme	17						
179								Collective Scheme	17						
180								Collective Scheme	17						

	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC
230	MATREPO+D1													
231	MATREPD+D1													
232	Valid	1991	Frequency	Percent	Valid Percent	Cumulative Percent			1994	Frequency	Percent	Valid Percent	Cumulative Percent	
233		1996	2	17	11	22			1996	2	9	10	15	
234		1997	1	8	11	33			1997	2	9	15	20	
235		1998	5	42	44	78			1998	3	13	25	30	
236		1999	2	17	11	89			1999	9	39	30	45	
237		1990	1	8	11	100			Total	7	30	30	70	
238	Total		12	100	100				Total	23	100	100	100	
239	Missing	System	9	50										
240	Total		18	100										
241														
242														
243														
244														
245														



	A	B	C	D	E	F	G	H	I	J	K	L	M	N
308	Legal and Finance	9	10		1	1								
309	Human Resources	0	2		2	2								
310	Public Relations	0	11		14	14								
311	Environment	36	52		2	2								
312	IT/ Systems/ Quality	11	13		1	1								
313	Sales and Marketing	11	12		-1	-1								
314	Research and Development	6	5		5	5								
315	Production	10	15		12	12								
316	Health and Safety	24	36		2	2								
317	Distribution	11	13											
318		136	179		41									
319														
320														
321														
322														
323	Unknown	100	0		1	1								
324	Oil Spills	400	2		102	102								
325	Forestry and paper	168	12		434	434								
326	Electric and electrical equipment	2	265		101	101								
327	Beverages	100	28		177	177								
328	Personal care & household products	177	0		90	90								
329	General retailers	90	0		5	5								
330	Support services	0	5		0	0								
331	Electronics	0	0		37	37								
332	Insurance	0	0		0	0								
333	Socially and other finance	0	0		401	401								
334	Steel & other metals	100	301		261	261								
335	Mining	100	161		1050	1050								
336	Engineering & machinery	100	40		108	108								
337	Food producers and processors	100	8		0	0								
338	Pharmaceuticals	100	0		0	0								
339	Leisure entertainment & hotels	0	0		0	0								
340	Transport	0	0		0	0								
341	Gas Distribution	0	0		0	0								
342	Life Assurance	0	0		125	125								
343	Information technology hardware	90	35		400	400								
344	Chemicals	100	20		30	30								
345	Aerospace and defence	65	20		65	65								
346	Automotives	65	0		100	100								
347	Health	100	0		100	100								
348	Tobacco	100	0		100	100								
349	Media and photography	313	0		313	313								
350	Food and drug retailers	0	0		0	0								
351	Water	0	0		0	0								
352	Investment companies	0	0		0	0								
353	Software & computer services	10	0		10	10								
354	Construction & building materials	300	145		445	445								
355	Diversified industries	100	0		100	100								
356	Household goods & textiles	136	205		560	560								
357	Packaging	510	80		800	800								
358	Distributors	466	140		100	100								
359	Restaurants, pubs, breweries	0	0		0	0								
360	Telecommunication Services	0	0		0	0								
361	Real Estate	0	0		0	0								
362	Blanks	0	0		0	0								
363	Real Estate	0	0		35	35								
364	Agrochem	90	5		100	100								
365	Contract catering	100	0		100	100								
366	Publishing	100	0		100	100								
367	Horiculture	100	0		100	100								
368	Wholesale	100	0		100	100								
369		5301	1800		7101	7101								
370														
371														
372														

	A	B	C	D	E	F	G	H	I
308									
309	Legal and Finance			10 C309-8309					
310	Human Resources			12 C310-8310					
311	Public Relations			11 C311-8311					
312	Environment			62 C312-8312					
313	IT/ Systems/ Quality			13 C313-8313					
314	Sales and Marketing			12 C314-8314					
315	Research and Development			8 C315-8315					
316	Production			18 C316-8316					
317	Health and Safety			36 C317-8317					
318	Distribution			13 C318-8318					
319		SUM(C309:8318)		SUM(C309:8318)					
320									
321									
322									
323									
324									
325									
326	Unknown								
327	Oil Lanes								
328	Forestry and paper								
329	Electric and electrical equipment								
330	Beverages								
331	Personal care & household products								
332	General retailers								
333	Support services								
334	Electricity								
335	Insurance								
336	Specialty and other finance								
337	Steel & other metals								
338	Mining								
339	Engineering & machinery								
340	Food producers and processors								
341	Pharmaceuticals								
342	Leisure, entertainment & hotels								
343	Transport								
344	Gas Distribution								
345	Life Assurance								
346	Information technology hardware								
347	Chemicals								
348	Aerospace and defence								
349	Automobiles								
350	Health								
351	Tobacco								
352	Media and photography								
353	Food and drug retailers								
354	Wider								
355	Investment companies								
356	Software & computer services								
357	Construction & building materials								
358	Diversified industries								
359	Household goods & textiles								
360	Packaging								
361	Distributors								
362	Restaurants, pubs, breweries								
363	Telecommunication Services								
364	Real Estate								
365	Agrochem								
366	Contract catering								
367	Publishing								
368	Horticulture								
369	Wholesale								
370									
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	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X
						see Landfill 1998	1997	1998	1998	Coal	Landfill 1998	1997	1998	1998				
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25	1898					
26	280					
27	2400	340				
28	2	2400				
29	2	26				
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31	517	440				
32	125	0				
33	0					
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1	Col					
2	1997	1997	1997	1998	1998	1999
3	F(BS20.0, C02/BT2)	F(BT20.0, C02/BT2)	F(BU20.0, C02/BV2)	F(BV20.0, C02/BV2)	F(BW20.0, C02/BW2)	F(BX20.0, C02/BX2)
4	F(BS20.0, C03/BT3)	F(BT20.0, C03/BT3)	F(BU20.0, C03/BV3)	F(BV20.0, C03/BV3)	F(BW20.0, C03/BW3)	F(BX20.0, C03/BX3)
5	F(BS20.0, C04/BT4)	F(BT20.0, C04/BT4)	F(BU20.0, C04/BV4)	F(BV20.0, C04/BV4)	F(BW20.0, C04/BW4)	F(BX20.0, C04/BX4)
6	F(BS20.0, C05/BT5)	F(BT20.0, C05/BT5)	F(BU20.0, C05/BV5)	F(BV20.0, C05/BV5)	F(BW20.0, C05/BW5)	F(BX20.0, C05/BX5)
7	F(BS20.0, C06/BT6)	F(BT20.0, C06/BT6)	F(BU20.0, C06/BV6)	F(BV20.0, C06/BV6)	F(BW20.0, C06/BW6)	F(BX20.0, C06/BX6)
8	F(BS20.0, C07/BT7)	F(BT20.0, C07/BT7)	F(BU20.0, C07/BV7)	F(BV20.0, C07/BV7)	F(BW20.0, C07/BW7)	F(BX20.0, C07/BX7)
9	F(BS20.0, C08/BT8)	F(BT20.0, C08/BT8)	F(BU20.0, C08/BV8)	F(BV20.0, C08/BV8)	F(BW20.0, C08/BW8)	F(BX20.0, C08/BX8)
10	F(BS20.0, C09/BT9)	F(BT20.0, C09/BT9)	F(BU20.0, C09/BV9)	F(BV20.0, C09/BV9)	F(BW20.0, C09/BW9)	F(BX20.0, C09/BX9)
11	F(BS20.0, C10/BT10)	F(BT20.0, C10/BT10)	F(BU20.0, C10/BV10)	F(BV20.0, C10/BV10)	F(BW20.0, C10/BW10)	F(BX20.0, C10/BX10)
12	F(BS20.0, C11/BT11)	F(BT20.0, C11/BT11)	F(BU20.0, C11/BV11)	F(BV20.0, C11/BV11)	F(BW20.0, C11/BW11)	F(BX20.0, C11/BX11)
13	F(BS20.0, C12/BT12)	F(BT20.0, C12/BT12)	F(BU20.0, C12/BV12)	F(BV20.0, C12/BV12)	F(BW20.0, C12/BW12)	F(BX20.0, C12/BX12)
14	F(BS20.0, C13/BT13)	F(BT20.0, C13/BT13)	F(BU20.0, C13/BV13)	F(BV20.0, C13/BV13)	F(BW20.0, C13/BW13)	F(BX20.0, C13/BX13)
15	F(BS20.0, C14/BT14)	F(BT20.0, C14/BT14)	F(BU20.0, C14/BV14)	F(BV20.0, C14/BV14)	F(BW20.0, C14/BW14)	F(BX20.0, C14/BX14)
16	F(BS20.0, C15/BT15)	F(BT20.0, C15/BT15)	F(BU20.0, C15/BV15)	F(BV20.0, C15/BV15)	F(BW20.0, C15/BW15)	F(BX20.0, C15/BX15)
17	F(BS20.0, C16/BT16)	F(BT20.0, C16/BT16)	F(BU20.0, C16/BV16)	F(BV20.0, C16/BV16)	F(BW20.0, C16/BW16)	F(BX20.0, C16/BX16)
18	F(BS20.0, C17/BT17)	F(BT20.0, C17/BT17)	F(BU20.0, C17/BV17)	F(BV20.0, C17/BV17)	F(BW20.0, C17/BW17)	F(BX20.0, C17/BX17)
19	F(BS20.0, C18/BT18)	F(BT20.0, C18/BT18)	F(BU20.0, C18/BV18)	F(BV20.0, C18/BV18)	F(BW20.0, C18/BW18)	F(BX20.0, C18/BX18)
20	F(BS20.0, C19/BT19)	F(BT20.0, C19/BT19)	F(BU20.0, C19/BV19)	F(BV20.0, C19/BV19)	F(BW20.0, C19/BW19)	F(BX20.0, C19/BX19)
21	F(BS20.0, C20/BT20)	F(BT20.0, C20/BT20)	F(BU20.0, C20/BV20)	F(BV20.0, C20/BV20)	F(BW20.0, C20/BW20)	F(BX20.0, C20/BX20)
22	F(BS20.0, C21/BT21)	F(BT20.0, C21/BT21)	F(BU20.0, C21/BV21)	F(BV20.0, C21/BV21)	F(BW20.0, C21/BW21)	F(BX20.0, C21/BX21)
23	F(BS20.0, C22/BT22)	F(BT20.0, C22/BT22)	F(BU20.0, C22/BV22)	F(BV20.0, C22/BV22)	F(BW20.0, C22/BW22)	F(BX20.0, C22/BX22)
24	F(BS20.0, C23/BT23)	F(BT20.0, C23/BT23)	F(BU20.0, C23/BV23)	F(BV20.0, C23/BV23)	F(BW20.0, C23/BW23)	F(BX20.0, C23/BX23)
25	F(BS20.0, C24/BT24)	F(BT20.0, C24/BT24)	F(BU20.0, C24/BV24)	F(BV20.0, C24/BV24)	F(BW20.0, C24/BW24)	F(BX20.0, C24/BX24)
26	F(BS20.0, C25/BT25)	F(BT20.0, C25/BT25)	F(BU20.0, C25/BV25)	F(BV20.0, C25/BV25)	F(BW20.0, C25/BW25)	F(BX20.0, C25/BX25)
27	F(BS20.0, C26/BT26)	F(BT20.0, C26/BT26)	F(BU20.0, C26/BV26)	F(BV20.0, C26/BV26)	F(BW20.0, C26/BW26)	F(BX20.0, C26/BX26)
28	F(BS20.0, C27/BT27)	F(BT20.0, C27/BT27)	F(BU20.0, C27/BV27)	F(BV20.0, C27/BV27)	F(BW20.0, C27/BW27)	F(BX20.0, C27/BX27)
29	F(BS20.0, C28/BT28)	F(BT20.0, C28/BT28)	F(BU20.0, C28/BV28)	F(BV20.0, C28/BV28)	F(BW20.0, C28/BW28)	F(BX20.0, C28/BX28)
30	F(BS20.0, C29/BT29)	F(BT20.0, C29/BT29)	F(BU20.0, C29/BV29)	F(BV20.0, C29/BV29)	F(BW20.0, C29/BW29)	F(BX20.0, C29/BX29)
31	F(BS20.0, C30/BT30)	F(BT20.0, C30/BT30)	F(BU20.0, C30/BV30)	F(BV20.0, C30/BV30)	F(BW20.0, C30/BW30)	F(BX20.0, C30/BX30)
32	F(BS20.0, C31/BT31)	F(BT20.0, C31/BT31)	F(BU20.0, C31/BV31)	F(BV20.0, C31/BV31)	F(BW20.0, C31/BW31)	F(BX20.0, C31/BX31)
33	F(BS20.0, C32/BT32)	F(BT20.0, C32/BT32)	F(BU20.0, C32/BV32)	F(BV20.0, C32/BV32)	F(BW20.0, C32/BW32)	F(BX20.0, C32/BX32)
34	F(BS20.0, C33/BT33)	F(BT20.0, C33/BT33)	F(BU20.0, C33/BV33)	F(BV20.0, C33/BV33)	F(BW20.0, C33/BW33)	F(BX20.0, C33/BX33)
35	F(BS20.0, C34/BT34)	F(BT20.0, C34/BT34)	F(BU20.0, C34/BV34)	F(BV20.0, C34/BV34)	F(BW20.0, C34/BW34)	F(BX20.0, C34/BX34)
36	F(BS20.0, C35/BT35)	F(BT20.0, C35/BT35)	F(BU20.0, C35/BV35)	F(BV20.0, C35/BV35)	F(BW20.0, C35/BW35)	F(BX20.0, C35/BX35)
37	F(BS20.0, C36/BT36)	F(BT20.0, C36/BT36)	F(BU20.0, C36/BV36)	F(BV20.0, C36/BV36)	F(BW20.0, C36/BW36)	F(BX20.0, C36/BX36)
38	F(BS20.0, C37/BT37)	F(BT20.0, C37/BT37)	F(BU20.0, C37/BV37)	F(BV20.0, C37/BV37)	F(BW20.0, C37/BW37)	F(BX20.0, C37/BX37)
39	F(BS20.0, C38/BT38)	F(BT20.0, C38/BT38)	F(BU20.0, C38/BV38)	F(BV20.0, C38/BV38)	F(BW20.0, C38/BW38)	F(BX20.0, C38/BX38)
40	F(BS20.0, C39/BT39)	F(BT20.0, C39/BT39)	F(BU20.0, C39/BV39)	F(BV20.0, C39/BV39)	F(BW20.0, C39/BW39)	F(BX20.0, C39/BX39)
41	F(BS20.0, C40/BT40)	F(BT20.0, C40/BT40)	F(BU20.0, C40/BV40)	F(BV20.0, C40/BV40)	F(BW20.0, C40/BW40)	F(BX20.0, C40/BX40)
42	F(BS20.0, C41/BT41)	F(BT20.0, C41/BT41)	F(BU20.0, C41/BV41)	F(BV20.0, C41/BV41)	F(BW20.0, C41/BW41)	F(BX20.0, C41/BX41)
43	F(BS20.0, C42/BT42)	F(BT20.0, C42/BT42)	F(BU20.0, C42/BV42)	F(BV20.0, C42/BV42)	F(BW20.0, C42/BW42)	F(BX20.0, C42/BX42)
44	F(BS20.0, C43/BT43)	F(BT20.0, C43/BT43)	F(BU20.0, C43/BV43)	F(BV20.0, C43/BV43)	F(BW20.0, C43/BW43)	F(BX20.0, C43/BX43)
45	F(BS20.0, C44/BT44)	F(BT20.0, C44/BT44)	F(BU20.0, C44/BV44)	F(BV20.0, C44/BV44)	F(BW20.0, C44/BW44)	F(BX20.0, C44/BX44)
46	F(BS20.0, C45/BT45)	F(BT20.0, C45/BT45)	F(BU20.0, C45/BV45)	F(BV20.0, C45/BV45)	F(BW20.0, C45/BW45)	F(BX20.0, C45/BX45)
47	F(BS20.0, C46/BT46)	F(BT20.0, C46/BT46)	F(BU20.0, C46/BV46)	F(BV20.0, C46/BV46)	F(BW20.0, C46/BW46)	F(BX20.0, C46/BX46)
48	F(BS20.0, C47/BT47)	F(BT20.0, C47/BT47)	F(BU20.0, C47/BV47)	F(BV20.0, C47/BV47)	F(BW20.0, C47/BW47)	F(BX20.0, C47/BX47)
49	F(BS20.0, C48/BT48)	F(BT20.0, C48/BT48)	F(BU20.0, C48/BV48)	F(BV20.0, C48/BV48)	F(BW20.0, C48/BW48)	F(BX20.0, C48/BX48)
50	F(BS20.0, C49/BT49)	F(BT20.0, C49/BT49)	F(BU20.0, C49/BV49)	F(BV20.0, C49/BV49)	F(BW20.0, C49/BW49)	F(BX20.0, C49/BX49)
51	F(BS20.0, C50/BT50)	F(BT20.0, C50/BT50)	F(BU20.0, C50/BV50)	F(BV20.0, C50/BV50)	F(BW20.0, C50/BW50)	F(BX20.0, C50/BX50)
52	F(BS20.0, C51/BT51)	F(BT20.0, C51/BT51)	F(BU20.0, C51/BV51)	F(BV20.0, C51/BV51)	F(BW20.0, C51/BW51)	F(BX20.0, C51/BX51)
53	F(BS20.0, C52/BT52)	F(BT20.0, C52/BT52)	F(BU20.0, C52/BV52)	F(BV20.0, C52/BV52)	F(BW20.0, C52/BW52)	F(BX20.0, C52/BX52)
54	F(BS20.0, C53/BT53)	F(BT20.0, C53/BT53)	F(BU20.0, C53/BV53)	F(BV20.0, C53/BV53)	F(BW20.0, C53/BW53)	F(BX20.0, C53/BX53)
55	F(BS20.0, C54/BT54)	F(BT20.0, C54/BT54)	F(BU20.0, C54/BV54)	F(BV20.0, C54/BV54)	F(BW20.0, C54/BW54)	F(BX20.0, C54/BX54)
56	F(BS20.0, C55/BT55)	F(BT20.0, C55/BT55)	F(BU20.0, C55/BV55)	F(BV20.0, C55/BV55)	F(BW20.0, C55/BW55)	F(BX20.0, C55/BX55)
57	F(BS20.0, C56/BT56)	F(BT20.0, C56/BT56)	F(BU20.0, C56/BV56)	F(BV20.0, C56/BV56)	F(BW20.0, C56/BW56)	F(BX20.0, C56/BX56)
58	SUM(A3:AF56)/COUNTIF(A3:AF56, ">0")	SUM(AG3:AG56)/COUNTIF(AG3:AG56, ">0")	SUM(AH3:AH56)/COUNTIF(AH3:AH56, ">0")	SUM(AI3:AI56)/COUNTIF(AI3:AI56, ">0")	SUM(AJ3:AJ56)/COUNTIF(AJ3:AJ56, ">0")	SUM(AK3:AK56)/COUNTIF(AK3:AK56, ">0")
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152	AG26-AF26	AJ26-AJ26				
153	AG27-AF27	AJ27-AJ27				
154	AG28-AF28	AJ28-AJ28				
155	AG29-AF29	AJ29-AJ29				
156	AG30-AF30	AJ30-AJ30				
157	AG31-AF31	AJ31-AJ31				
158	AG32-AF32	AJ32-AJ32				
159	AG33-AF33	AJ33-AJ33				
160	AG34-AF34	AJ34-AJ34				
161	AG35-AF35	AJ35-AJ35				
162	AG36-AF36	AJ36-AJ36				
163	AG37-AF37	AJ37-AJ37				
164	AG38-AF38	AJ38-AJ38				
165	AG39-AF39	AJ39-AJ39				
166	AG40-AF40	AJ40-AJ40				
167	AG41-AF41	AJ41-AJ41				
168	AG42-AF42	AJ42-AJ42				
169	AG43-AF43	AJ43-AJ43				
170	AG44-AF44	AJ44-AJ44				
171	AG45-AF45	AJ45-AJ45				
172	AG46-AF46	AJ46-AJ46				
173	AG47-AF47	AJ47-AJ47				
174	AG48-AF48	AJ48-AJ48				
175	AG49-AF49	AJ49-AJ49				
176	AG50-AF50	AJ50-AJ50				
177	AG51-AF51	AJ51-AJ51				
178	AG52-AF52	AJ52-AJ52				
179	AG53-AF53	AJ53-AJ53				
180	AG54-AF54	AJ54-AJ54				
181	AG55-AF55	AJ55-AJ55				
182	AG56-AF56	AJ56-AJ56				
183	AG57-AF57	AJ57-AJ57				
184	1897/1898	1898/1897				
185	AH80-AG60	AJ80-AJ80				
186	AH81-AG61	AJ81-AJ81				
187	AH82-AG62	AJ82-AJ82				
188	AH83-AG63	AJ83-AJ83				
189	AH84-AG64	AJ84-AJ84				
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	BA	BB	BC	BD	BE	BF	BG	BH	BI	BJ	BK	BL	BM	BN	BO	BP	BQ	BR	BS	BT	BU	
1																						
2		Card Recycled																				
3	1996	303.7407407	482.1666667	1996	534.5925926	61.64074074	154.4203704	183.9186852	183.8425926	49.31111111	71.60555556	80.3507963	71.69074074	22.36888889	83.71296296	161.462963	138.5	9.877777778	43.73703704	109.3198333	1998	106.0666667
4	1997			1997																	1997	
5	Card/Paper	303.74	482.17	1996	534.59																1998	
6	Plastic	81.84	154.42	1996	183.92	183.84															1998	
7	Metal	49.31	71.61	1996	80.35	71.69															1998	
8	Wood	22.39	83.71	1996	139.50	139.50															1998	
9	Other	9.88	43.74	1996	109.07	109.07															1998	
10																						
11	Card Recycled																					
12	1996	145.5	143.8888889	1996	227.5333333	483.5	74.55555556	43.86888889	43.86888889	11.05555556	28.40277778	11.22222222	22.36888889	235.0555556	2173.25	2242.386111	2144.055556	34.77777778	33.11111111	109.3198333	1997	29.16666667
13	1997			1997																	1997	
14	Card/Paper	145.5	143.8888889	1996	227.5333333	483.5	74.55555556	43.86888889	43.86888889	11.05555556	28.40277778	11.22222222	22.36888889	235.0555556	2173.25	2242.386111	2144.055556	34.77777778	33.11111111	109.3198333	1998	29.16666667
15	Plastic	145.5	143.8888889	1996	227.5333333	483.5	74.55555556	43.86888889	43.86888889	11.05555556	28.40277778	11.22222222	22.36888889	235.0555556	2173.25	2242.386111	2144.055556	34.77777778	33.11111111	109.3198333	1998	29.16666667
16	Metal	145.5	143.8888889	1996	227.5333333	483.5	74.55555556	43.86888889	43.86888889	11.05555556	28.40277778	11.22222222	22.36888889	235.0555556	2173.25	2242.386111	2144.055556	34.77777778	33.11111111	109.3198333	1998	29.16666667
17	Wood	145.5	143.8888889	1996	227.5333333	483.5	74.55555556	43.86888889	43.86888889	11.05555556	28.40277778	11.22222222	22.36888889	235.0555556	2173.25	2242.386111	2144.055556	34.77777778	33.11111111	109.3198333	1998	29.16666667
18	Other	145.5	143.8888889	1996	227.5333333	483.5	74.55555556	43.86888889	43.86888889	11.05555556	28.40277778	11.22222222	22.36888889	235.0555556	2173.25	2242.386111	2144.055556	34.77777778	33.11111111	109.3198333	1998	29.16666667
19																						
20	CS																					
21	Card Handled																					
22	1996	303.7407407	482.1666667	1996	534.5925926	61.64074074	154.4203704	183.9186852	183.8425926	49.31111111	71.60555556	80.3507963	71.69074074	22.36888889	83.71296296	161.462963	138.5	9.877777778	43.73703704	109.3198333	1997	106.0666667
23	1997			1997																	1997	
24	Card/Paper	304	482	1996	596	535															1998	
25	Plastic	62	154	1996	164	164															1998	
26	Metal	49	72	1996	80	72															1998	
27	Wood	22	84	1996	161	139															1998	
28	Other	10	44	1996	109	108															1998	
29																						
30	CS																					
31	Card Handled																					
32	1996	145.5	143.8888889	1996	227.5333333	483.5	74.55555556	43.86888889	43.86888889	11.05555556	28.40277778	11.22222222	22.36888889	235.0555556	2173.25	2242.386111	2144.055556	34.77777778	33.11111111	109.3198333	1997	29.16666667
33	1997			1997																	1997	
34	Card/Paper	145.5	143.8888889	1996	227.5333333	483.5	74.55555556	43.86888889	43.86888889	11.05555556	28.40277778	11.22222222	22.36888889	235.0555556	2173.25	2242.386111	2144.055556	34.77777778	33.11111111	109.3198333	1998	29.16666667
35	Plastic	145.5	143.8888889	1996	227.5333333	483.5	74.55555556	43.86888889	43.86888889	11.05555556	28.40277778	11.22222222	22.36888889	235.0555556	2173.25	2242.386111	2144.055556	34.77777778	33.11111111	109.3198333	1998	29.16666667
36	Metal	145.5	143.8888889	1996	227.5333333	483.5	74.55555556	43.86888889	43.86888889	11.05555556	28.40277778	11.22222222	22.36888889	235.0555556	2173.25	2242.386111	2144.055556	34.77777778	33.11111111	109.3198333	1998	29.16666667
37	Wood	145.5	143.8888889	1996	227.5333333	483.5	74.55555556	43.86888889	43.86888889	11.05555556	28.40277778	11.22222222	22.36888889	235.0555556	2173.25	2242.386111	2144.055556	34.77777778	33.11111111	109.3198333	1998	29.16666667
38	Other	145.5	143.8888889	1996	227.5333333	483.5	74.55555556	43.86888889	43.86888889	11.05555556	28.40277778	11.22222222	22.36888889	235.0555556	2173.25	2242.386111	2144.055556	34.77777778	33.11111111	109.3198333	1998	29.16666667
39																						
40	Card/Paper	149	144	1996	228	464															1998	
41	Plastic	75	44	1996	49	93															1998	
42	Metal	5	11	1996	28	11															1998	
43	Wood	235	2173	1996	2242	2144															1998	
44	Other	35	33	1996	29	29															1998	

	BV	BW	BX	BY	BZ	CA	CB	CC	CD	CE	CF	CG	CH	CI	CJ	CK	CL	CM	CN	CO	CP	CQ
1		Recyclate	(Ave. for those that used recyclate)																			
2		1996	1997	1998	1999																	
3	Collective:	2		9	10																	
4	Environme	0		0	0																	
5																						
6																						
7	Non-packaging Recycled																					
8	Card Recycled																					
9	1996	1997	1998	1999																		
10	8	9		18	12	0	1	0	11	12	12	13	0	0	0	0	0	116	74	61		
11	0	0		19	0	0	0	0	57	57	230	56	4	5	5	4	250	444	429	239		
12																						
13	cs																					
14		1996	1997	1998	1999																	
15	Card/Pape	8		9	18	12																
16	Plastic	0		0	1	0																
17	Metal	11		12	12	13																
18	Wood	0		0	0	4																
19	Other	0		116	74	61																
20																						
21	ea																					
22		1996	1997	1998	1999																	
23	Card/Pape	0		0	19	0																
24	Plastic	0		0	28	0																
25	Metal	57		57	230	56																
26	Wood	4		5	5	4																
27	Other	250		444	429	239																
28																						
29																						
30																						

	BB	BC	BD	BE	BF	BG	BH	BI	BJ	BK	BL	BM
1	Card Recycled											
2	1996	1997	1998	1999	1996	1997	1998	1999	1996	1997	1998	1999
3	SUM(BS2.BS55)/54	SUM(BT2.BT55)/54	SUM(BU2.BU55)/54	SUM(BV2.BV55)/54	SUM(BW2.BW55)/54	SUM(BX2.BX55)/54	SUM(BY2.BY55)/54	SUM(BZ2.BZ55)/54	SUM(CA2.CA55)/54	SUM(CB2.CB55)/54	SUM(CC2.CC55)/54	SUM(CD2.CD55)/54
4		303.74	482.17	585.70	534.59							
5	Card/Paper	61.64	154.42	183.92	163.64							
6	Plastic	49.31	71.61	80.35	71.69							
7	Metal	22.39	83.71	161.46	138.50							
8	Wood	9.88	43.74	109.32	106.07							
9	Other											
10	Card Recycled											
11	1996	1997	1998	1999	1996	1997	1998	1999	1996	1997	1998	1999
12	SUM(BS2.BS19)/18	SUM(BT2.BT19)/18	SUM(BU2.BU19)/18	SUM(BV2.BV19)/18	SUM(BW2.BW19)/18	SUM(BX2.BX19)/18	SUM(BY2.BY19)/18	SUM(BZ2.BZ19)/18	SUM(CA2.CA19)/18	SUM(CB2.CB19)/18	SUM(CC2.CC19)/18	SUM(CD2.CD19)/18
13		146	144	228	464							
14	Card/Paper	75	44	49	93							
15	Plastic	5	11	28	11							
16	Metal	235	2173	2242	2144							
17	Wood	35	33	29	29							
18	Other											
19	CS											
20	Card Handled											
21	1996	1997	1998	1999	1996	1997	1998	1999	1996	1997	1998	1999
22	SUM(BS2.BS55)/54	SUM(BT2.BT55)/54	SUM(BU2.BU55)/54	SUM(BV2.BV55)/54	SUM(BW2.BW55)/54	SUM(BX2.BX55)/54	SUM(BY2.BY55)/54	SUM(BZ2.BZ55)/54	SUM(CA2.CA55)/54	SUM(CB2.CB55)/54	SUM(CC2.CC55)/54	SUM(CD2.CD55)/54
23		304	482	588	535							
24	Card/Paper	62	154	184	164							
25	Plastic	49	72	80	72							
26	Metal	22	84	161	139							
27	Wood	10	44	109	106							
28	Other											
29	CS											
30	Card Handled											
31	1996	1997	1998	1999	1996	1997	1998	1999	1996	1997	1998	1999
32	SUM(BS2.BS19)/18	SUM(BT2.BT19)/18	SUM(BU2.BU19)/18	SUM(BV2.BV19)/18	SUM(BW2.BW19)/18	SUM(BX2.BX19)/18	SUM(BY2.BY19)/18	SUM(BZ2.BZ19)/18	SUM(CA2.CA19)/18	SUM(CB2.CB19)/18	SUM(CC2.CC19)/18	SUM(CD2.CD19)/18
33		146	144	228	464							
34	Card/Paper	75	44	49	93							
35	Plastic	5	11	28	11							
36	Metal	235	2173	2242	2144							
37	Wood	35	33	29	29							
38	Other											
39	CS											
40	Card Handled											
41	1996	1997	1998	1999	1996	1997	1998	1999	1996	1997	1998	1999
42	SUM(BS2.BS55)/54	SUM(BT2.BT55)/54	SUM(BU2.BU55)/54	SUM(BV2.BV55)/54	SUM(BW2.BW55)/54	SUM(BX2.BX55)/54	SUM(BY2.BY55)/54	SUM(BZ2.BZ55)/54	SUM(CA2.CA55)/54	SUM(CB2.CB55)/54	SUM(CC2.CC55)/54	SUM(CD2.CD55)/54
		304	482	588	535							
	Card/Paper	62	154	184	164							
	Plastic	49	72	80	72							
	Metal	22	84	161	139							
	Wood	10	44	109	106							
	Other											
	CS											
	Card Handled											
	1996	1997	1998	1999	1996	1997	1998	1999	1996	1997	1998	1999
	SUM(BS2.BS19)/18	SUM(BT2.BT19)/18	SUM(BU2.BU19)/18	SUM(BV2.BV19)/18	SUM(BW2.BW19)/18	SUM(BX2.BX19)/18	SUM(BY2.BY19)/18	SUM(BZ2.BZ19)/18	SUM(CA2.CA19)/18	SUM(CB2.CB19)/18	SUM(CC2.CC19)/18	SUM(CD2.CD19)/18
		146	144	228	464							
	Card/Paper	75	44	49	93							
	Plastic	5	11	28	11							
	Metal	235	2173	2242	2144							
	Wood	35	33	29	29							
	Other											
	CS											
	Card Handled											

	BV	BX	BY	BZ	CA	CB	CC	CD	CE	CF	CG
1	Recyclables	(Ave. for those that used recycle)									
2	1998	1997	1998	1998	1997	1998	1998	1998	1997	1998	1998
3	Collective Scheme	SUM(DJ2 D65)COUNTIF(D12:D65, ">0")	SUM(DK2 DK55)COUNTIF(F12:DK55, ">0")	SUM(DL2 DL19)COUNTIF(G12:DL19, ">0")	SUM(DR2 DR55)COUNTIF(J12:DR55, ">0")	SUM(DS2 DS55)COUNTIF(M12:DS55, ">0")	SUM(DT2 DT55)COUNTIF(P12:DT55, ">0")	SUM(DU2 DU55)COUNTIF(S12:DU55, ">0")	SUM(DV2 DV55)COUNTIF(V12:DV55, ">0")	SUM(DW2 DW55)COUNTIF(X12:DW55, ">0")	SUM(DX2 DX55)COUNTIF(Z12:DX55, ">0")
4	Environment Agency	SUM(DJ2 D19)COUNTIF(D12:D19, ">0")	SUM(DK2 DK19)COUNTIF(F12:DK19, ">0")	SUM(DL2 DL19)COUNTIF(G12:DL19, ">0")	SUM(DR2 DR19)COUNTIF(J12:DR19, ">0")	SUM(DS2 DS19)COUNTIF(M12:DS19, ">0")	SUM(DT2 DT19)COUNTIF(P12:DT19, ">0")	SUM(DU2 DU19)COUNTIF(S12:DU19, ">0")	SUM(DV2 DV19)COUNTIF(V12:DV19, ">0")	SUM(DW2 DW19)COUNTIF(X12:DW19, ">0")	SUM(DX2 DX19)COUNTIF(Z12:DX19, ">0")
5	Non-packaging Recycled	1998	1998	1998	1998	1998	1998	1998	1997	1998	1998
6	Card Recycled	SUM(DK2 DK65)COUNTIF(D12:DK65, ">0")	SUM(DL2 DL65)COUNTIF(F12:DL65, ">0")	SUM(DM2 DM65)COUNTIF(H12:DM65, ">0")	SUM(DN2 DN65)COUNTIF(J12:DN65, ">0")	SUM(DO2 DO65)COUNTIF(L12:DO65, ">0")	SUM(DP2 DP65)COUNTIF(N12:DP65, ">0")	SUM(DQ2 DQ65)COUNTIF(P12:DQ65, ">0")	SUM(DR2 DR65)COUNTIF(R12:DR65, ">0")	SUM(DS2 DS65)COUNTIF(T12:DS65, ">0")	SUM(DT2 DT65)COUNTIF(V12:DT65, ">0")
7	1998	1997	1998	1998	1997	1998	1998	1998	1997	1998	1998
8	CS	SUM(DJ2 CS)COUNTIF(D12:CS, ">0")	SUM(DK2 CS)COUNTIF(F12:CS, ">0")	SUM(DL2 CS)COUNTIF(G12:CS, ">0")	SUM(DM2 CS)COUNTIF(I12:CS, ">0")	SUM(DN2 CS)COUNTIF(K12:CS, ">0")	SUM(DO2 CS)COUNTIF(M12:CS, ">0")	SUM(DP2 CS)COUNTIF(O12:CS, ">0")	SUM(DQ2 CS)COUNTIF(Q12:CS, ">0")	SUM(DR2 CS)COUNTIF(S12:CS, ">0")	SUM(DS2 CS)COUNTIF(U12:CS, ">0")
9	Card Paper	1998	1998	1998	1998	1998	1998	1998	1997	1998	1998
10	Plastic	SUM(DJ2 DP)COUNTIF(D12:DP, ">0")	SUM(DK2 DP)COUNTIF(F12:DP, ">0")	SUM(DL2 DP)COUNTIF(G12:DP, ">0")	SUM(DM2 DP)COUNTIF(I12:DP, ">0")	SUM(DN2 DP)COUNTIF(K12:DP, ">0")	SUM(DO2 DP)COUNTIF(M12:DP, ">0")	SUM(DP2 DP)COUNTIF(O12:DP, ">0")	SUM(DQ2 DP)COUNTIF(Q12:DP, ">0")	SUM(DR2 DP)COUNTIF(S12:DP, ">0")	SUM(DS2 DP)COUNTIF(U12:DP, ">0")
11	Metal	1998	1998	1998	1998	1998	1998	1998	1997	1998	1998
12	Wood	SUM(DJ2 DW)COUNTIF(D12:DW, ">0")	SUM(DK2 DW)COUNTIF(F12:DW, ">0")	SUM(DL2 DW)COUNTIF(G12:DW, ">0")	SUM(DM2 DW)COUNTIF(I12:DW, ">0")	SUM(DN2 DW)COUNTIF(K12:DW, ">0")	SUM(DO2 DW)COUNTIF(M12:DW, ">0")	SUM(DP2 DW)COUNTIF(O12:DW, ">0")	SUM(DQ2 DW)COUNTIF(Q12:DW, ">0")	SUM(DR2 DW)COUNTIF(S12:DW, ">0")	SUM(DS2 DW)COUNTIF(U12:DW, ">0")
13	Other	1998	1998	1998	1998	1998	1998	1998	1997	1998	1998
14	Card Paper	SUM(DJ2 DP)COUNTIF(D12:DP, ">0")	SUM(DK2 DP)COUNTIF(F12:DP, ">0")	SUM(DL2 DP)COUNTIF(G12:DP, ">0")	SUM(DM2 DP)COUNTIF(I12:DP, ">0")	SUM(DN2 DP)COUNTIF(K12:DP, ">0")	SUM(DO2 DP)COUNTIF(M12:DP, ">0")	SUM(DP2 DP)COUNTIF(O12:DP, ">0")	SUM(DQ2 DP)COUNTIF(Q12:DP, ">0")	SUM(DR2 DP)COUNTIF(S12:DP, ">0")	SUM(DS2 DP)COUNTIF(U12:DP, ">0")
15	Plastic	1998	1998	1998	1998	1998	1998	1998	1997	1998	1998
16	Metal	SUM(DJ2 DW)COUNTIF(D12:DW, ">0")	SUM(DK2 DW)COUNTIF(F12:DW, ">0")	SUM(DL2 DW)COUNTIF(G12:DW, ">0")	SUM(DM2 DW)COUNTIF(I12:DW, ">0")	SUM(DN2 DW)COUNTIF(K12:DW, ">0")	SUM(DO2 DW)COUNTIF(M12:DW, ">0")	SUM(DP2 DW)COUNTIF(O12:DW, ">0")	SUM(DQ2 DW)COUNTIF(Q12:DW, ">0")	SUM(DR2 DW)COUNTIF(S12:DW, ">0")	SUM(DS2 DW)COUNTIF(U12:DW, ">0")
17	Wood	1998	1998	1998	1998	1998	1998	1998	1997	1998	1998
18	Other	SUM(DJ2 DP)COUNTIF(D12:DP, ">0")	SUM(DK2 DP)COUNTIF(F12:DP, ">0")	SUM(DL2 DP)COUNTIF(G12:DP, ">0")	SUM(DM2 DP)COUNTIF(I12:DP, ">0")	SUM(DN2 DP)COUNTIF(K12:DP, ">0")	SUM(DO2 DP)COUNTIF(M12:DP, ">0")	SUM(DP2 DP)COUNTIF(O12:DP, ">0")	SUM(DQ2 DP)COUNTIF(Q12:DP, ">0")	SUM(DR2 DP)COUNTIF(S12:DP, ">0")	SUM(DS2 DP)COUNTIF(U12:DP, ">0")
19	Card Paper	1998	1998	1998	1998	1998	1998	1998	1997	1998	1998
20	Plastic	SUM(DJ2 DW)COUNTIF(D12:DW, ">0")	SUM(DK2 DW)COUNTIF(F12:DW, ">0")	SUM(DL2 DW)COUNTIF(G12:DW, ">0")	SUM(DM2 DW)COUNTIF(I12:DW, ">0")	SUM(DN2 DW)COUNTIF(K12:DW, ">0")	SUM(DO2 DW)COUNTIF(M12:DW, ">0")	SUM(DP2 DW)COUNTIF(O12:DW, ">0")	SUM(DQ2 DW)COUNTIF(Q12:DW, ">0")	SUM(DR2 DW)COUNTIF(S12:DW, ">0")	SUM(DS2 DW)COUNTIF(U12:DW, ">0")
21	Metal	1998	1998	1998	1998	1998	1998	1998	1997	1998	1998
22	Wood	SUM(DJ2 DP)COUNTIF(D12:DP, ">0")	SUM(DK2 DP)COUNTIF(F12:DP, ">0")	SUM(DL2 DP)COUNTIF(G12:DP, ">0")	SUM(DM2 DP)COUNTIF(I12:DP, ">0")	SUM(DN2 DP)COUNTIF(K12:DP, ">0")	SUM(DO2 DP)COUNTIF(M12:DP, ">0")	SUM(DP2 DP)COUNTIF(O12:DP, ">0")	SUM(DQ2 DP)COUNTIF(Q12:DP, ">0")	SUM(DR2 DP)COUNTIF(S12:DP, ">0")	SUM(DS2 DP)COUNTIF(U12:DP, ">0")
23	Other	1998	1998	1998	1998	1998	1998	1998	1997	1998	1998
24	Card Paper	SUM(DJ2 DW)COUNTIF(D12:DW, ">0")	SUM(DK2 DW)COUNTIF(F12:DW, ">0")	SUM(DL2 DW)COUNTIF(G12:DW, ">0")	SUM(DM2 DW)COUNTIF(I12:DW, ">0")	SUM(DN2 DW)COUNTIF(K12:DW, ">0")	SUM(DO2 DW)COUNTIF(M12:DW, ">0")	SUM(DP2 DW)COUNTIF(O12:DW, ">0")	SUM(DQ2 DW)COUNTIF(Q12:DW, ">0")	SUM(DR2 DW)COUNTIF(S12:DW, ">0")	SUM(DS2 DW)COUNTIF(U12:DW, ">0")
25	Plastic	1998	1998	1998	1998	1998	1998	1998	1997	1998	1998
26	Metal	SUM(DJ2 DP)COUNTIF(D12:DP, ">0")	SUM(DK2 DP)COUNTIF(F12:DP, ">0")	SUM(DL2 DP)COUNTIF(G12:DP, ">0")	SUM(DM2 DP)COUNTIF(I12:DP, ">0")	SUM(DN2 DP)COUNTIF(K12:DP, ">0")	SUM(DO2 DP)COUNTIF(M12:DP, ">0")	SUM(DP2 DP)COUNTIF(O12:DP, ">0")	SUM(DQ2 DP)COUNTIF(Q12:DP, ">0")	SUM(DR2 DP)COUNTIF(S12:DP, ">0")	SUM(DS2 DP)COUNTIF(U12:DP, ">0")
27	Wood	1998	1998	1998	1998	1998	1998	1998	1997	1998	1998
28	Other	SUM(DJ2 DW)COUNTIF(D12:DW, ">0")	SUM(DK2 DW)COUNTIF(F12:DW, ">0")	SUM(DL2 DW)COUNTIF(G12:DW, ">0")	SUM(DM2 DW)COUNTIF(I12:DW, ">0")	SUM(DN2 DW)COUNTIF(K12:DW, ">0")	SUM(DO2 DW)COUNTIF(M12:DW, ">0")	SUM(DP2 DW)COUNTIF(O12:DW, ">0")	SUM(DQ2 DW)COUNTIF(Q12:DW, ">0")	SUM(DR2 DW)COUNTIF(S12:DW, ">0")	SUM(DS2 DW)COUNTIF(U12:DW, ">0")
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31											
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	CP	CQ	CR	CS	CT	CU	CV
1	CS		Energy Consumption Measures	Percentage	Energy Consumption Measures	Frequency	
2		Total (KWh)	Total (KWh)	2%	Total (KWh)	1	
3		Per unit space (KWh/ square footage)	Per unit space (KWh/ square footage)	6%	Per unit space (KWh/ square footage)	3	
4		Per unit production (KWh/ unit production)	Per unit production (KWh/ unit production)	7%	Per unit production (KWh/ unit production)	4	
5		Per unit space and per unit production	Per unit space and per unit production	4%	Per unit space and per unit production	2	
6		None	None	81%	None	44	
7			100% total	100%	None	54	
8	ea		Energy Consumption Measures	Percentage	Energy Consumption Measures	Frequency	
9		Total (KWh)	Total (KWh)	0%	Total (KWh)	0	
10		Per unit space (KWh/ square footage)	Per unit space (KWh/ square footage)	11%	Per unit space (KWh/ square footage)	2	
11		Per unit production (KWh/ unit production)	Per unit production (KWh/ unit production)	11%	Per unit production (KWh/ unit production)	2	
12		Per unit space and per unit production	Per unit space and per unit production	6%	Per unit space and per unit production	1	
13		None	None	72%	None	13	
14							18.00
15							
16							
17							
						100.00% Total	

	CP	CQ	CR	CS	CT	CU	CV
1	cs						
2		Energy Consumption Measures	Percentage	Energy Consumption Measures	Frequency		
3		Total (KWh)	CT2/CT\$7	Total (KWh)		1	
4		Per unit space (KWh/ square footage)	CT3/CT\$7	Per unit space (KWh/ square footage)		3	
5		Per unit production (KWh/ unit production)	CT4/CT\$7	Per unit production (KWh/ unit production)		4	
6		Per unit space and per unit production	CT5/CT\$7	Per unit space and per unit production		2	
7		None	CT6/CT\$7	None	54-SUM(CT2:CT5)		
8	ea	Energy Consumption Measures	SUM(CR2:CR6)	Energy Consumption Measures	SUM(CT2:CT6)		
9		Total (KWh)	Percentage	Total (KWh)	Frequency		
10		Per unit space (KWh/ square footage)	CT9/CT\$14	Per unit space (KWh/ square footage)		0	
11		Per unit production (KWh/ unit production)	CT10/CT\$14	Per unit production (KWh/ unit production)		2	
12		Per unit space and per unit production	CT11/CT\$14	Per unit space and per unit production		2	
13		None	CT12/CT\$14	None	18-SUM(CT9:CT12)		
14			CT13/CT\$14	SUM(CR9:CR13)	Total	1	
15							SUM(CT9:CT13)
16							
17							

	CW	CX	CY	CZ	DA	DB	DC	DD	DE	DF
1	Energy consumption	Total	Total	Per Unit Space				Per Unit Production		
2		1999/1998		1997/1996	1998/1997	1999/1998		1997/1996	1998/1997	1999/1998
3		0.00%		0.00%	0.00%	0.00%		0.00%	0.00%	0.00%
4		0.00%		0.00%	0.00%	1.54%		0.00%	0.00%	1.27%
5		0.00%		0.00%	0.00%	0.00%		0.00%	0.00%	0.00%
6		0.00%		0.00%	0.00%	0.00%		0.00%	0.00%	0.00%
7		0.00%		0.00%	0.00%	0.00%		0.00%	0.00%	0.00%
8		-20.32%		0.00%	0.00%	0.00%		0.00%	0.00%	0.00%
9		0.00%		0.00%	0.00%	0.00%		0.00%	0.00%	0.00%
10		0.00%		0.00%	0.00%	0.00%		0.00%	0.00%	0.00%
11		0.00%		0.00%	0.00%	0.00%		-11.54%	13.33%	-20.00%
12		0.00%		0.00%	0.00%	0.00%		0.00%	0.00%	0.00%
13		0.00%		0.00%	0.00%	0.00%		0.00%	0.00%	0.00%
14		0.00%		0.00%	0.00%	0.00%		0.00%	0.00%	0.00%
15		0.00%		0.00%	0.00%	0.00%		0.00%	0.00%	0.00%
16		0.00%		0.00%	0.00%	0.00%		0.00%	0.00%	0.00%
17		0.00%		0.00%	0.00%	0.00%		0.00%	0.00%	0.00%
18		0.00%		0.00%	0.00%	0.00%		0.00%	0.00%	0.00%
19		0.00%		0.00%	0.00%	0.00%		0.00%	0.00%	0.00%
20		0.00%		0.00%	0.00%	0.00%		0.00%	0.00%	0.00%
21		0.00%		0.00%	0.00%	0.00%		0.00%	0.00%	0.00%
22		0.00%		0.00%	0.00%	0.00%		0.00%	0.00%	0.00%
23		0.00%		-20.20%	11.44%	6.32%		0.00%	0.00%	0.00%
24		0.00%		0.00%	0.00%	0.00%		0.00%	0.00%	0.00%
25		0.00%		0.00%	0.00%	0.00%		0.00%	0.00%	0.00%
26		0.00%		0.00%	0.00%	0.00%		0.00%	0.00%	0.00%
27		0.00%		0.00%	0.00%	0.00%		0.00%	0.00%	0.00%
28		0.00%		0.00%	0.00%	0.00%		0.00%	0.00%	0.00%
29		0.00%		0.00%	0.00%	0.00%		0.00%	0.00%	0.00%
30		0.00%		0.00%	0.00%	0.00%		0.00%	0.00%	0.00%
31		0.00%		0.00%	0.00%	0.00%		0.00%	0.00%	0.00%
32		0.00%		0.00%	0.00%	0.00%		0.00%	0.00%	0.00%
33		0.00%		0.00%	0.00%	0.00%		0.00%	0.00%	0.00%
34		0.00%		0.00%	0.00%	0.00%		0.00%	0.00%	0.00%
35		0.00%		0.00%	0.00%	0.00%		0.00%	0.00%	0.00%
36		0.00%		0.00%	0.00%	0.00%		0.00%	0.00%	0.00%
37		0.00%		0.00%	0.00%	0.00%		0.00%	0.00%	0.00%
38		0.00%		0.00%	0.00%	0.00%		0.00%	0.00%	0.00%
39		0.00%		0.00%	0.00%	0.00%		0.00%	0.00%	0.00%
40		0.00%		0.00%	0.00%	0.00%		0.00%	0.00%	0.00%
41		0.00%		0.00%	0.00%	0.00%		0.00%	0.00%	0.00%
42		0.00%		0.00%	0.00%	0.00%		0.00%	0.00%	0.00%
43		0.00%		0.00%	0.00%	0.00%		0.00%	0.00%	0.00%
44		0.00%		0.00%	0.00%	0.00%		0.00%	0.00%	0.00%
45		0.00%		0.00%	0.00%	0.00%		0.00%	4.23%	-6.48%
46		0.00%		0.00%	0.00%	0.00%		0.00%	0.00%	0.00%
47		0.00%		0.00%	0.00%	0.00%		0.00%	0.00%	0.00%
48		0.00%		0.00%	0.00%	0.00%		-4.40%	5.00%	2.50%
49		0.00%		0.00%	0.00%	0.00%		0.00%	0.00%	0.00%
50		0.00%		0.00%	0.00%	0.00%		0.00%	0.00%	0.00%
51		0.00%		-2.39%	-0.98%	-15.77%		0.00%	0.00%	0.00%
52		0.00%		0.00%	0.00%	5.62%		11.22%	31.20%	37.58%
53		0.00%		0.00%	0.00%	0.00%		0.00%	0.00%	0.00%
54		0.00%		0.00%	0.00%	0.00%		0.00%	0.00%	0.00%
55		0.00%		0.00%	0.00%	0.00%		0.00%	0.00%	0.00%
56		0.00%		0.00%	0.00%	-1.30%		0.00%	0.00%	0.00%
57		0.00%		0.00%	0.00%	0.00%		0.00%	0.00%	0.00%
58		0%		0%	-11%	5%		0.00%	0.00%	0.00%
59		coll						0%	-2%	13%
60		Average Percentage Change in Energy Consumption								
61			1997/1996	1998/1997	1999/1998					
62		Total			-20%					
63		Per Unit Sp	-11%	5%	-1%					
64		Per Unit Pn	-2%	13%	3%					
65		ea								
66		Average Percentage Change in Energy Consumption								
67			1997/1996	1998/1997	1999/1998					
68		Total			0%					
69		Per Unit Sp	-280%	30%	-12%					
70		Per Unit Pn	104%	119%	160%					
71		Energy con Total								
72			Per Unit Space				Per Unit Production			
73		1999/1998	1997/1996	1998/1997	1999/1998	1997/1996	1998/1997	1999/1998		
74		0.00%	6.58%	-0.10%	0.20%	0.00%	0.00%	0.00%		
75		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%		
76		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%		
77		0.00%	-2.39%	-0.98%	-15.77%	0.00%	0.00%	0.00%		
78		0.00%	0.00%	0.00%	0.00%	112.63%	145.34%	160.21%		
79		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%		
80		0.00%	-84.15%	89.64%	-21.61%	0.00%	0.00%	0.00%		
81		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%		
82		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%		
83		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%		
84		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%		
85		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%		
86		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%		
87		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%		
88		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%		
89		0.00%	0.00%	0.00%	0.00%	96.00%	91.67%	0.00%		
90		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%		
91		0%	-280%	30%	-12%	104%	119%	160%		



	CW	CX	CY	CZ	DA
1	Energy consumption	Total	Total	Per Unit Space	
2		1997/1998		1997/1998	1998/1997
3		IF(EM20,0,(EM2-EL2)YEM2)		IF(E020,0,(E02-EN2)YEO2)	IF(EP20,0,(EP2-E02)YEP2)
4		IF(EM30,0,(EM3-EL3)YEM3)		IF(E030,0,(E03-EN3)YEO3)	
5		IF(EM40,0,(EM4-EL4)YEM4)		IF(E040,0,(E04-EN4)YEO4)	0.00%
6			0.00%	IF(E050,0,(E05-EN5)YEO5)	IF(EP40,0,(EP4-E04)YEP4)
7		IF(EM60,0,(EM6-EL6)YEM6)		IF(E060,0,(E06-EN6)YEO6)	IF(EP50,0,(EP5-E05)YEP5)
8		IF(EM70,0,(EM7-EL7)YEM7)		IF(E070,0,(E07-EN7)YEO7)	IF(EP60,0,(EP6-E06)YEP6)
9		IF(EM80,0,(EM8-EL8)YEM8)		IF(E080,0,(E08-EN8)YEO8)	IF(EP70,0,(EP7-E07)YEP7)
10		IF(EM90,0,(EM9-EL9)YEM9)		IF(E090,0,(E09-EN9)YEO9)	IF(EP80,0,(EP8-E08)YEP8)
11		IF(EM100,0,(EM10-EL10)YEM10)		IF(E0100,0,(E010-EN10)YEO10)	IF(EP90,0,(EP9-E09)YEP9)
12		IF(EM110,0,(EM11-EL11)YEM11)		IF(E0110,0,(E011-EN11)YEO11)	IF(EP100,0,(EP10-E010)YEP10)
13		IF(EM120,0,(EM12-EL12)YEM12)		IF(E0120,0,(E012-EN12)YEO12)	IF(EP110,0,(EP11-E011)YEP11)
14		IF(EM130,0,(EM13-EL13)YEM13)		IF(E0130,0,(E013-EN13)YEO13)	IF(EP120,0,(EP12-E012)YEP12)
15		IF(EM140,0,(EM14-EL14)YEM14)		IF(E0140,0,(E014-EN14)YEO14)	IF(EP130,0,(EP13-E013)YEP13)
16		IF(EM150,0,(EM15-EL15)YEM15)		IF(E0150,0,(E015-EN15)YEO15)	IF(EP140,0,(EP14-E014)YEP14)
17		IF(EM160,0,(EM16-EL16)YEM16)		IF(E0160,0,(E016-EN16)YEO16)	IF(EP150,0,(EP15-E015)YEP15)
18		IF(EM170,0,(EM17-EL17)YEM17)		IF(E0170,0,(E017-EN17)YEO17)	IF(EP160,0,(EP16-E016)YEP16)
19		IF(EM180,0,(EM18-EL18)YEM18)		IF(E0180,0,(E018-EN18)YEO18)	IF(EP170,0,(EP17-E017)YEP17)
20		IF(EM190,0,(EM19-EL19)YEM19)		IF(E0190,0,(E019-EN19)YEO19)	IF(EP180,0,(EP18-E018)YEP18)
21		IF(EM200,0,(EM20-EL20)YEM20)		IF(E0200,0,(E020-EN20)YEO20)	IF(EP190,0,(EP19-E019)YEP19)
22		IF(EM210,0,(EM21-EL21)YEM21)		IF(E0210,0,(E021-EN21)YEO21)	IF(EP200,0,(EP20-E020)YEP20)
23		IF(EM220,0,(EM22-EL22)YEM22)		IF(E0220,0,(E022-EN22)YEO22)	IF(EP210,0,(EP21-E021)YEP21)
24		IF(EM230,0,(EM23-EL23)YEM23)		IF(E0230,0,(E023-EN23)YEO23)	IF(EP220,0,(EP22-E022)YEP22)
25		IF(EM240,0,(EM24-EL24)YEM24)		IF(E0240,0,(E024-EN24)YEO24)	IF(EP230,0,(EP23-E023)YEP23)
26		IF(EM250,0,(EM25-EL25)YEM25)		IF(E0250,0,(E025-EN25)YEO25)	IF(EP240,0,(EP24-E024)YEP24)
27		IF(EM260,0,(EM26-EL26)YEM26)		IF(E0260,0,(E026-EN26)YEO26)	IF(EP250,0,(EP25-E025)YEP25)
28		IF(EM270,0,(EM27-EL27)YEM27)		IF(E0270,0,(E027-EN27)YEO27)	IF(EP260,0,(EP26-E026)YEP26)
29		IF(EM280,0,(EM28-EL28)YEM28)		IF(E0280,0,(E028-EN28)YEO28)	IF(EP270,0,(EP27-E027)YEP27)
30		IF(EM290,0,(EM29-EL29)YEM29)		IF(E0290,0,(E029-EN29)YEO29)	IF(EP280,0,(EP28-E028)YEP28)
31		IF(EM300,0,(EM30-EL30)YEM30)		IF(E0300,0,(E030-EN30)YEO30)	IF(EP290,0,(EP29-E029)YEP29)
32		IF(EM310,0,(EM31-EL31)YEM31)		IF(E0310,0,(E031-EN31)YEO31)	IF(EP300,0,(EP30-E030)YEP30)
33		IF(EM320,0,(EM32-EL32)YEM32)		IF(E0320,0,(E032-EN32)YEO32)	IF(EP310,0,(EP31-E031)YEP31)
34		IF(EM330,0,(EM33-EL33)YEM33)		IF(E0330,0,(E033-EN33)YEO33)	IF(EP320,0,(EP32-E032)YEP32)
35		IF(EM340,0,(EM34-EL34)YEM34)		IF(E0340,0,(E034-EN34)YEO34)	IF(EP330,0,(EP33-E033)YEP33)
36		IF(EM350,0,(EM35-EL35)YEM35)		IF(E0350,0,(E035-EN35)YEO35)	IF(EP340,0,(EP34-E034)YEP34)
37		IF(EM360,0,(EM36-EL36)YEM36)		IF(E0360,0,(E036-EN36)YEO36)	IF(EP350,0,(EP35-E035)YEP35)
38		IF(EM370,0,(EM37-EL37)YEM37)		IF(E0370,0,(E037-EN37)YEO37)	IF(EP360,0,(EP36-E036)YEP36)
39		IF(EM380,0,(EM38-EL38)YEM38)		IF(E0380,0,(E038-EN38)YEO38)	IF(EP370,0,(EP37-E037)YEP37)
40		IF(EM390,0,(EM39-EL39)YEM39)		IF(E0390,0,(E039-EN39)YEO39)	IF(EP380,0,(EP38-E038)YEP38)
41		IF(EM400,0,(EM40-EL40)YEM40)		IF(E0400,0,(E040-EN40)YEO40)	IF(EP390,0,(EP39-E039)YEP39)
42		IF(EM410,0,(EM41-EL41)YEM41)		IF(E0410,0,(E041-EN41)YEO41)	IF(EP400,0,(EP40-E040)YEP40)
43		IF(EM420,0,(EM42-EL42)YEM42)		IF(E0420,0,(E042-EN42)YEO42)	IF(EP410,0,(EP41-E041)YEP41)
44		IF(EM430,0,(EM43-EL43)YEM43)		IF(E0430,0,(E043-EN43)YEO43)	IF(EP420,0,(EP42-E042)YEP42)
45		IF(EM440,0,(EM44-EL44)YEM44)		IF(E0440,0,(E044-EN44)YEO44)	IF(EP430,0,(EP43-E043)YEP43)
46		IF(EM450,0,(EM45-EL45)YEM45)		IF(E0450,0,(E045-EN45)YEO45)	IF(EP440,0,(EP44-E044)YEP44)
47		IF(EM460,0,(EM46-EL46)YEM46)		IF(E0460,0,(E046-EN46)YEO46)	IF(EP450,0,(EP45-E045)YEP45)
48		IF(EM470,0,(EM47-EL47)YEM47)		IF(E0470,0,(E047-EN47)YEO47)	IF(EP460,0,(EP46-E046)YEP46)
49		IF(EM480,0,(EM48-EL48)YEM48)		IF(E0480,0,(E048-EN48)YEO48)	IF(EP470,0,(EP47-E047)YEP47)
50		IF(EM490,0,(EM49-EL49)YEM49)		IF(E0490,0,(E049-EN49)YEO49)	IF(EP480,0,(EP48-E048)YEP48)
51		IF(EM500,0,(EM50-EL50)YEM50)		IF(E0500,0,(E050-EN50)YEO50)	IF(EP490,0,(EP49-E049)YEP49)
52		IF(EM510,0,(EM51-EL51)YEM51)		IF(E0510,0,(E051-EN51)YEO51)	
53		IF(EM520,0,(EM52-EL52)YEM52)		IF(E0520,0,(E052-EN52)YEO52)	IF(EP510,0,(EP51-E051)YEP51)
54		IF(EM530,0,(EM53-EL53)YEM53)		IF(E0530,0,(E053-EN53)YEO53)	IF(EP520,0,(EP52-E052)YEP52)
55		IF(EM540,0,(EM54-EL54)YEM54)		IF(E0540,0,(E054-EN54)YEO54)	IF(EP530,0,(EP53-E053)YEP53)
56		IF(EM550,0,(EM55-EL55)YEM55)		IF(E0550,0,(E055-EN55)YEO55)	
57		SUM(CW3,CW56)Y1		SUM(CY3,CY56)Y2	IF(EP550,0,(EP55-E055)YEP55)
58		col			SUM(CZ3,CZ56)YCOUNTIF(CZ3,CZ56,"<>0")
59		Average Percentage Change in Energy Consumption			
60			1997/1998	1998/1997	1999/1998
61		Total			
62		Per Unit Space	-11%		-20%
63		Per Unit Production	-2%		-1%
64				5%	13%
65					3%
66					
67		Average Percentage Change in Energy Consumption			
68			1997/1998	1998/1997	1999/1998
69		Total			
70		Per Unit Space	-280%		0%
71		Per Unit Production	104%		-12%
72		Energy consumption			119%
73		1997/1998	Total	Per Unit Space	1998/1997
74		IF(EM20,0,(EM2-EL2)YEM2)		IF(E020,0,(E02-EN2)YEO2)	IF(EP20,0,(EP2-E02)YEP2)
75		IF(EM30,0,(EM3-EL3)YEM3)		IF(E030,0,(E03-EN3)YEO3)	IF(EP30,0,(EP3-E03)YEP3)
76		IF(EM40,0,(EM4-EL4)YEM4)		IF(E040,0,(E04-EN4)YEO4)	IF(EP40,0,(EP4-E04)YEP4)
77		IF(EM50,0,(EM5-EL5)YEM5)		IF(E050,0,(E05-EN5)YEO5)	IF(EP50,0,(EP5-E05)YEP5)
78		IF(EM60,0,(EM6-EL6)YEM6)		IF(E060,0,(E06-EN6)YEO6)	IF(EP60,0,(EP6-E06)YEP6)
79		IF(EM70,0,(EM7-EL7)YEM7)		IF(E070,0,(E07-EN7)YEO7)	IF(EP70,0,(EP7-E07)YEP7)
80		IF(EM80,0,(EM8-EL8)YEM8)		IF(E080,0,(E08-EN8)YEO8)	IF(EP80,0,(EP8-E08)YEP8)
81		IF(EM90,0,(EM9-EL9)YEM9)		IF(E090,0,(E09-EN9)YEO9)	IF(EP90,0,(EP9-E09)YEP9)
82		IF(EM100,0,(EM10-EL10)YEM10)		IF(E0100,0,(E010-EN10)YEO10)	IF(EP100,0,(EP10-E010)YEP10)
83		IF(EM110,0,(EM11-EL11)YEM11)		IF(E0110,0,(E011-EN11)YEO11)	IF(EP110,0,(EP11-E011)YEP11)
84		IF(EM120,0,(EM12-EL12)YEM12)		IF(E0120,0,(E012-EN12)YEO12)	IF(EP120,0,(EP12-E012)YEP12)
85		IF(EM130,0,(EM13-EL13)YEM13)		IF(E0130,0,(E013-EN13)YEO13)	IF(EP130,0,(EP13-E013)YEP13)
86		IF(EM140,0,(EM14-EL14)YEM14)		IF(E0140,0,(E014-EN14)YEO14)	IF(EP140,0,(EP14-E014)YEP14)
87		IF(EM150,0,(EM15-EL15)YEM15)		IF(E0150,0,(E015-EN15)YEO15)	IF(EP150,0,(EP15-E015)YEP15)
88		IF(EM160,0,(EM16-EL16)YEM16)		IF(E0160,0,(E016-EN16)YEO16)	IF(EP160,0,(EP16-E016)YEP16)
89		IF(EM170,0,(EM17-EL17)YEM17)		IF(E0170,0,(E017-EN17)YEO17)	IF(EP170,0,(EP17-E017)YEP17)
90		IF(EM180,0,(EM18-EL18)YEM18)		IF(E0180,0,(E018-EN18)YEO18)	IF(EP180,0,(EP18-E018)YEP18)
91		IF(EM190,0,(EM19-EL19)YEM19)		IF(E0190,0,(E019-EN19)YEO19)	IF(EP190,0,(EP19-E019)YEP19)
			SUM(CY73,CY90)YCOUNTIF(CY73,CY90,"<>0")		SUM(CZ73,CZ90)YCOUNTIF(CZ73,CZ90,"<>0")

	DB	DC	DD	DE	DF
1			Per Unit Production		
2	1999/1998		1997/1998	1998/1997	1999/1998
3	IF(EQ20,0,(EQ2-EP2)EQ2)		IF(ES20,0,(ES2-ER2)YES2)	IF(ET20,0,(ET2-ES2)YET2)	IF(EU20,0,(EU2-ET2)YEU2)
4	IF(EQ30,0,(EQ3-EP3)EQ3)		IF(ES30,0,(ES3-ER3)YES3)		IF(EU30,0,(EU3-ET3)YEU3)
5	IF(EQ40,0,(EQ4-EP4)EQ4)		IF(ES40,0,(ES4-ER4)YES4)		IF(EU40,0,(EU4-ET4)YEU4)
6	IF(EQ50,0,(EQ5-EP5)EQ5)		IF(ES50,0,(ES5-ER5)YES5)		IF(EU50,0,(EU5-ET5)YEU5)
7	IF(EQ60,0,(EQ6-EP6)EQ6)		IF(ES60,0,(ES6-ER6)YES6)		IF(EU60,0,(EU6-ET6)YEU6)
8	IF(EQ70,0,(EQ7-EP7)EQ7)		IF(ES70,0,(ES7-ER7)YES7)		IF(EU70,0,(EU7-ET7)YEU7)
9	IF(EQ80,0,(EQ8-EP8)EQ8)		IF(ES80,0,(ES8-ER8)YES8)		IF(EU80,0,(EU8-ET8)YEU8)
10	IF(EQ90,0,(EQ9-EP9)EQ9)		IF(ES90,0,(ES9-ER9)YES9)		IF(EU90,0,(EU9-ET9)YEU9)
11	IF(EQ100,0,(EQ10-EP10)EQ10)		IF(ES100,0,(ES10-ER10)YES10)		IF(EU100,0,(EU10-ET10)YEU10)
12	IF(EQ110,0,(EQ11-EP11)EQ11)		IF(ES110,0,(ES11-ER11)YES11)		IF(EU110,0,(EU11-ET11)YEU11)
13	IF(EQ120,0,(EQ12-EP12)EQ12)		IF(ES120,0,(ES12-ER12)YES12)		IF(EU120,0,(EU12-ET12)YEU12)
14	IF(EQ130,0,(EQ13-EP13)EQ13)		IF(ES130,0,(ES13-ER13)YES13)		IF(EU130,0,(EU13-ET13)YEU13)
15	IF(EQ140,0,(EQ14-EP14)EQ14)		IF(ES140,0,(ES14-ER14)YES14)		IF(EU140,0,(EU14-ET14)YEU14)
16	IF(EQ150,0,(EQ15-EP15)EQ15)		IF(ES150,0,(ES15-ER15)YES15)		IF(EU150,0,(EU15-ET15)YEU15)
17	IF(EQ160,0,(EQ16-EP16)EQ16)		IF(ES160,0,(ES16-ER16)YES16)		IF(EU160,0,(EU16-ET16)YEU16)
18	IF(EQ170,0,(EQ17-EP17)EQ17)		IF(ES170,0,(ES17-ER17)YES17)		IF(EU170,0,(EU17-ET17)YEU17)
19	IF(EQ180,0,(EQ18-EP18)EQ18)		IF(ES180,0,(ES18-ER18)YES18)		IF(EU180,0,(EU18-ET18)YEU18)
20	IF(EQ190,0,(EQ19-EP19)EQ19)		IF(ES190,0,(ES19-ER19)YES19)		IF(EU190,0,(EU19-ET19)YEU19)
21	IF(EQ200,0,(EQ20-EP20)EQ20)		IF(ES200,0,(ES20-ER20)YES20)		IF(EU200,0,(EU20-ET20)YEU20)
22	IF(EQ210,0,(EQ21-EP21)EQ21)		IF(ES210,0,(ES21-ER21)YES21)		IF(EU210,0,(EU21-ET21)YEU21)
23	IF(EQ220,0,(EQ22-EP22)EQ22)		IF(ES220,0,(ES22-ER22)YES22)		IF(EU220,0,(EU22-ET22)YEU22)
24	IF(EQ230,0,(EQ23-EP23)EQ23)		IF(ES230,0,(ES23-ER23)YES23)		IF(EU230,0,(EU23-ET23)YEU23)
25	IF(EQ240,0,(EQ24-EP24)EQ24)		IF(ES240,0,(ES24-ER24)YES24)		IF(EU240,0,(EU24-ET24)YEU24)
26	IF(EQ250,0,(EQ25-EP25)EQ25)		IF(ES250,0,(ES25-ER25)YES25)		IF(EU250,0,(EU25-ET25)YEU25)
27	IF(EQ260,0,(EQ26-EP26)EQ26)		IF(ES260,0,(ES26-ER26)YES26)		IF(EU260,0,(EU26-ET26)YEU26)
28	IF(EQ270,0,(EQ27-EP27)EQ27)		IF(ES270,0,(ES27-ER27)YES27)		IF(EU270,0,(EU27-ET27)YEU27)
29	IF(EQ280,0,(EQ28-EP28)EQ28)		IF(ES280,0,(ES28-ER28)YES28)		IF(EU280,0,(EU28-ET28)YEU28)
30	IF(EQ290,0,(EQ29-EP29)EQ29)		IF(ES290,0,(ES29-ER29)YES29)		IF(EU290,0,(EU29-ET29)YEU29)
31	IF(EQ300,0,(EQ30-EP30)EQ30)		IF(ES300,0,(ES30-ER30)YES30)		IF(EU300,0,(EU30-ET30)YEU30)
32	IF(EQ310,0,(EQ31-EP31)EQ31)		IF(ES310,0,(ES31-ER31)YES31)		IF(EU310,0,(EU31-ET31)YEU31)
33	IF(EQ320,0,(EQ32-EP32)EQ32)		IF(ES320,0,(ES32-ER32)YES32)		IF(EU320,0,(EU32-ET32)YEU32)
34	IF(EQ330,0,(EQ33-EP33)EQ33)		IF(ES330,0,(ES33-ER33)YES33)		IF(EU330,0,(EU33-ET33)YEU33)
35	IF(EQ340,0,(EQ34-EP34)EQ34)		IF(ES340,0,(ES34-ER34)YES34)		IF(EU340,0,(EU34-ET34)YEU34)
36	IF(EQ350,0,(EQ35-EP35)EQ35)		IF(ES350,0,(ES35-ER35)YES35)		IF(EU350,0,(EU35-ET35)YEU35)
37	IF(EQ360,0,(EQ36-EP36)EQ36)		IF(ES360,0,(ES36-ER36)YES36)		IF(EU360,0,(EU36-ET36)YEU36)
38	IF(EQ370,0,(EQ37-EP37)EQ37)		IF(ES370,0,(ES37-ER37)YES37)		IF(EU370,0,(EU37-ET37)YEU37)
39	IF(EQ380,0,(EQ38-EP38)EQ38)		IF(ES380,0,(ES38-ER38)YES38)		IF(EU380,0,(EU38-ET38)YEU38)
40	IF(EQ390,0,(EQ39-EP39)EQ39)		IF(ES390,0,(ES39-ER39)YES39)		IF(EU390,0,(EU39-ET39)YEU39)
41	IF(EQ400,0,(EQ40-EP40)EQ40)		IF(ES400,0,(ES40-ER40)YES40)		IF(EU400,0,(EU40-ET40)YEU40)
42	IF(EQ410,0,(EQ41-EP41)EQ41)		IF(ES410,0,(ES41-ER41)YES41)		IF(EU410,0,(EU41-ET41)YEU41)
43	IF(EQ420,0,(EQ42-EP42)EQ42)		IF(ES420,0,(ES42-ER42)YES42)		IF(EU420,0,(EU42-ET42)YEU42)
44	IF(EQ430,0,(EQ43-EP43)EQ43)		IF(ES430,0,(ES43-ER43)YES43)		IF(EU430,0,(EU43-ET43)YEU43)
45	IF(EQ440,0,(EQ44-EP44)EQ44)		IF(ES440,0,(ES44-ER44)YES44)		IF(EU440,0,(EU44-ET44)YEU44)
46	IF(EQ450,0,(EQ45-EP45)EQ45)		IF(ES450,0,(ES45-ER45)YES45)		IF(EU450,0,(EU45-ET45)YEU45)
47	IF(EQ460,0,(EQ46-EP46)EQ46)		IF(ES460,0,(ES46-ER46)YES46)		IF(EU460,0,(EU46-ET46)YEU46)
48	IF(EQ470,0,(EQ47-EP47)EQ47)		IF(ES470,0,(ES47-ER47)YES47)		IF(EU470,0,(EU47-ET47)YEU47)
49	IF(EQ480,0,(EQ48-EP48)EQ48)		IF(ES480,0,(ES48-ER48)YES48)		IF(EU480,0,(EU48-ET48)YEU48)
50	IF(EQ490,0,(EQ49-EP49)EQ49)		IF(ES490,0,(ES49-ER49)YES49)		IF(EU490,0,(EU49-ET49)YEU49)
51	IF(EQ500,0,(EQ50-EP50)EQ50)		IF(ES500,0,(ES50-ER50)YES50)		IF(EU500,0,(EU50-ET50)YEU50)
52	IF(EQ510,0,(EQ51-EP51)EQ51)		IF(ES510,0,(ES51-ER51)YES51)		IF(EU510,0,(EU51-ET51)YEU51)
53	IF(EQ520,0,(EQ52-EP52)EQ52)		IF(ES520,0,(ES52-ER52)YES52)		IF(EU520,0,(EU52-ET52)YEU52)
54	IF(EQ530,0,(EQ53-EP53)EQ53)		IF(ES530,0,(ES53-ER53)YES53)		IF(EU530,0,(EU53-ET53)YEU53)
55	IF(EQ540,0,(EQ54-EP54)EQ54)		IF(ES540,0,(ES54-ER54)YES54)		IF(EU540,0,(EU54-ET54)YEU54)
56	IF(EQ550,0,(EQ55-EP55)EQ55)		IF(ES550,0,(ES55-ER55)YES55)		IF(EU550,0,(EU55-ET55)YEU55)
57	SUM(DA3:DA56)/COUNTIF(DA3:DA56,"<0")		SUM(DC3:DC56)/COUNTIF(DC3:DC56,"<0")		SUM(DE3:DE56)/COUNTIF(DE3:DE56,"<0")
58					
59					
60					
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65					
66					
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68					
69					
70					
71					
72	1999/1998		Per Unit Production		
73	IF(EQ20,0,(EQ2-EP2)EQ2)		1997/1998	1998/1997	1999/1998
74	IF(EQ30,0,(EQ3-EP3)EQ3)		IF(ER20,0,(ER2)ER2)	IF(ES20,0,(ET2)ES2)	IF(ET20,0,(EU2)ET2)
75	IF(EQ40,0,(EQ4-EP4)EQ4)		IF(ER30,0,(ER3)ER3)	IF(ES30,0,(ET3)ES3)	IF(ET30,0,(EU3)ET3)
76	IF(EQ50,0,(EQ5-EP5)EQ5)		IF(ER40,0,(ER4)ER4)	IF(ES40,0,(ET4)ES4)	IF(ET40,0,(EU4)ET4)
77	IF(EQ60,0,(EQ6-EP6)EQ6)		IF(ER50,0,(ER5)ER5)	IF(ES50,0,(ET5)ES5)	IF(ET50,0,(EU5)ET5)
78	IF(EQ70,0,(EQ7-EP7)EQ7)		IF(ER60,0,(ER6)ER6)	IF(ES60,0,(ET6)ES6)	IF(ET60,0,(EU6)ET6)
79	IF(EQ80,0,(EQ8-EP8)EQ8)		IF(ER70,0,(ER7)ER7)	IF(ES70,0,(ET7)ES7)	IF(ET70,0,(EU7)ET7)
80	IF(EQ90,0,(EQ9-EP9)EQ9)		IF(ER80,0,(ER8)ER8)	IF(ES80,0,(ET8)ES8)	IF(ET80,0,(EU8)ET8)
81	IF(EQ100,0,(EQ10-EP10)EQ10)		IF(ER90,0,(ER9)ER9)	IF(ES90,0,(ET9)ES9)	IF(ET90,0,(EU9)ET9)
82	IF(EQ110,0,(EQ11-EP11)EQ11)		IF(ER100,0,(ER10)ER10)	IF(ES100,0,(ET10)ES10)	IF(ET100,0,(EU10)ET10)
83	IF(EQ120,0,(EQ12-EP12)EQ12)		IF(ER110,0,(ER11)ER11)	IF(ES110,0,(ET11)ES11)	IF(ET110,0,(EU11)ET11)
84	IF(EQ130,0,(EQ13-EP13)EQ13)		IF(ER120,0,(ER12)ER12)	IF(ES120,0,(ET12)ES12)	IF(ET120,0,(EU12)ET12)
85	IF(EQ140,0,(EQ14-EP14)EQ14)		IF(ER130,0,(ER13)ER13)	IF(ES130,0,(ET13)ES13)	IF(ET130,0,(EU13)ET13)
86	IF(EQ150,0,(EQ15-EP15)EQ15)		IF(ER140,0,(ER14)ER14)	IF(ES140,0,(ET14)ES14)	IF(ET140,0,(EU14)ET14)
87	IF(EQ160,0,(EQ16-EP16)EQ16)		IF(ER150,0,(ER15)ER15)	IF(ES150,0,(ET15)ES15)	IF(ET150,0,(EU15)ET15)
88	IF(EQ170,0,(EQ17-EP17)EQ17)		IF(ER160,0,(ER16)ER16)	IF(ES160,0,(ET16)ES16)	IF(ET160,0,(EU16)ET16)
89	IF(EQ180,0,(EQ18-EP18)EQ18)		IF(ER170,0,(ER17)ER17)	IF(ES170,0,(ET17)ES17)	IF(ET170,0,(EU17)ET17)
90	IF(EQ190,0,(EQ19-EP19)EQ19)		IF(ER180,0,(ER18)ER18)	IF(ES180,0,(ET18)ES18)	IF(ET180,0,(EU18)ET18)
91	SUM(DA73:DA90)/COUNTIF(DA73:DA90,"<0")		SUM(DC73:DC90)/COUNTIF(DC73:DC90,"<0")		SUM(DE73:DE90)/COUNTIF(DE73:DE90,"<0")





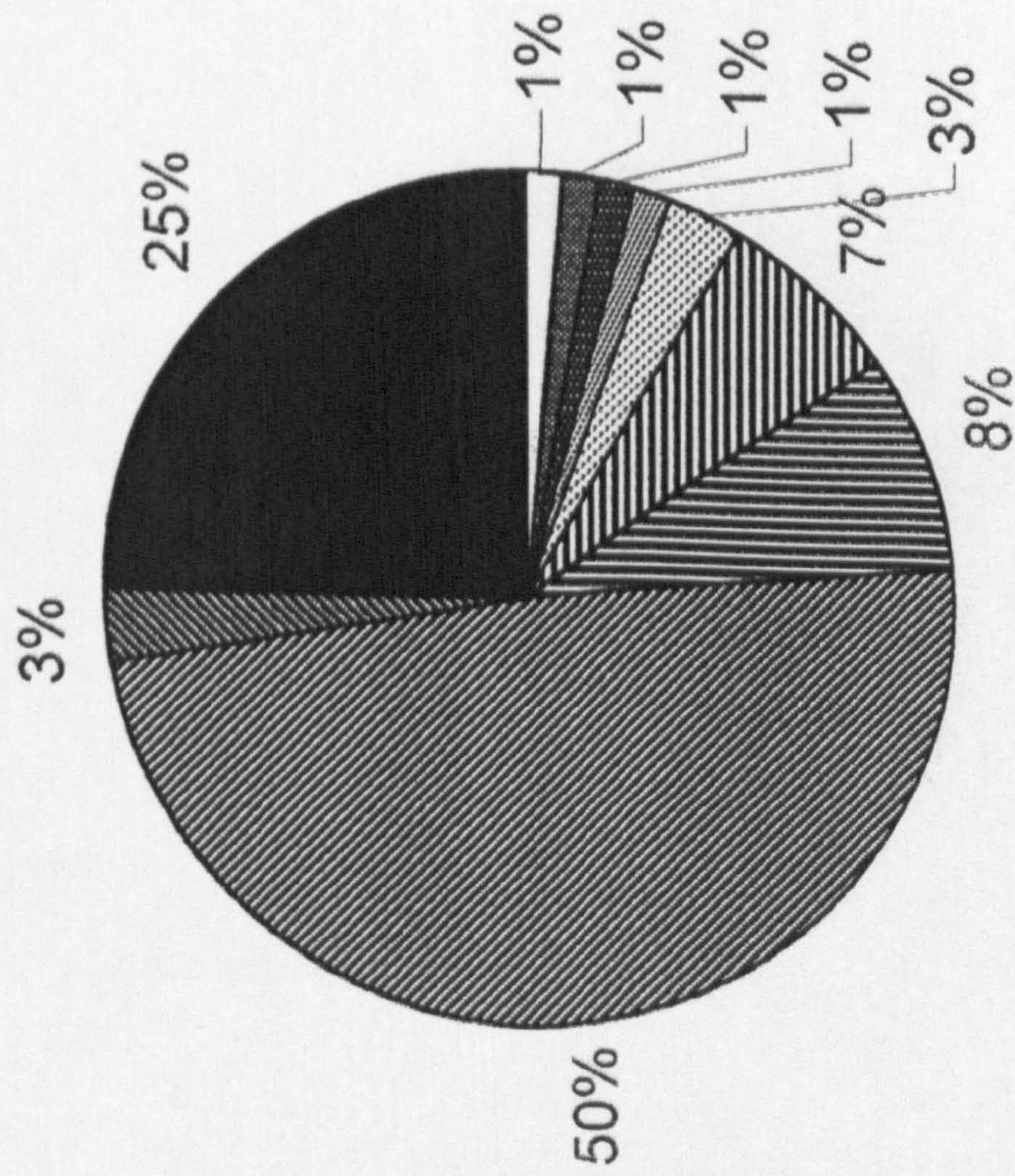
**Annex 3**

**Appendix 3**

**Graphical Representations of Survey Results and Non-parametric Test Data**

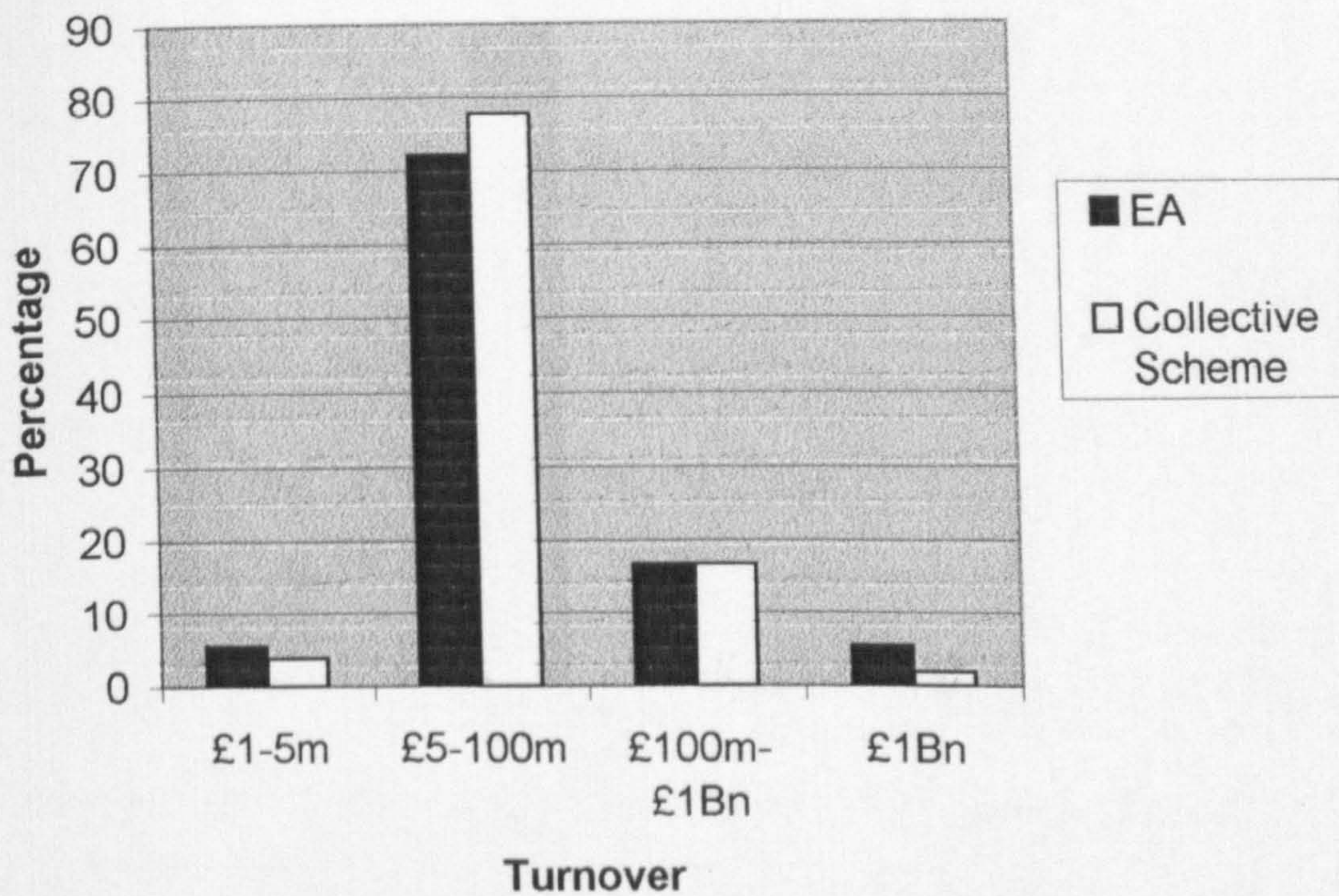


# Breakdown of Respondents' Registrations

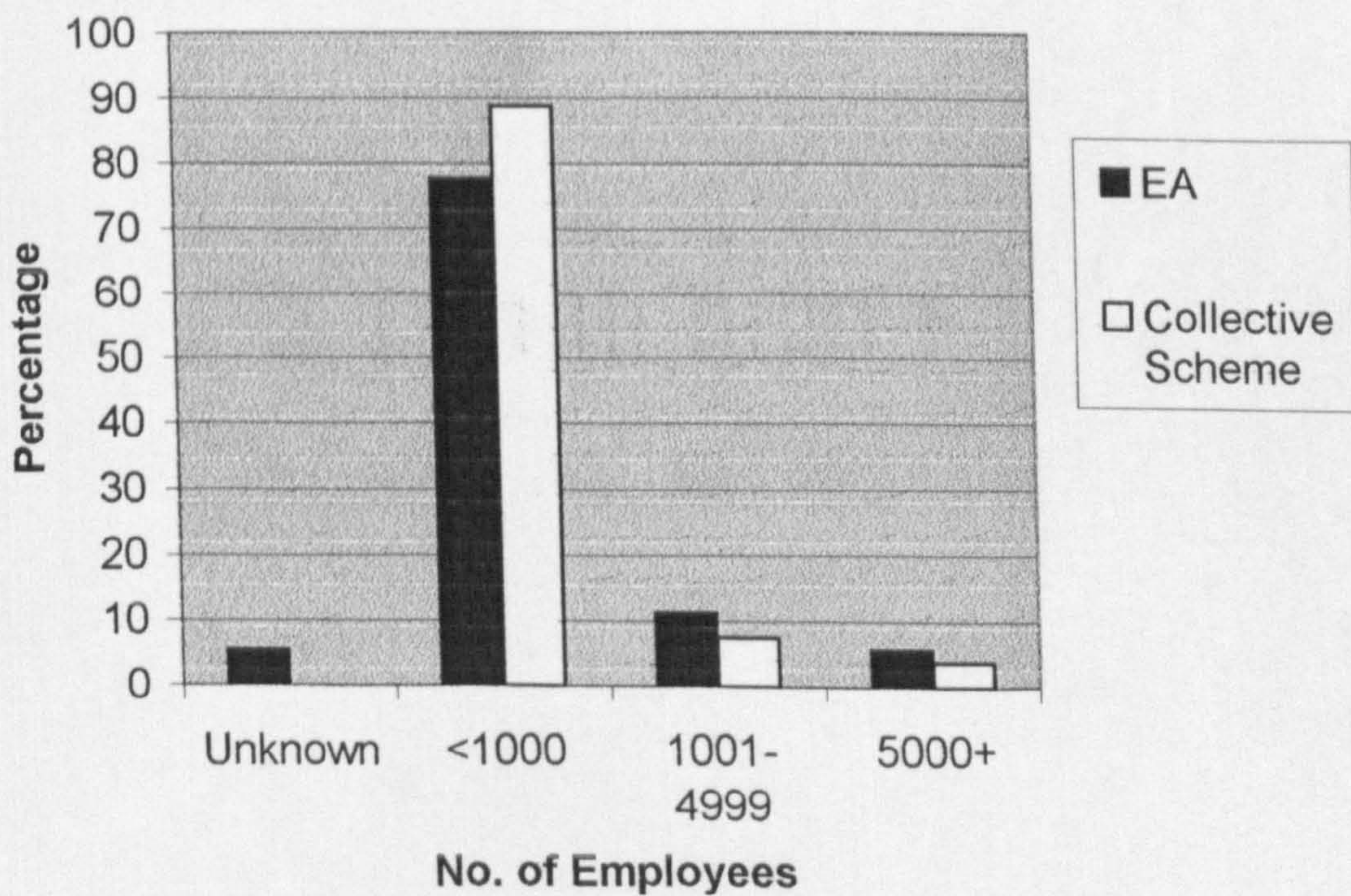


- Environment Agency
- Pennine-pack
- Packwaste
- Paper Collect
- Cleanapak
- Properpak
- Biffpak
- Paperpak
- Valpak
- Other collective scheme

**Turnover Variations According to Registration Status**



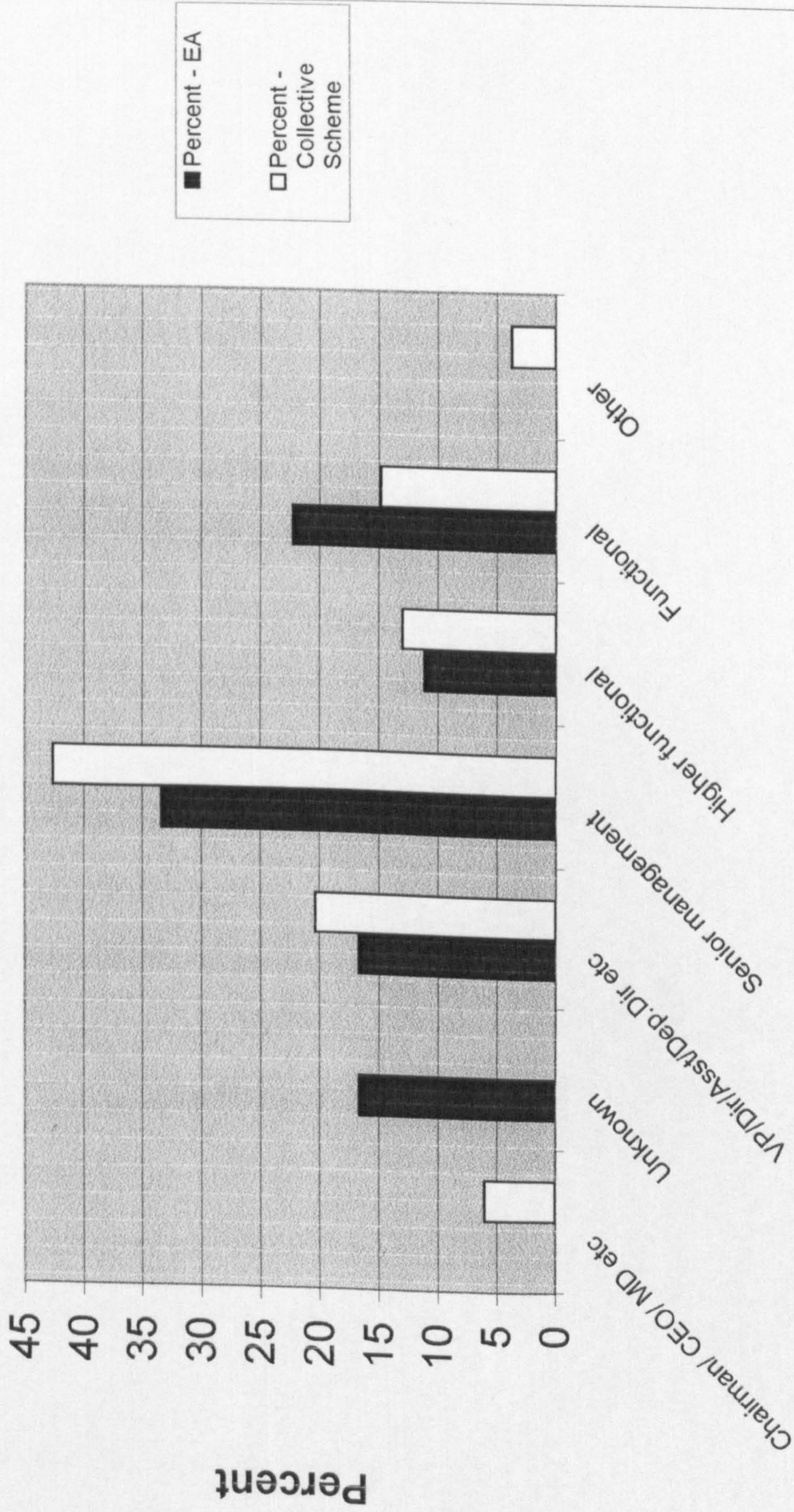
**No. of Employees Variations According to Registration Status**





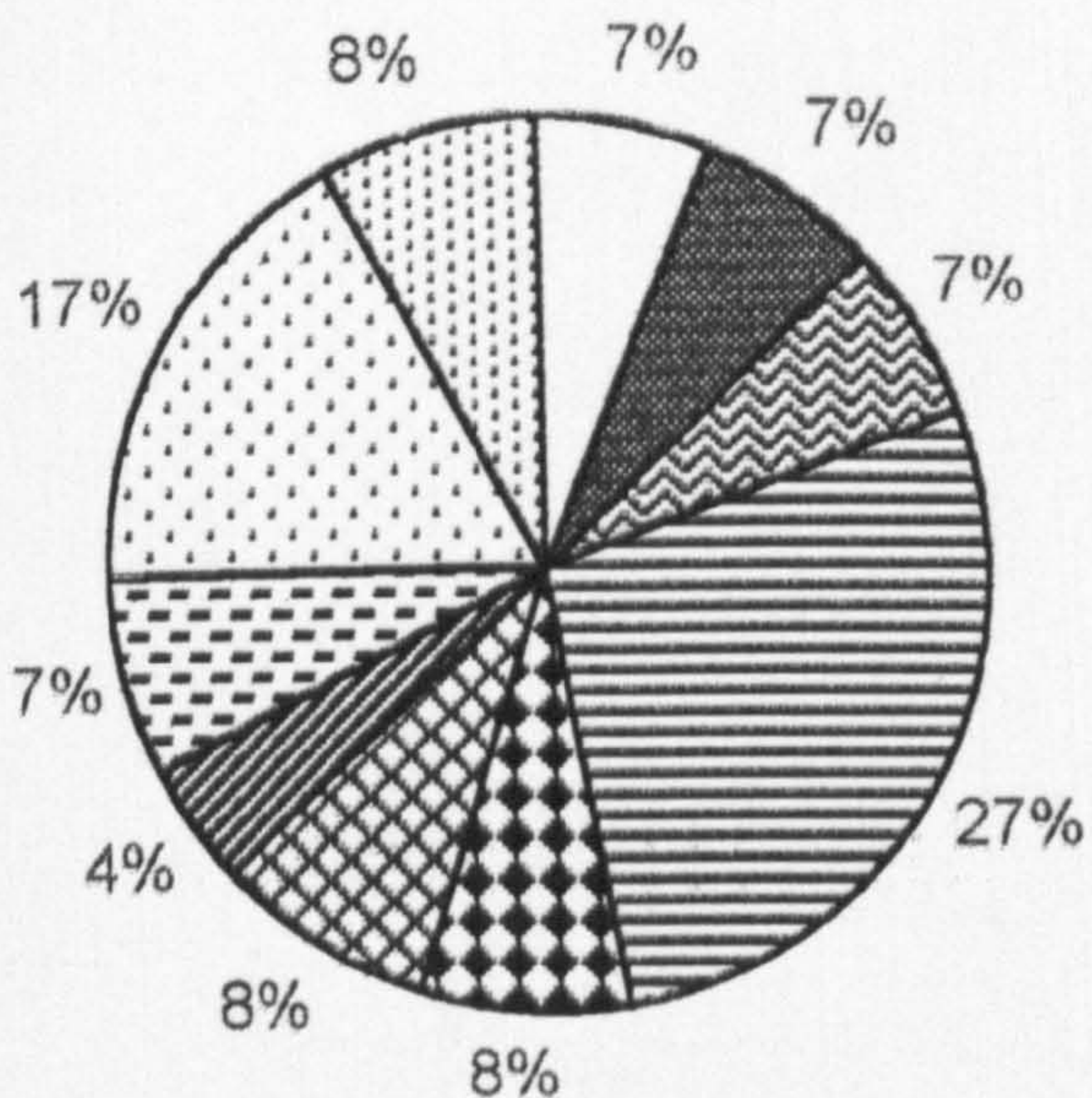
# Level of Authority Variations According to Registration Status

Status



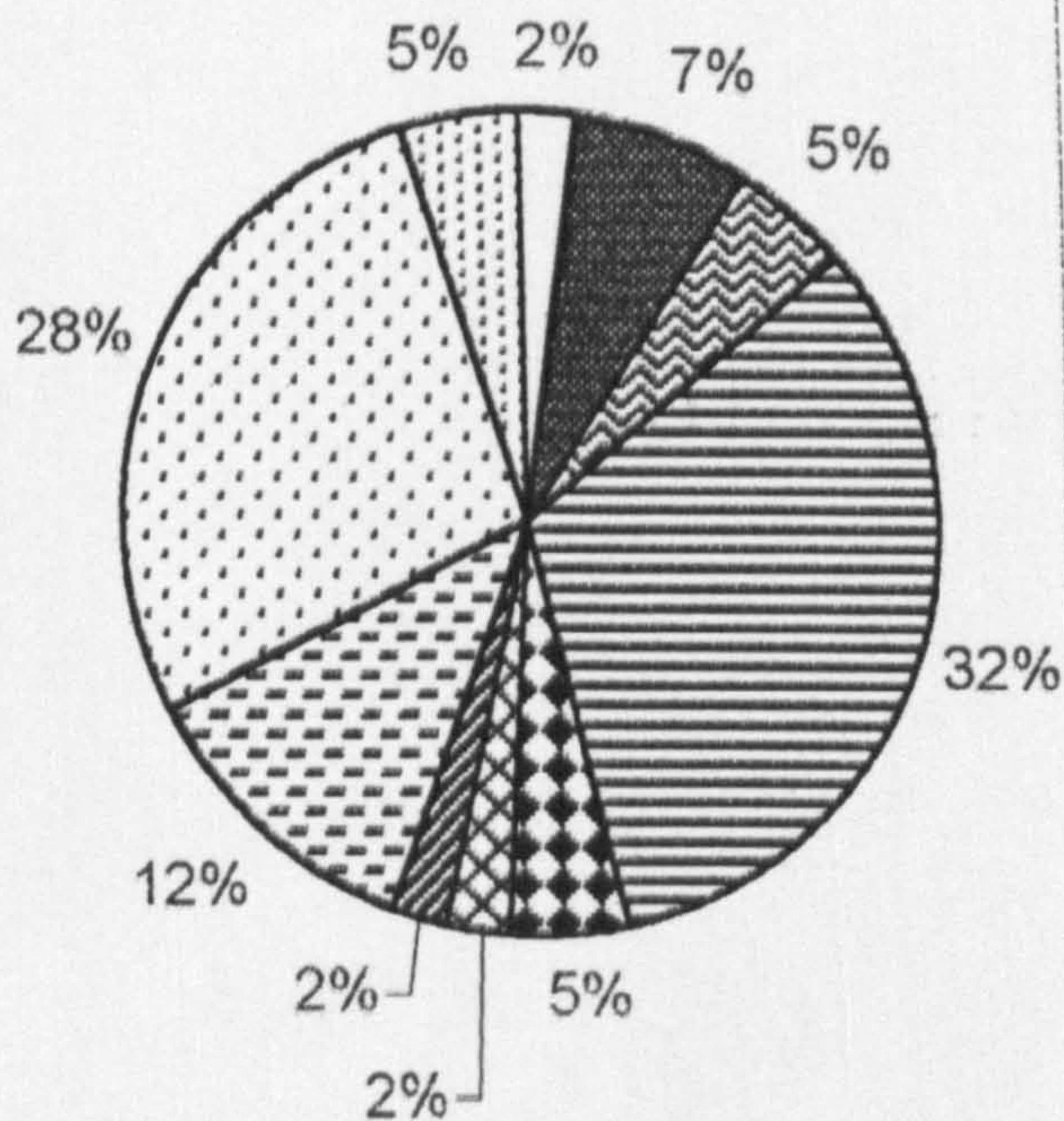
Level of Authority

**Collective Scheme Member's  
Area of Responsibility**



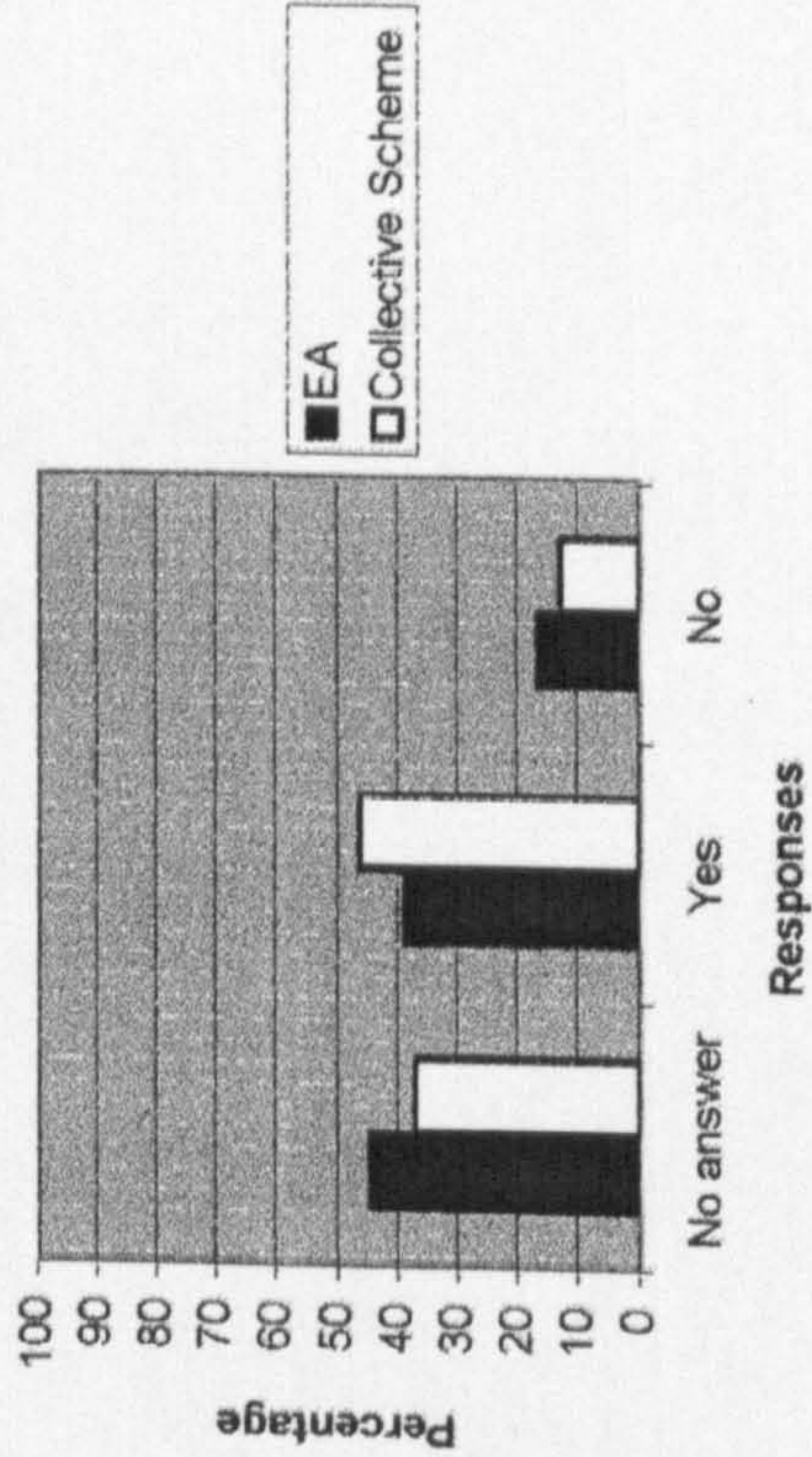
- Legal and Finance
- Human Resources
- Public Relations
- Environment
- IT/ Systems/ Quality
- Sales and Marketing
- Research and Development
- Production
- Health and Safety
- Distribution

**EA Registrant's  
Area of Responsibility**

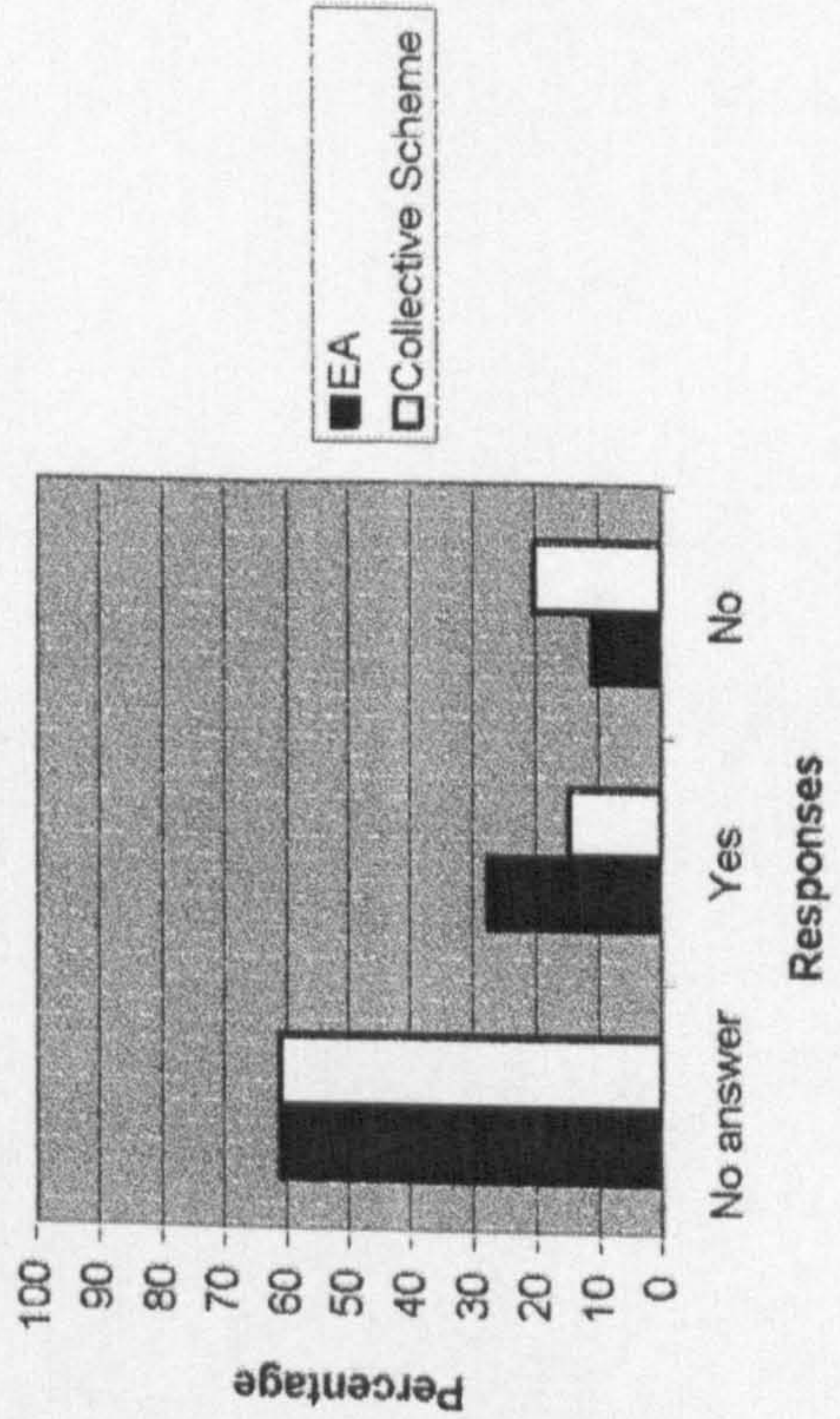


- Legal and Finance
- Human Resources
- Public Relations
- Environment
- IT/ Systems/ Quality
- Sales and Marketing
- Research and Development
- Production
- Health and Safety
- Distribution

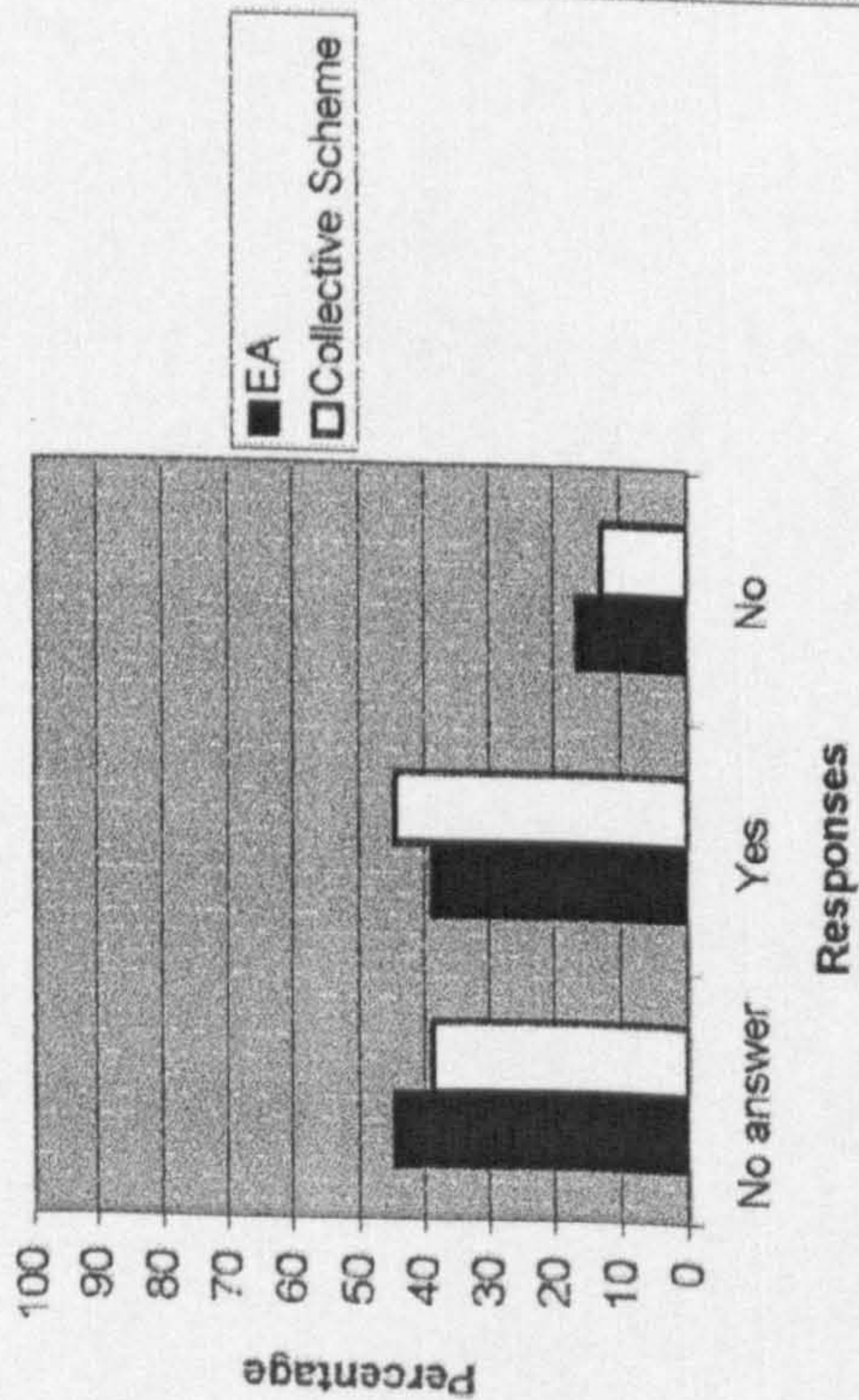
**Packaging Consumption by Material Type: Measures Introduced Due to Regulations Variations Due to Registration Status**



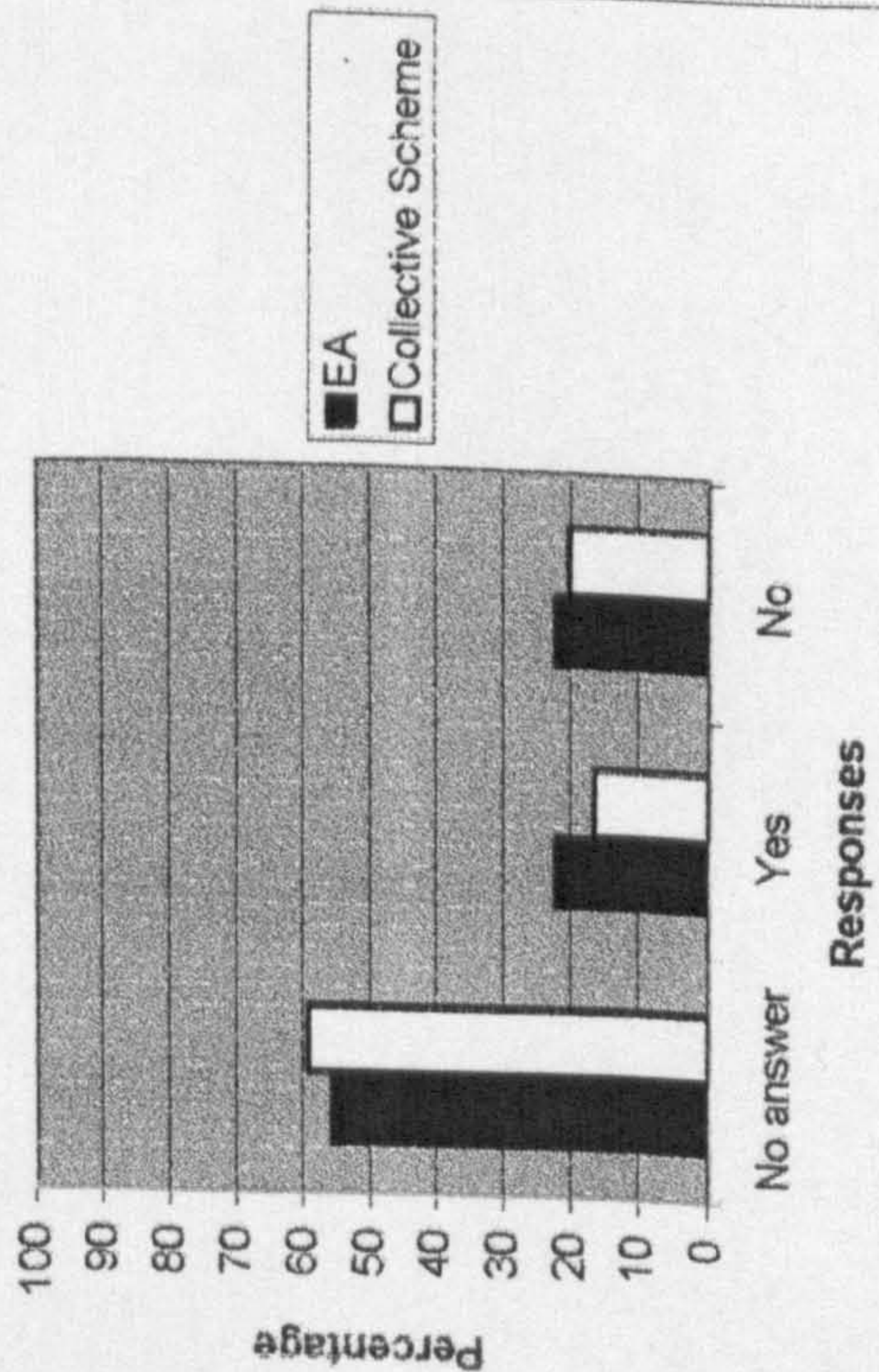
**Packaging Reuse by Material Type Measures Introduced Due to Regulations Variations According to Registration Status**



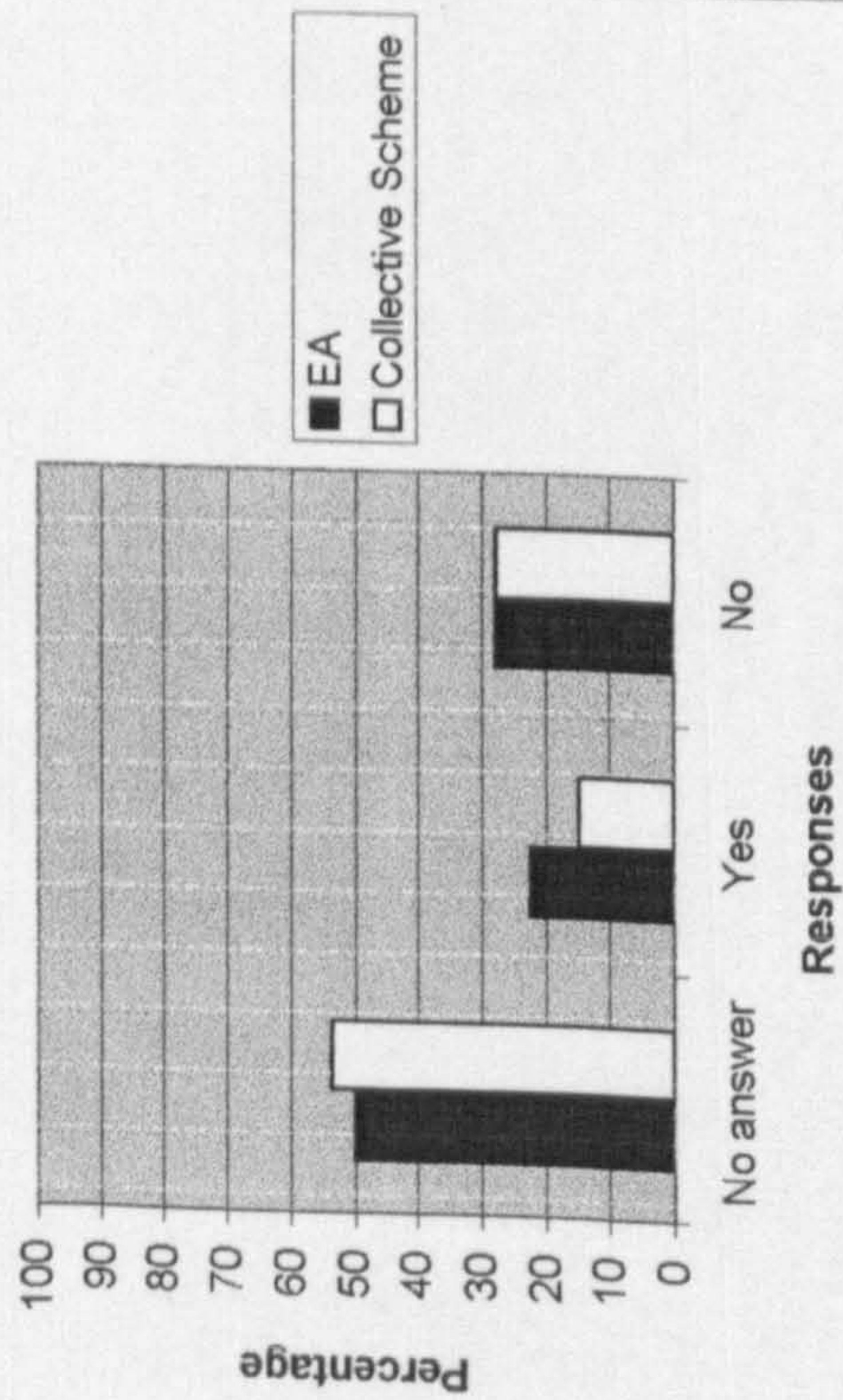
**Packaging Consumption Measures: Introduction Due to Regulations According to Registration Status**



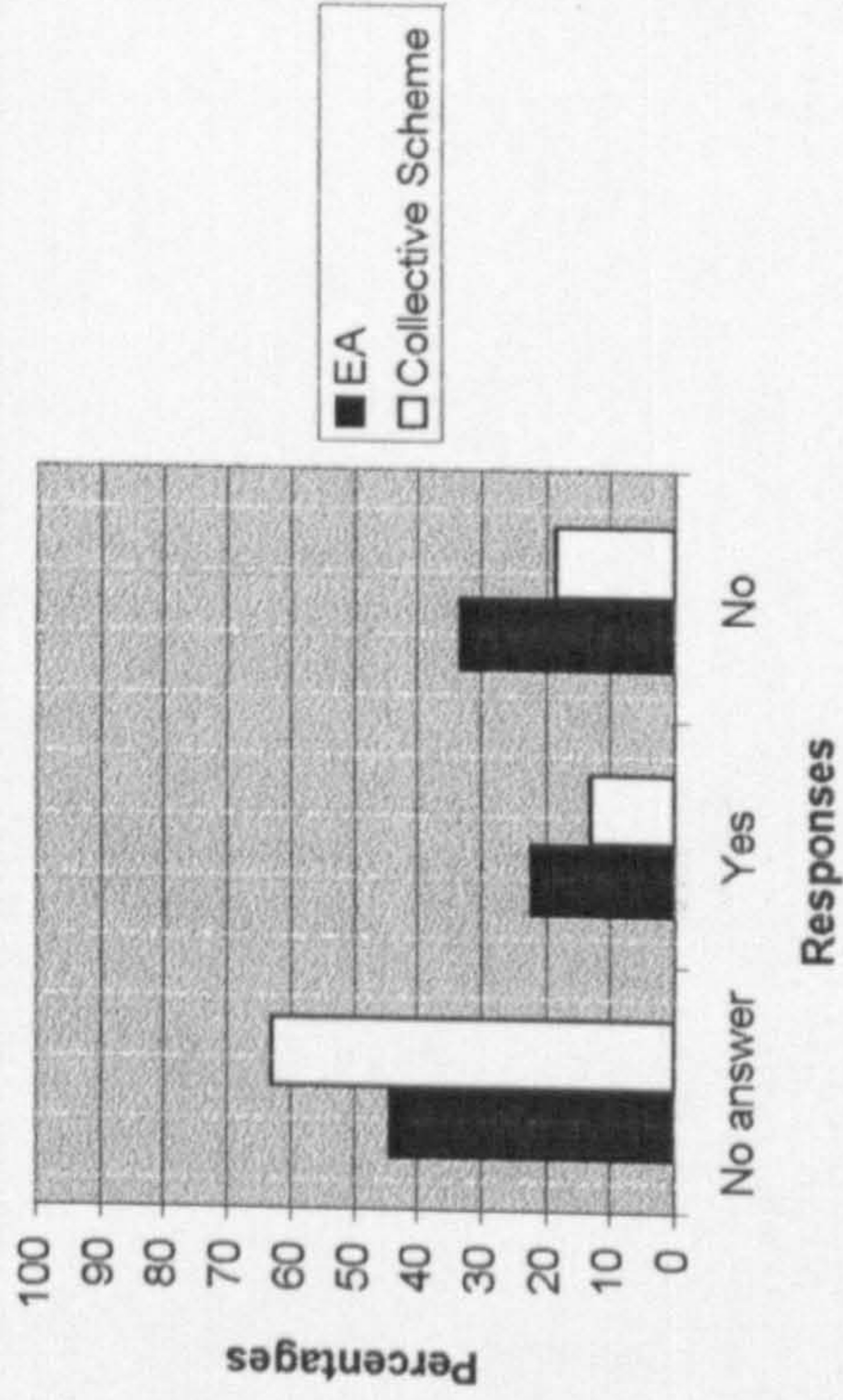
**Packaging Reuse Measures Introduced Due to the Regulations Variations According to Registration Status**



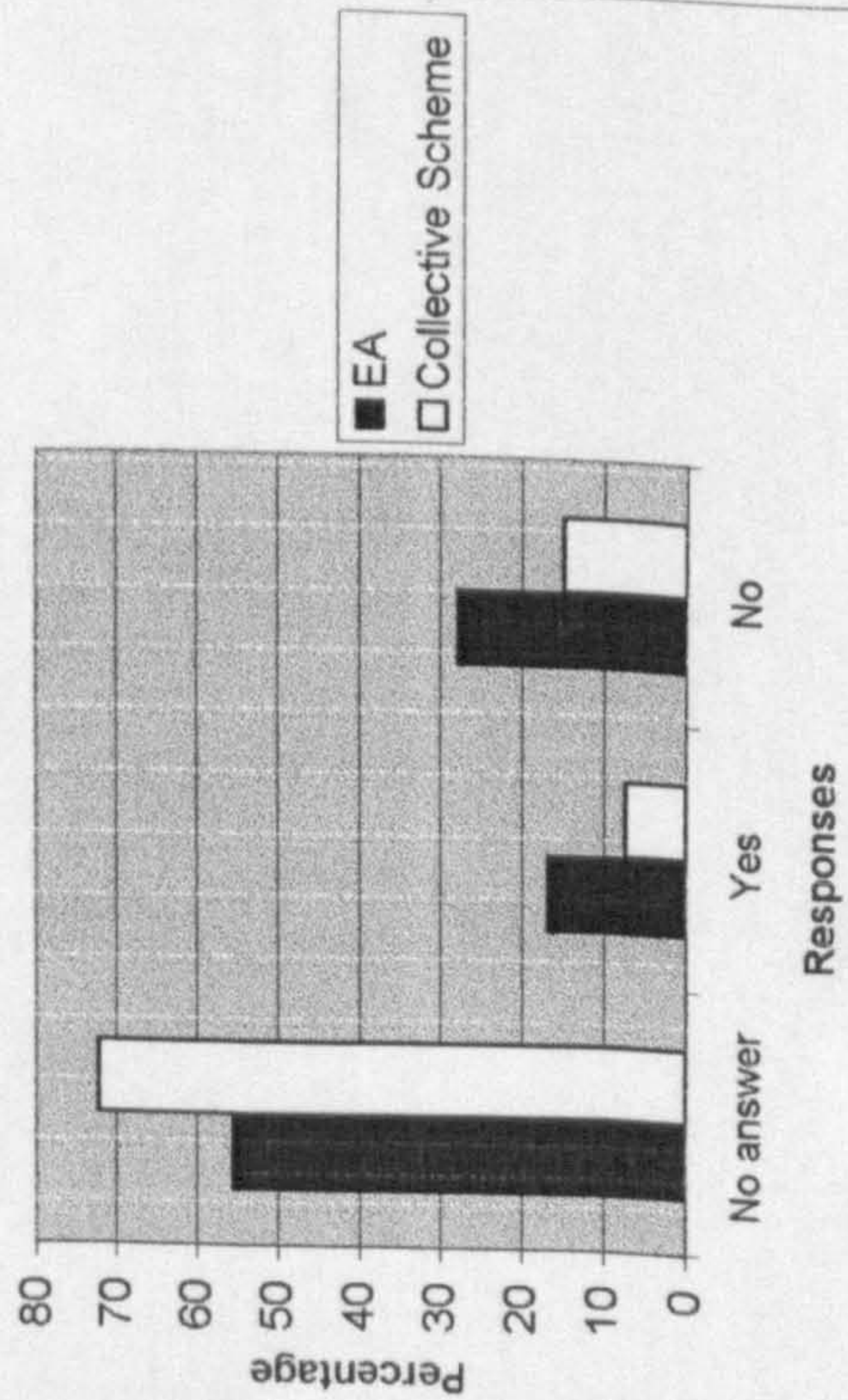
Packaging Recycled Measures Introduced Due to Regulations According to Registration Status



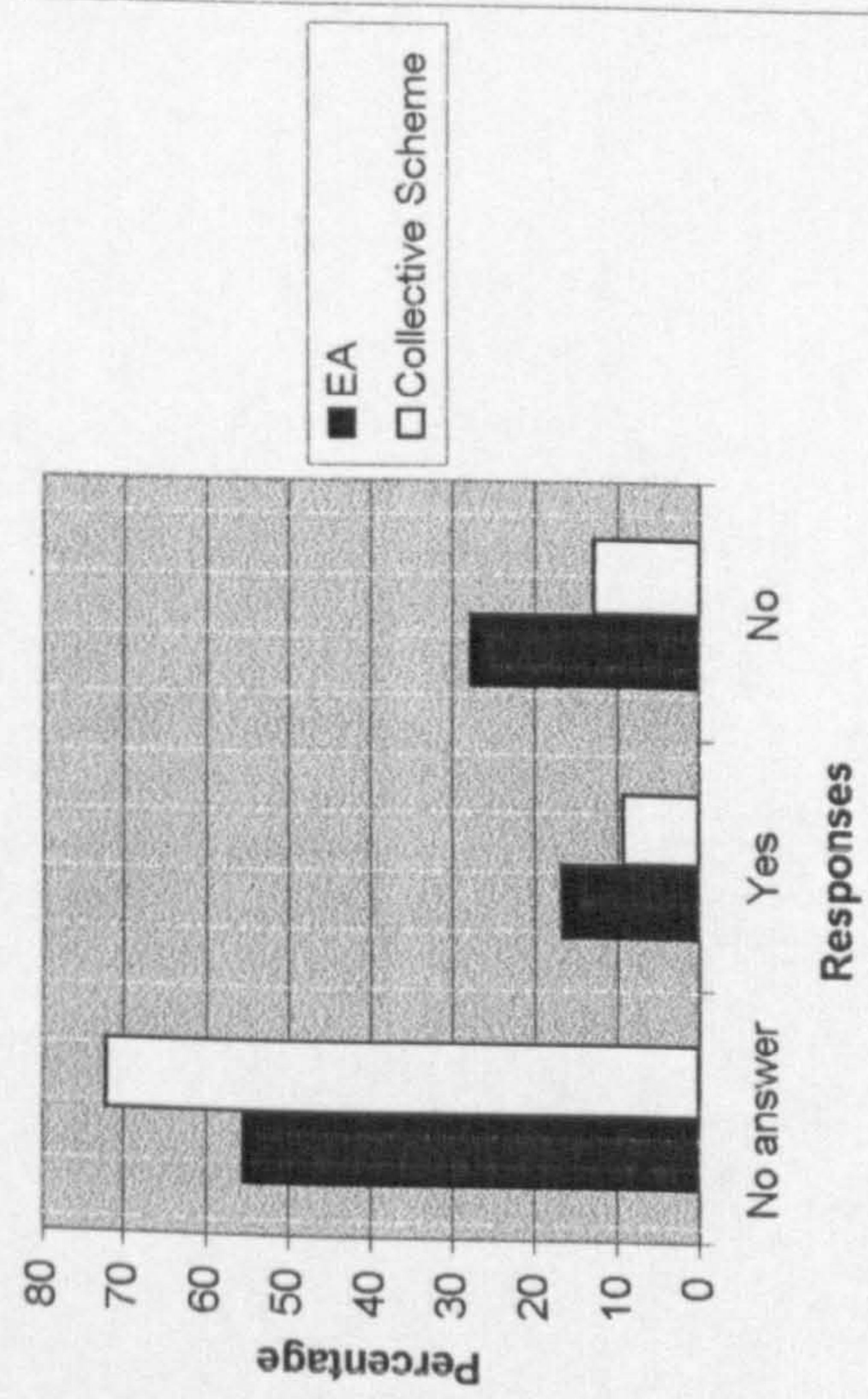
Packaging Recycled by Material Type Measures Introduced Due to Regulations Variations According to Registration Status



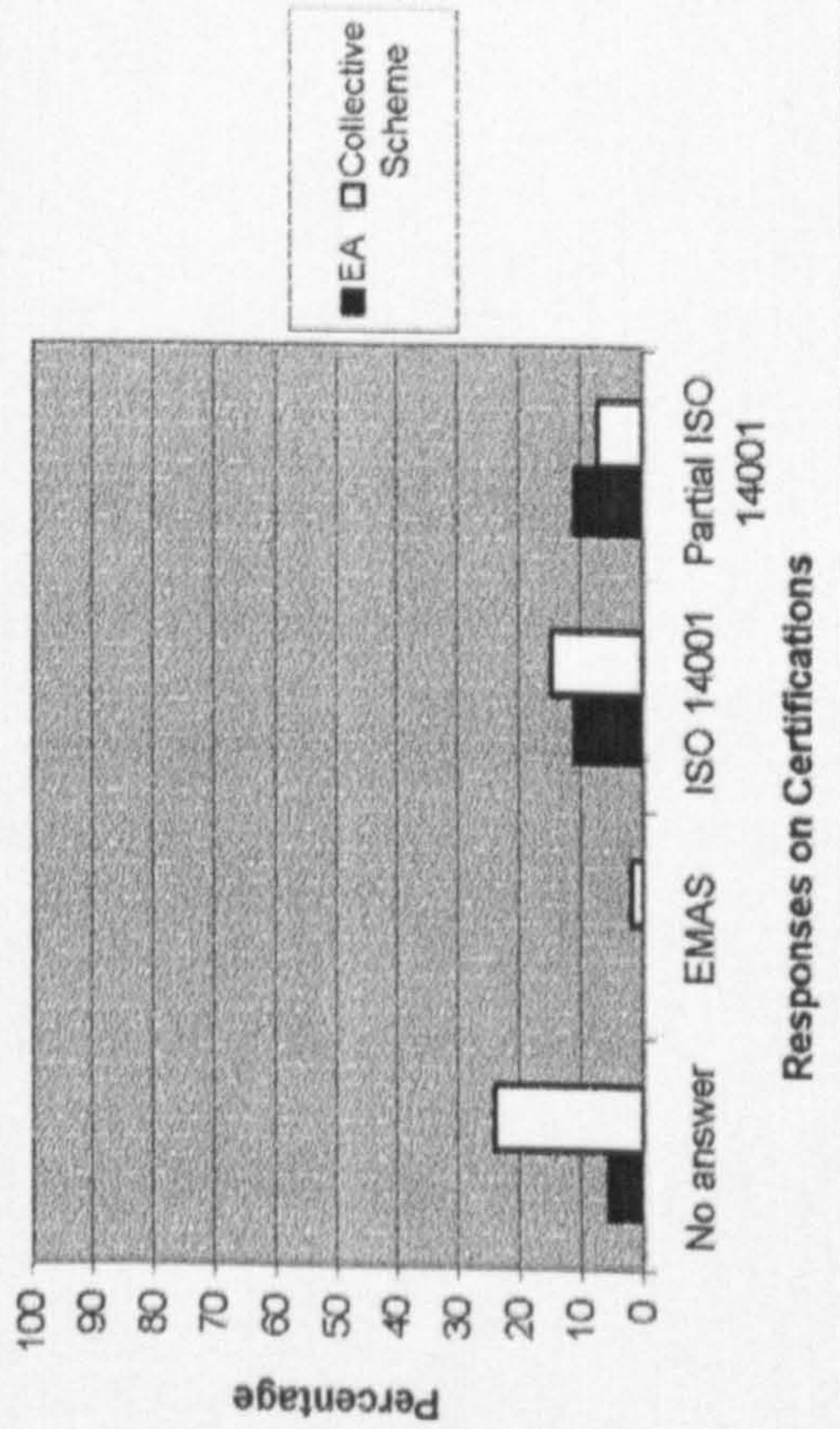
Packaging Recycle Measures Introduced Due to Regulations Variations According to Registration Status



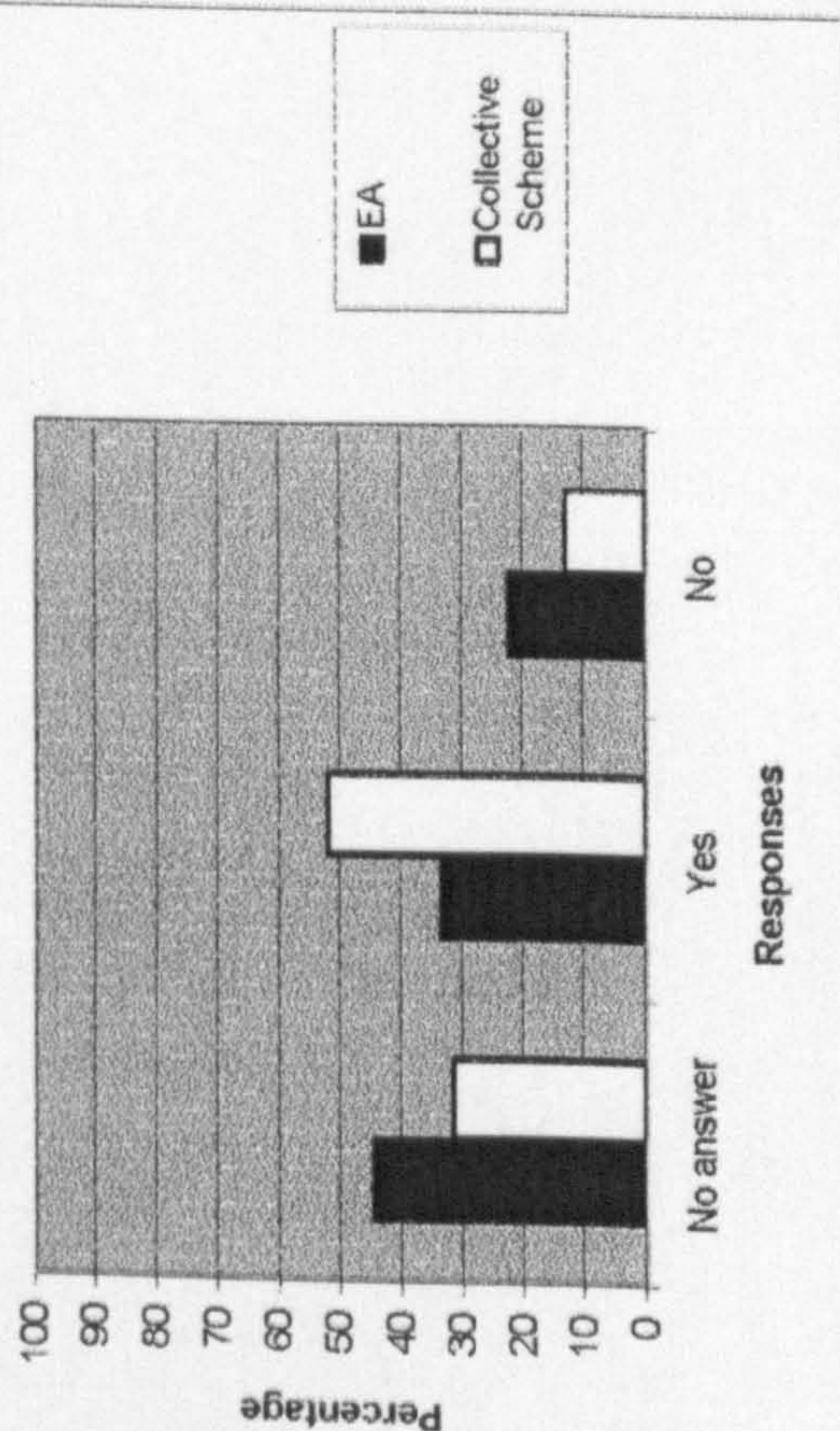
Packaging Recycle by Material Type Measures Introduced Due to Regulations Variations According to Registration Status



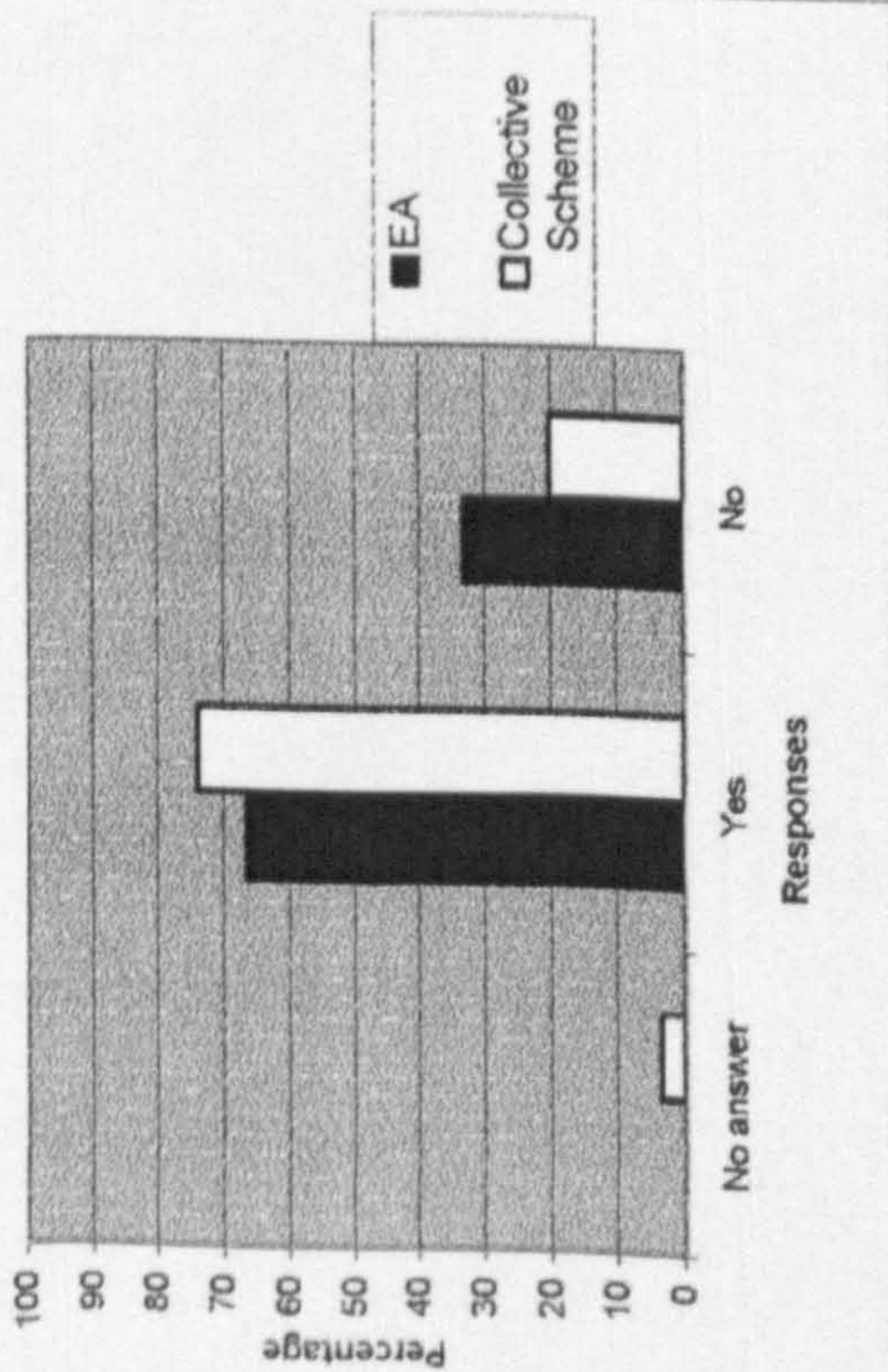
Environmental Management Systems Variations According to Registration Status



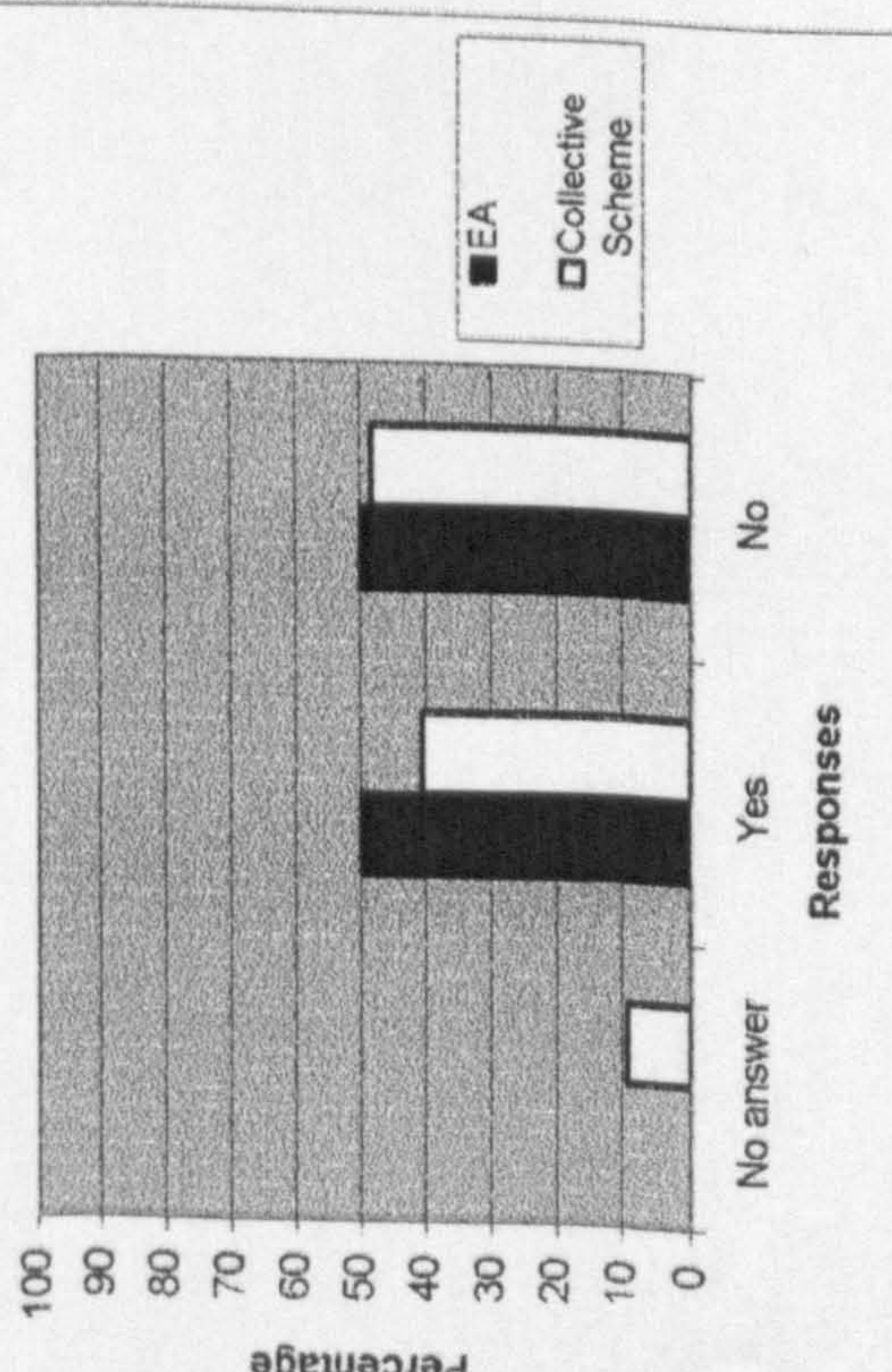
Awareness of the Essential Requirements Regulations Variations According to Registration Status



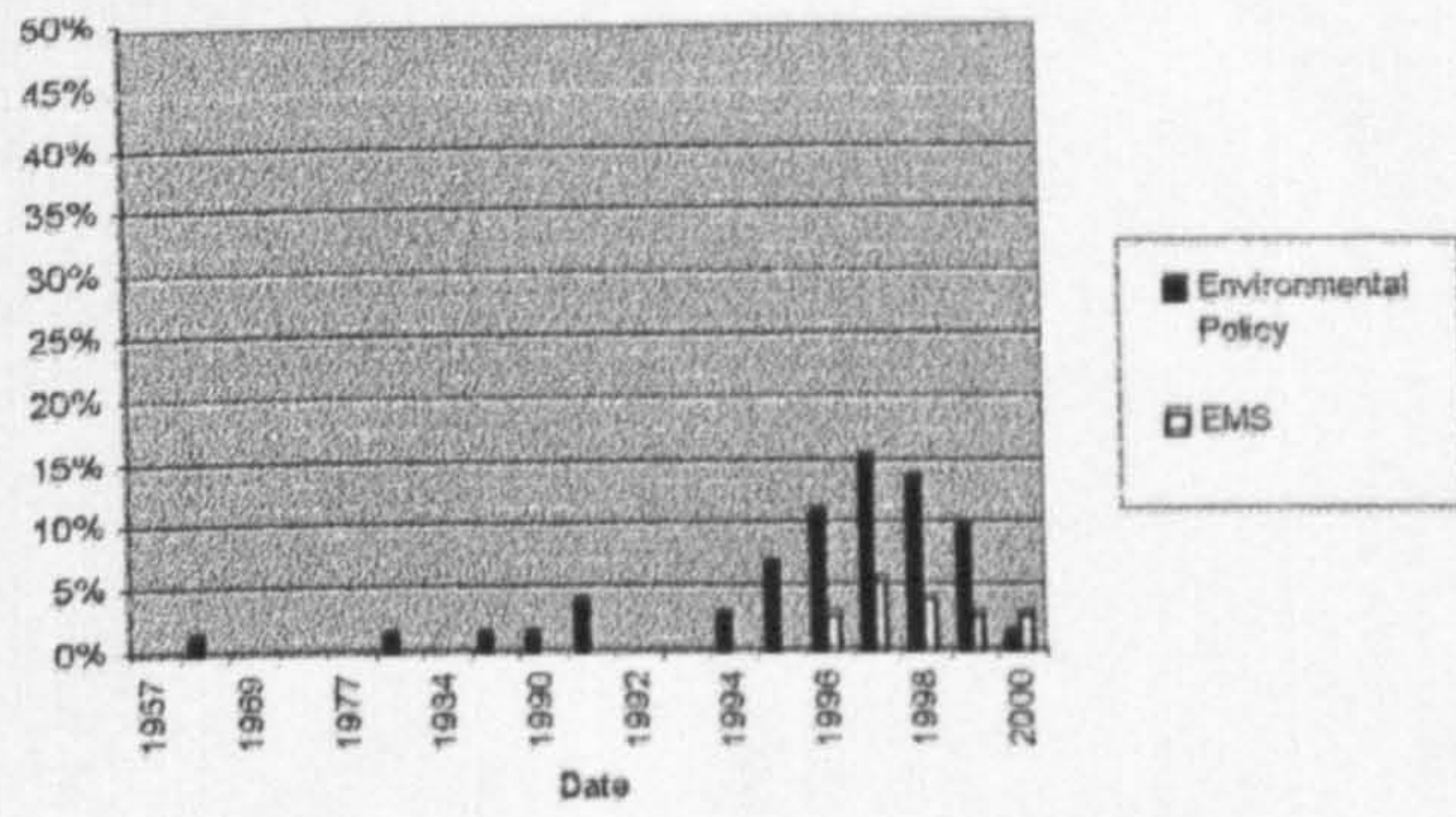
Environmental Policy Variations According to Registration Status



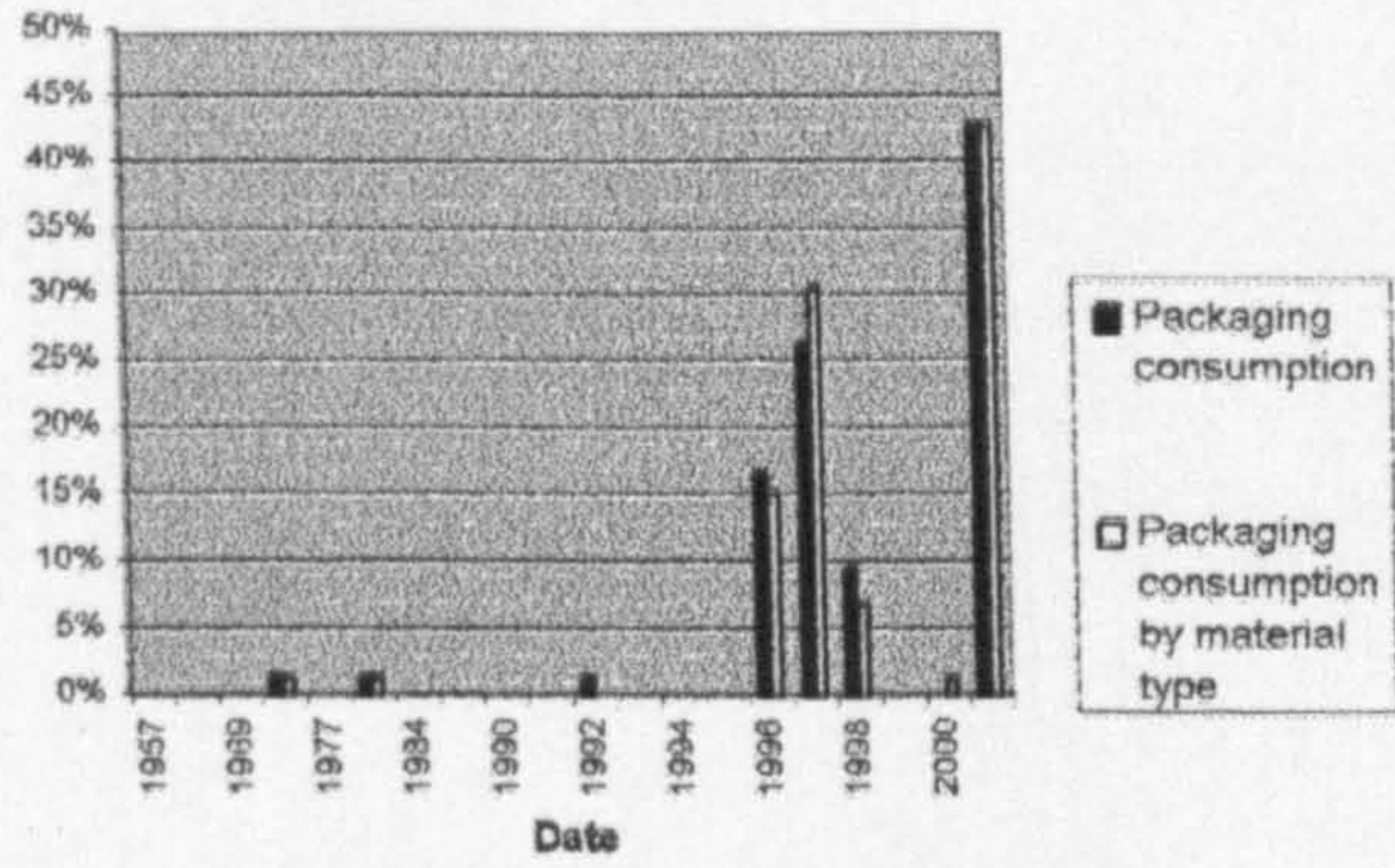
Substitution of Packaging Materials Variations According to Registration Status



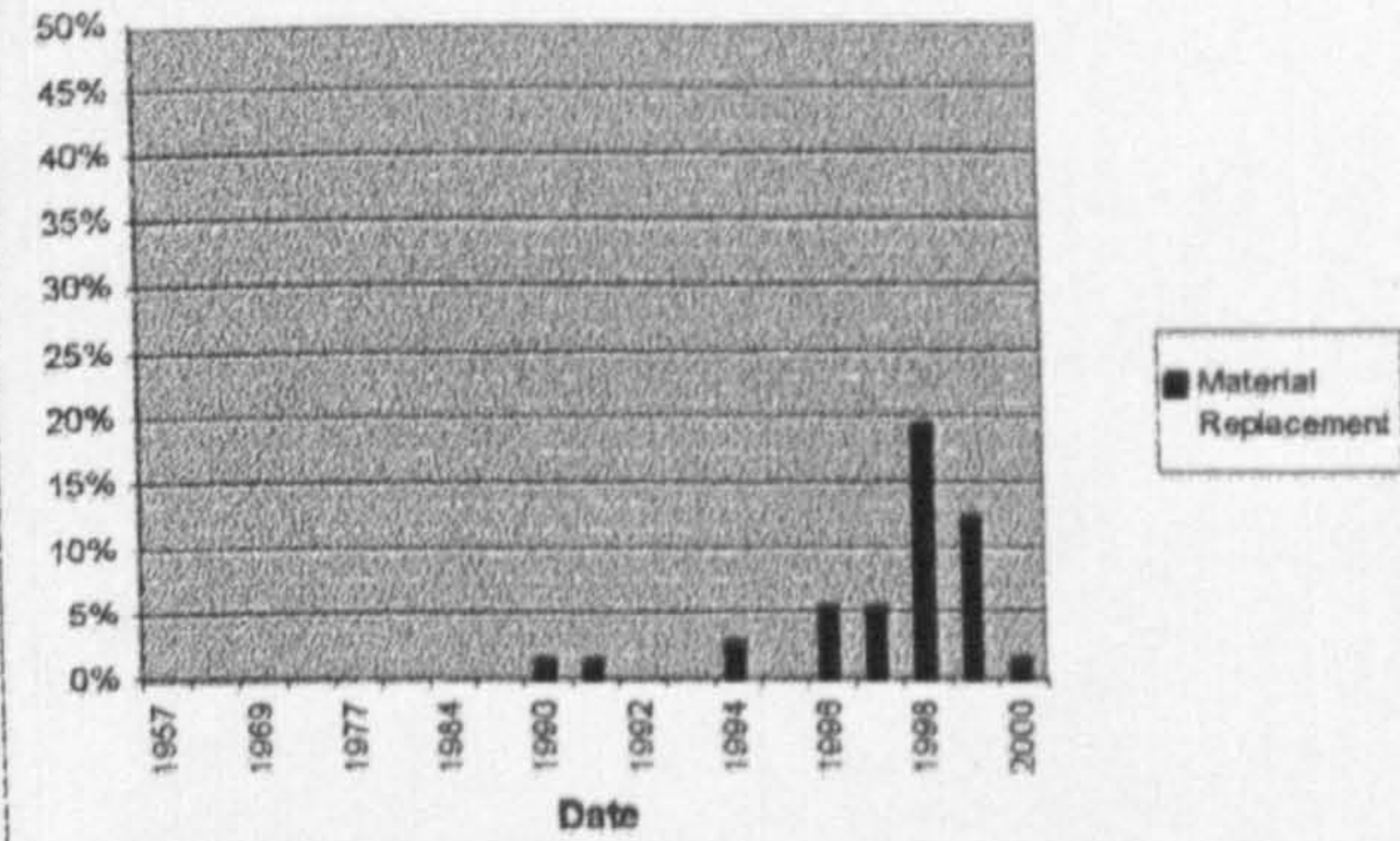
**Environmental Policy and EMS Introduction**



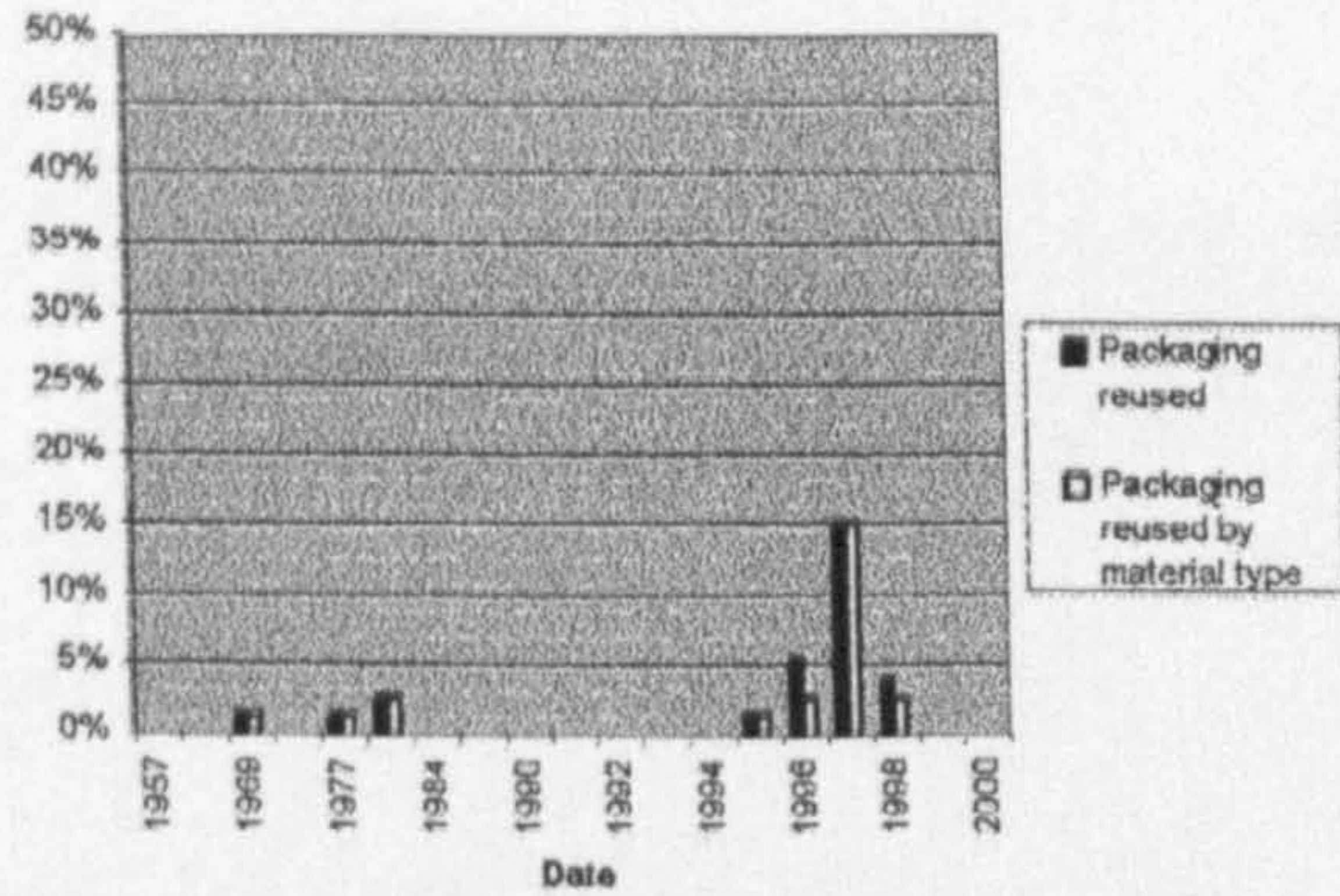
**Introduction of Packaging Consumption Measures**



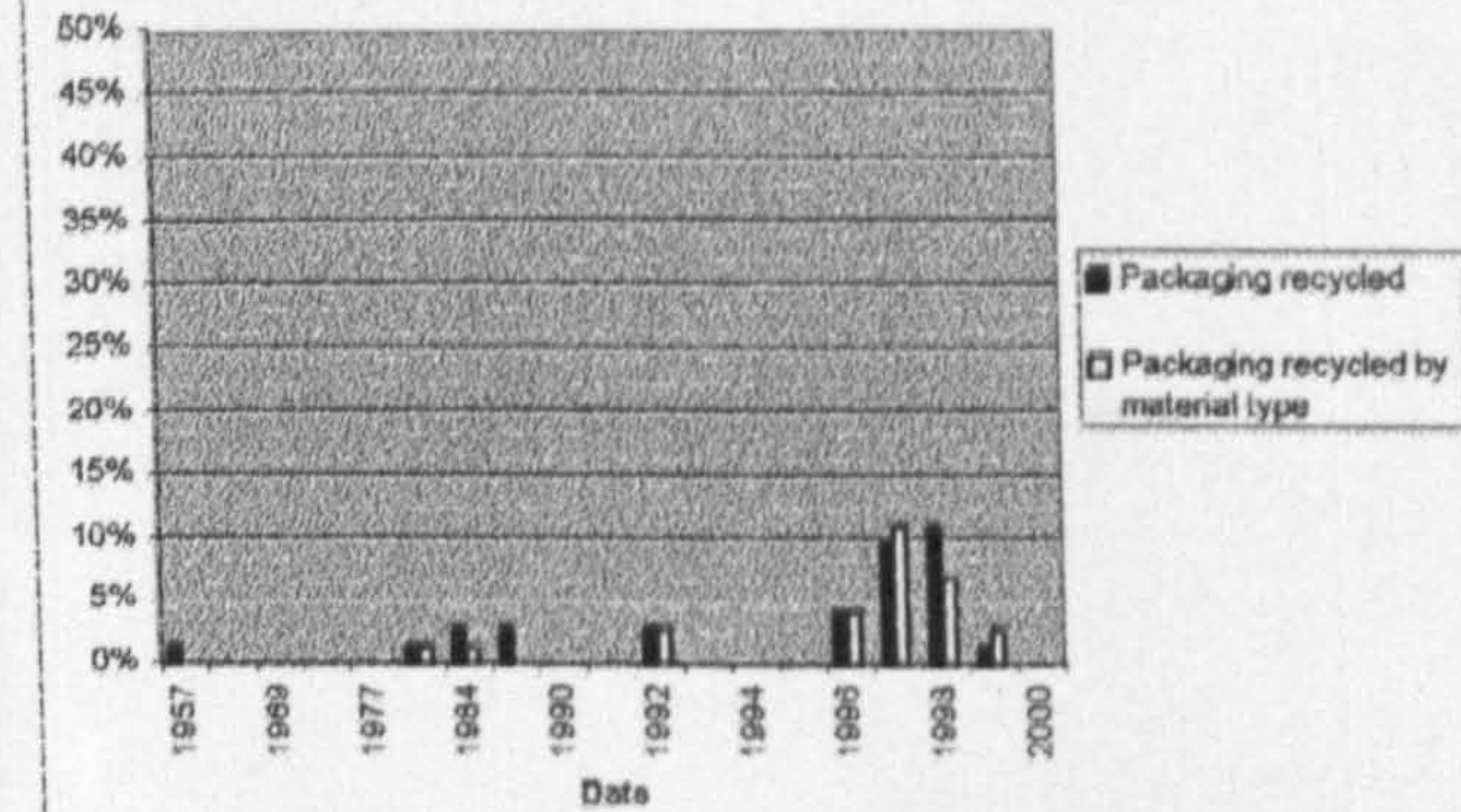
**Substitution of Packaging Materials**



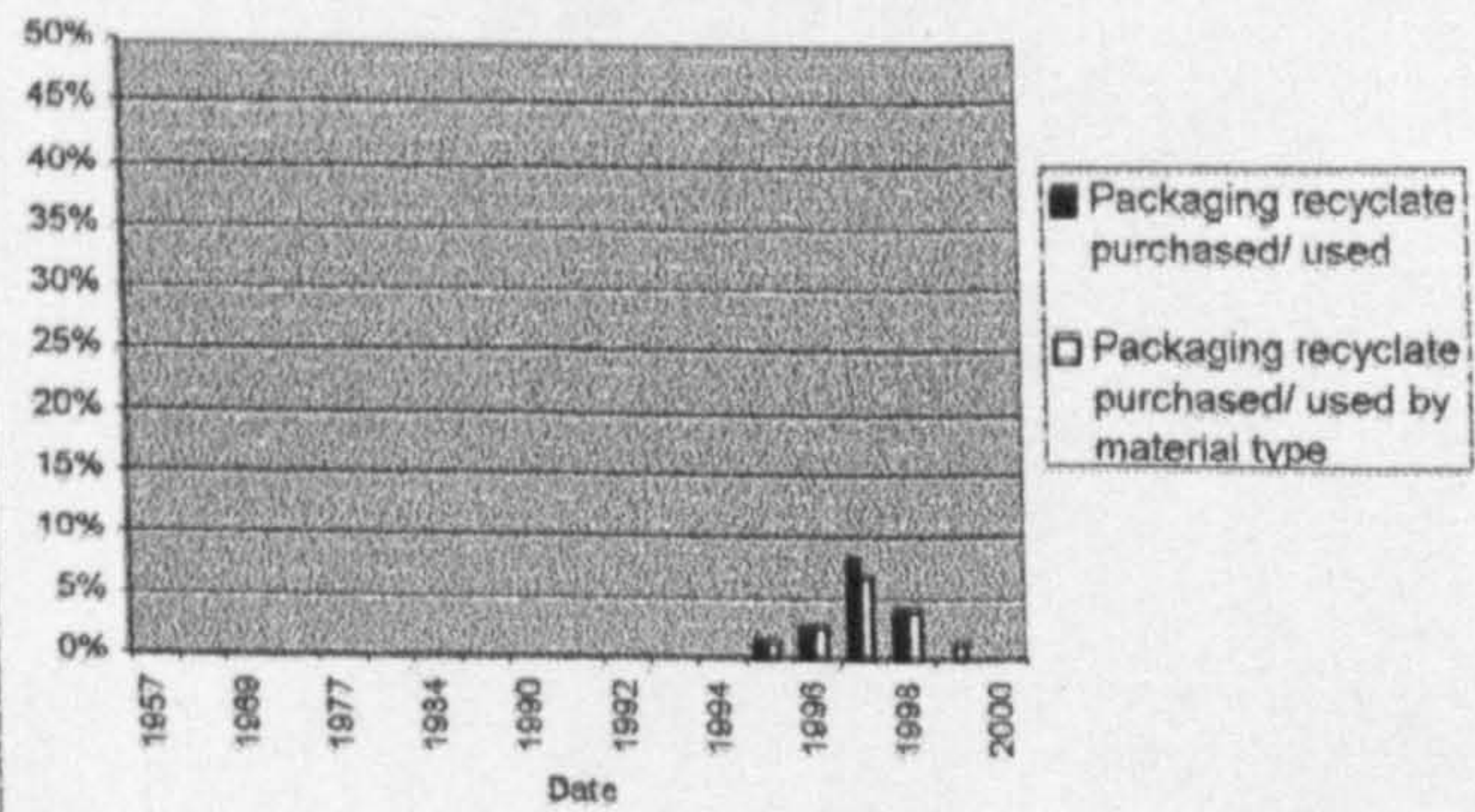
**Introduction of Packaging Reuse Measures**



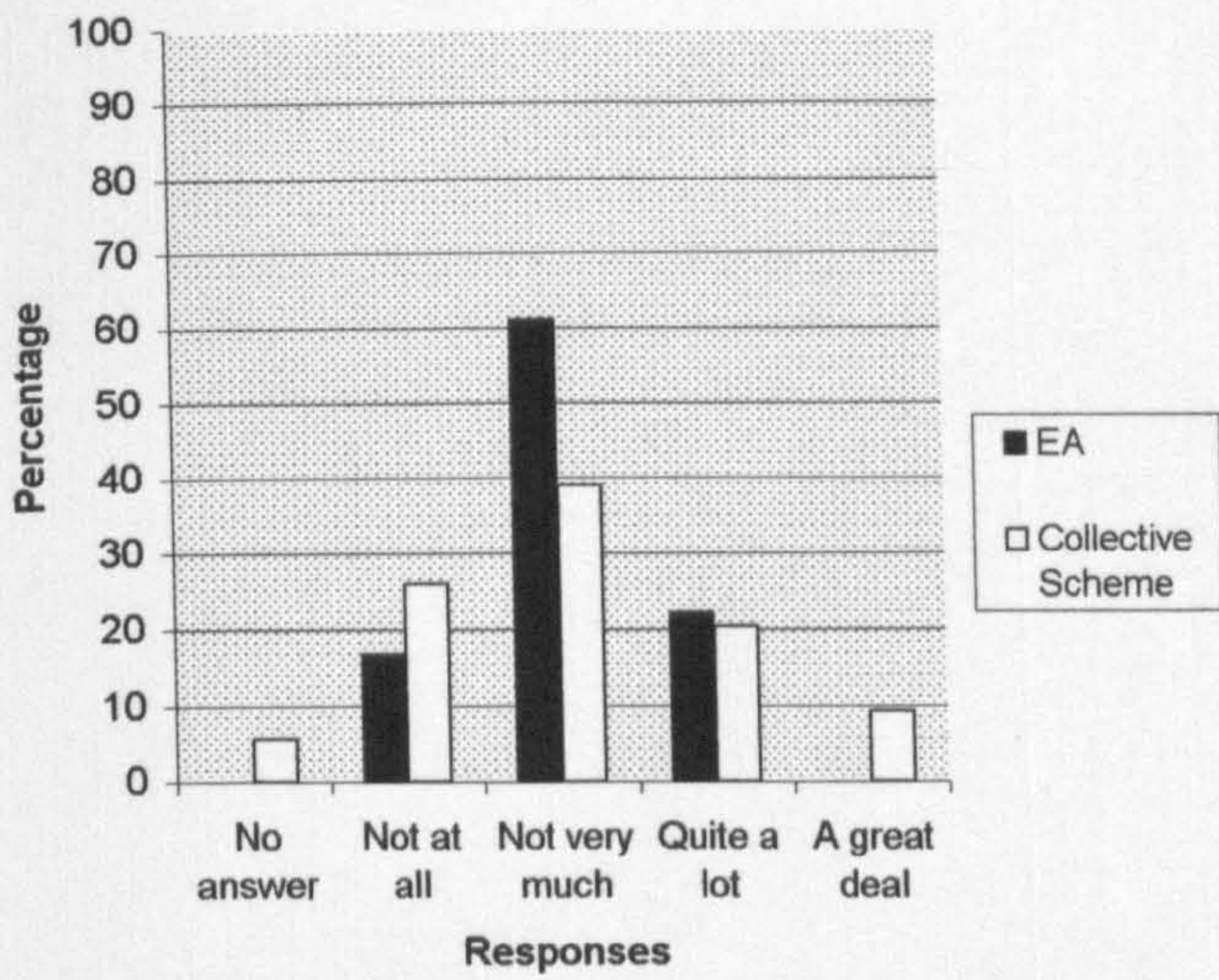
**Introduction of Packaging Recycling Measures**



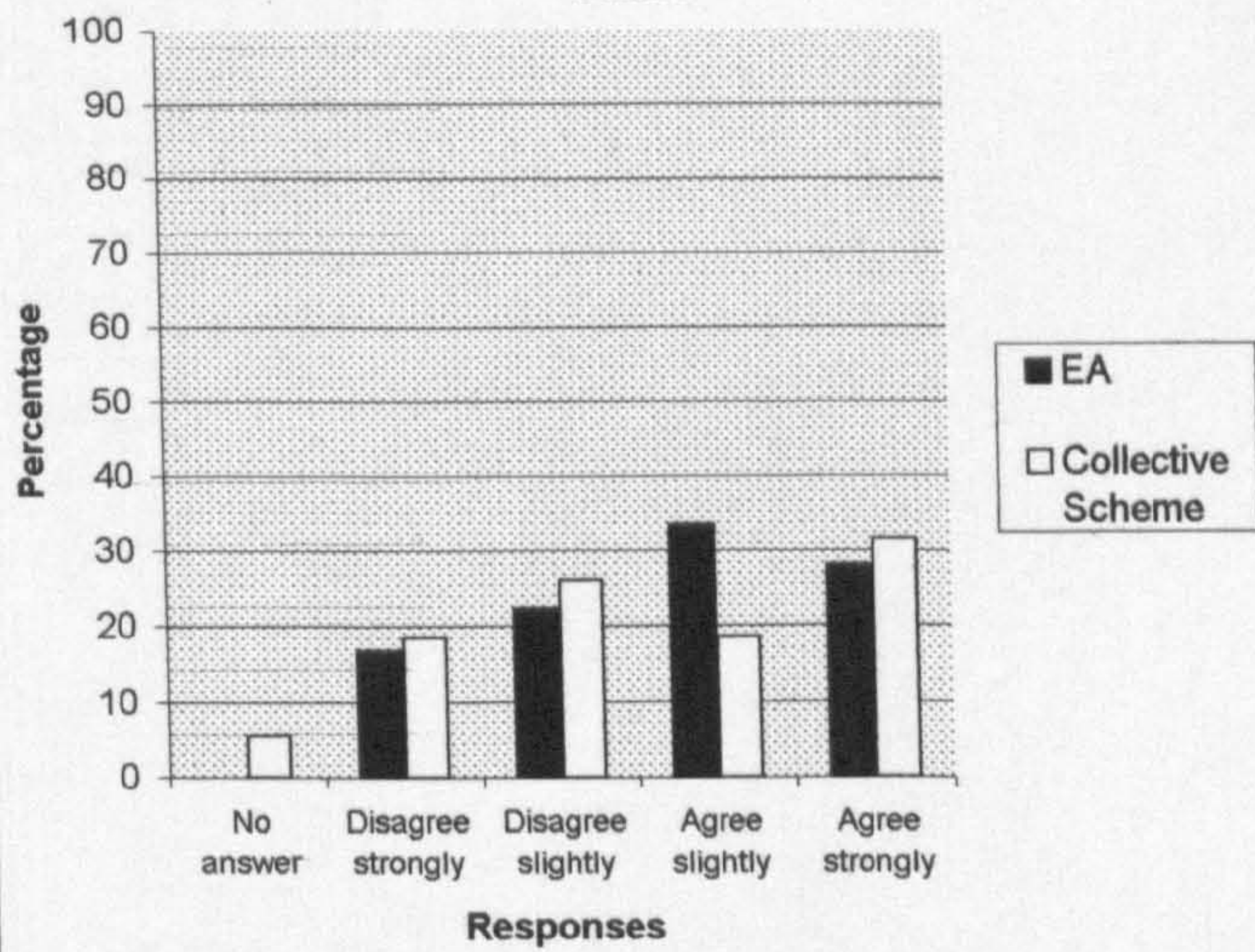
**Introduction of Recyclate Measures**



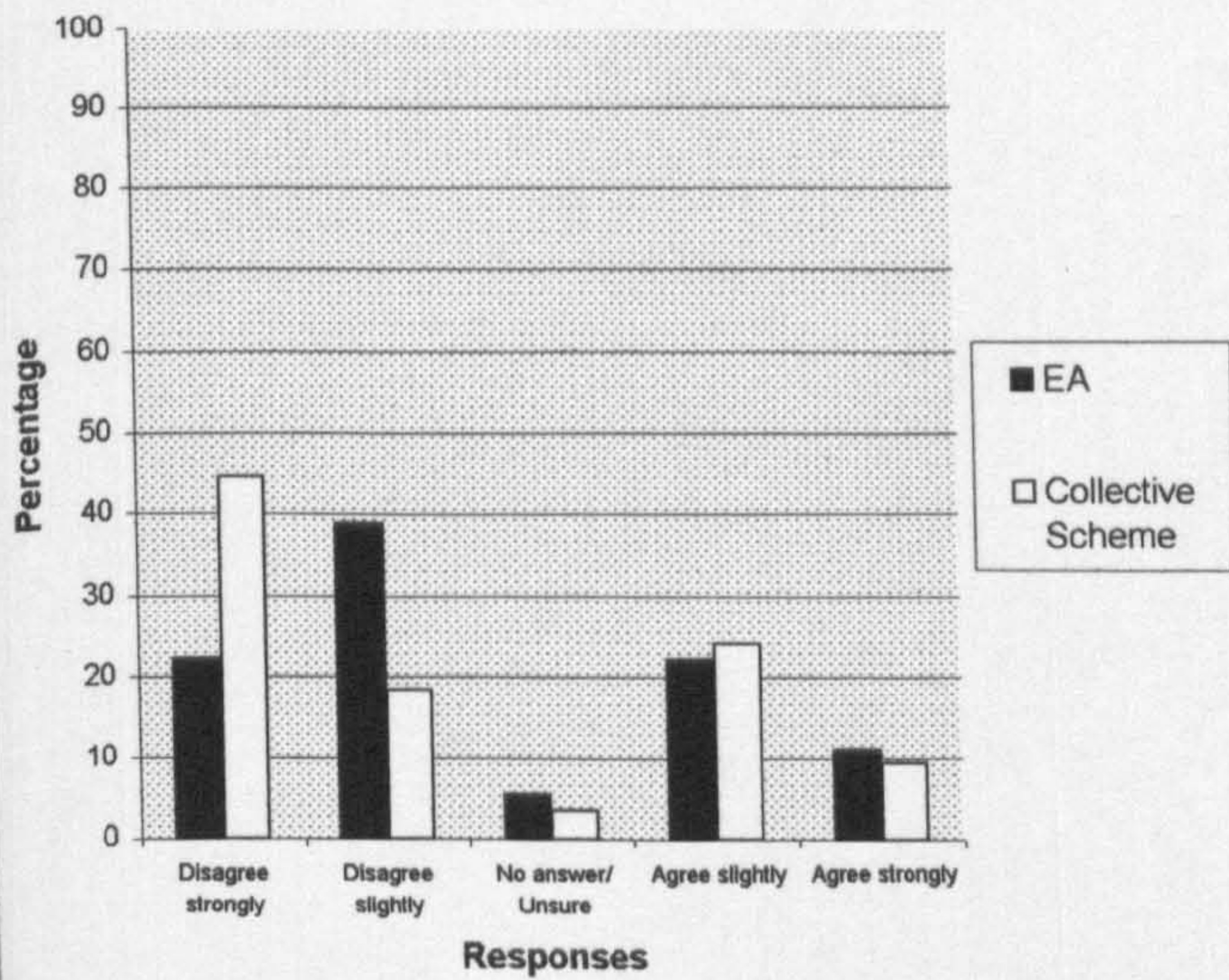
**Influence on Environmental Performance Variations According to Registration Status**



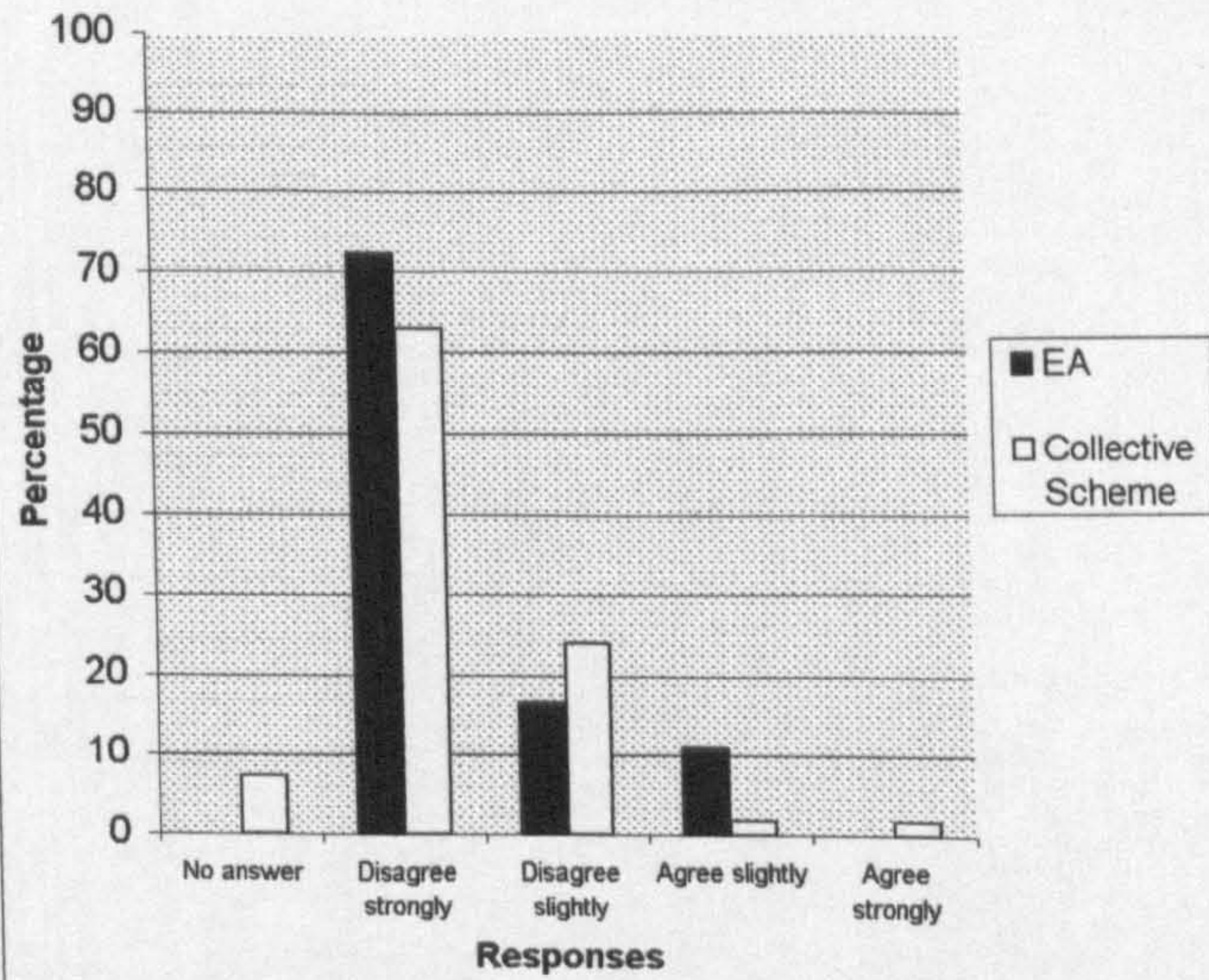
**Regulations Have Not Affected Environmental Programmes Variations According to Registration Status**



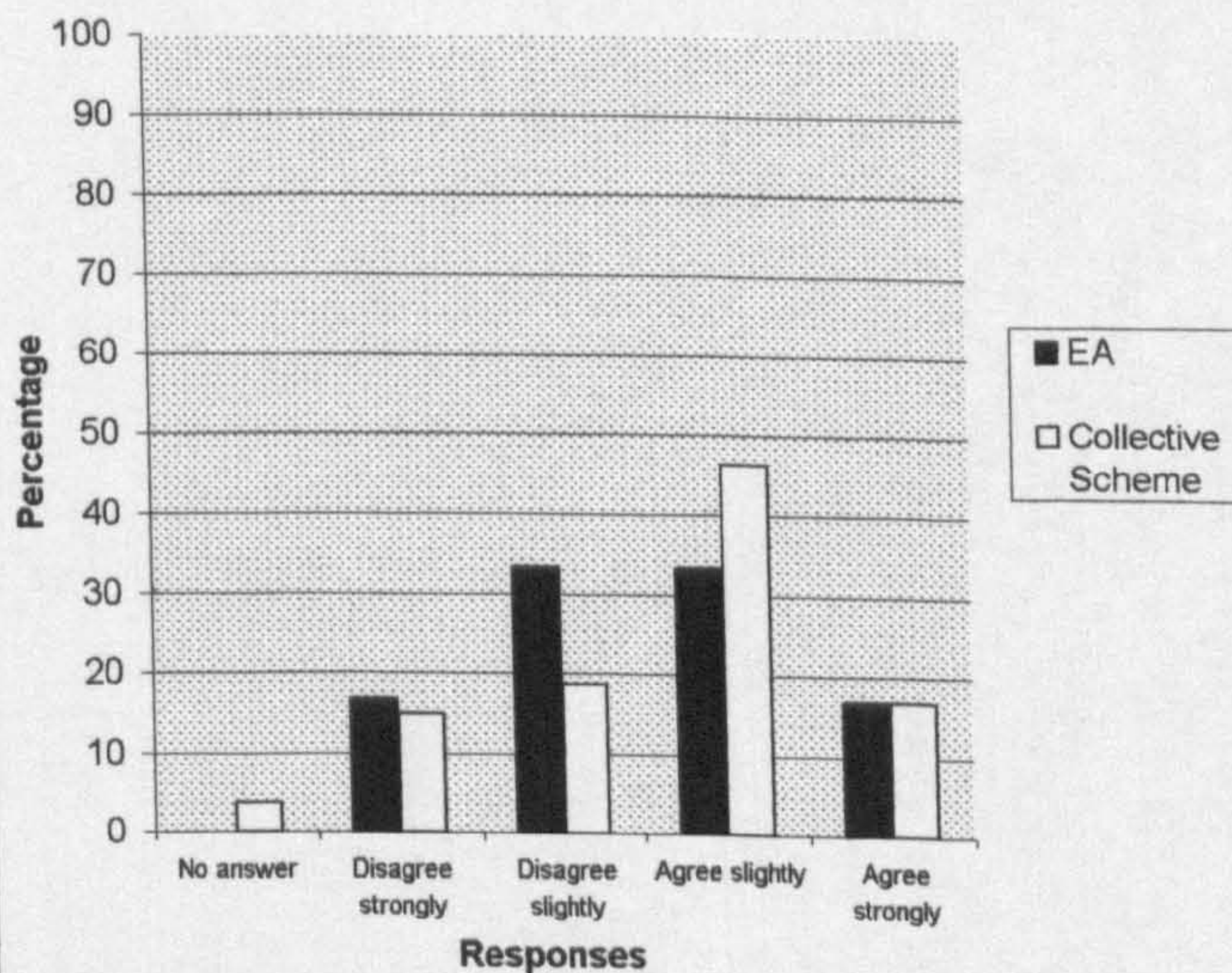
**Regulations Driving Environmental Performance Variations According to Registration Status**



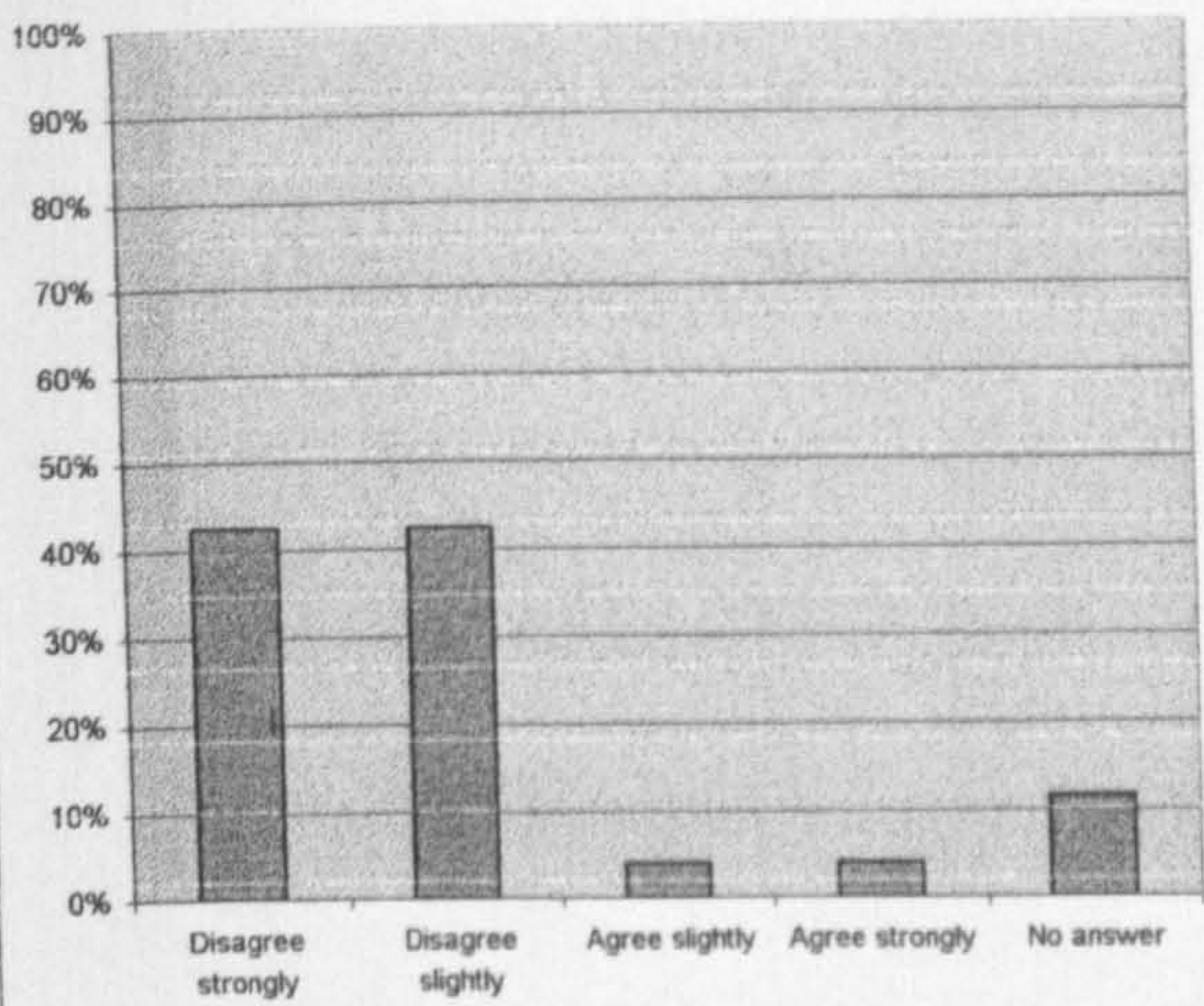
**Regulations Have Had a Detrimental Effect on Environmental Performance Variations According to Registration Status**



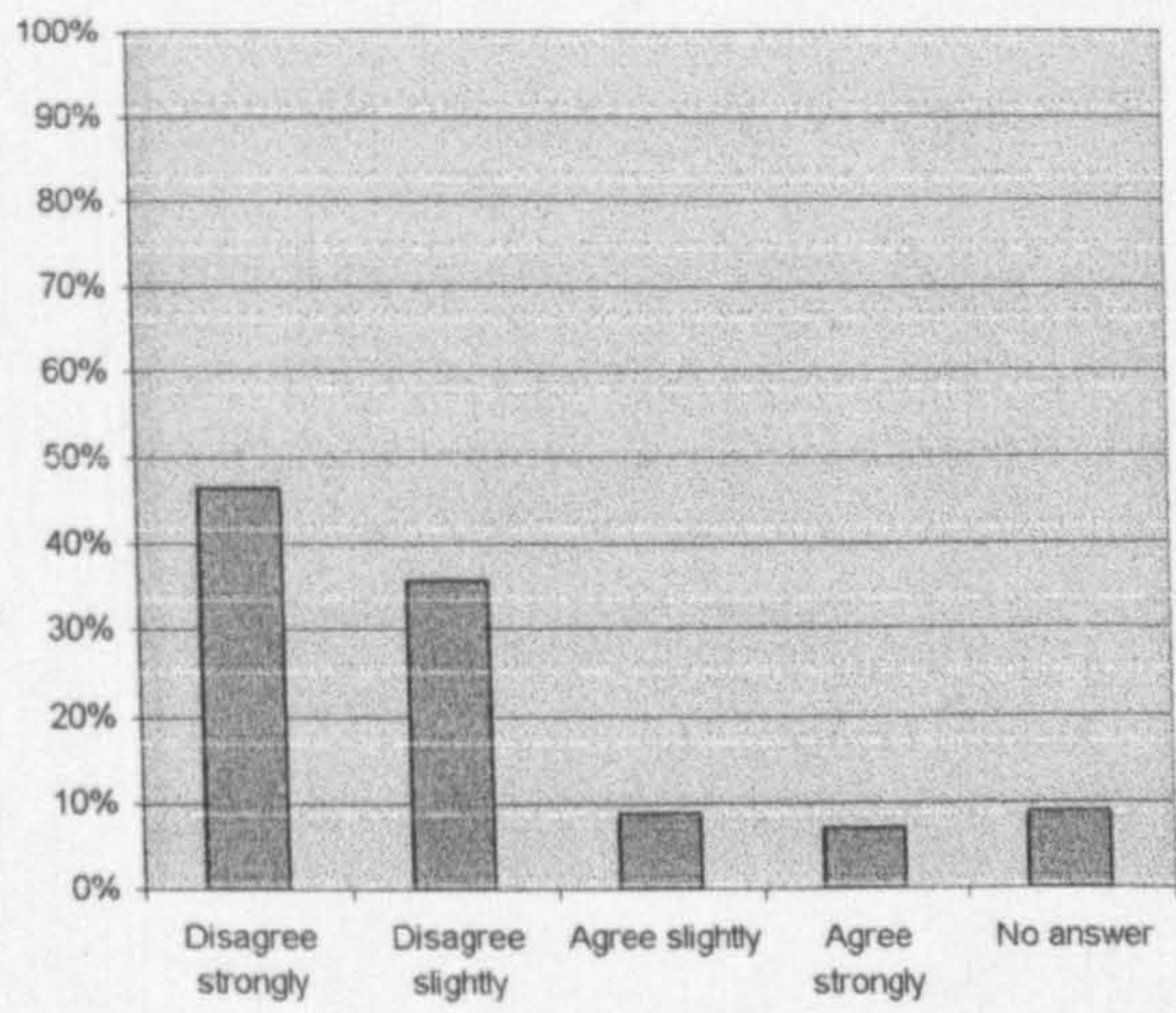
**The Regulations Have Significantly Affected Bottom Line Variations According to Registration Status**



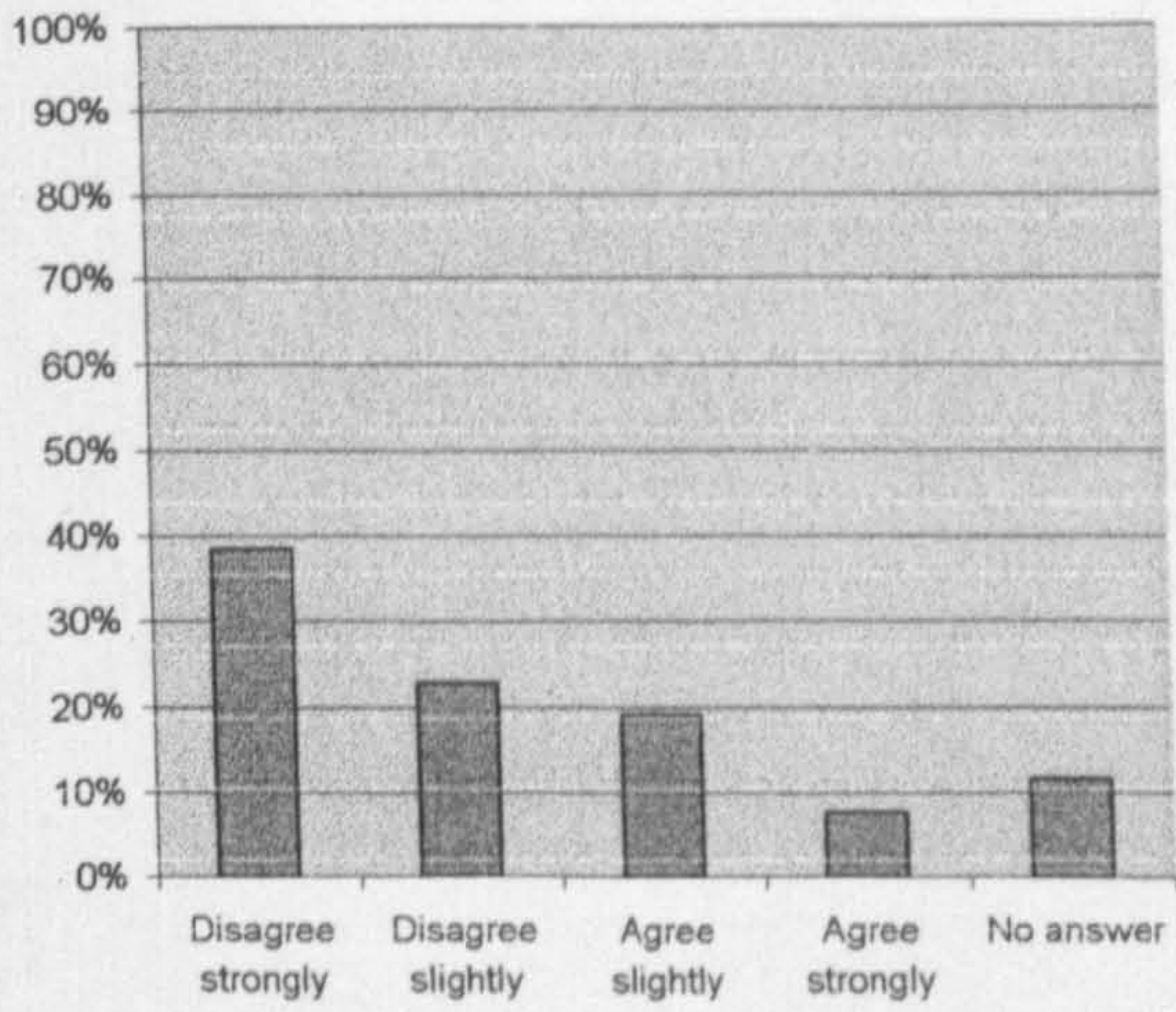
Individual Registration Has Had Deleterious Effect on Environmental Programmes



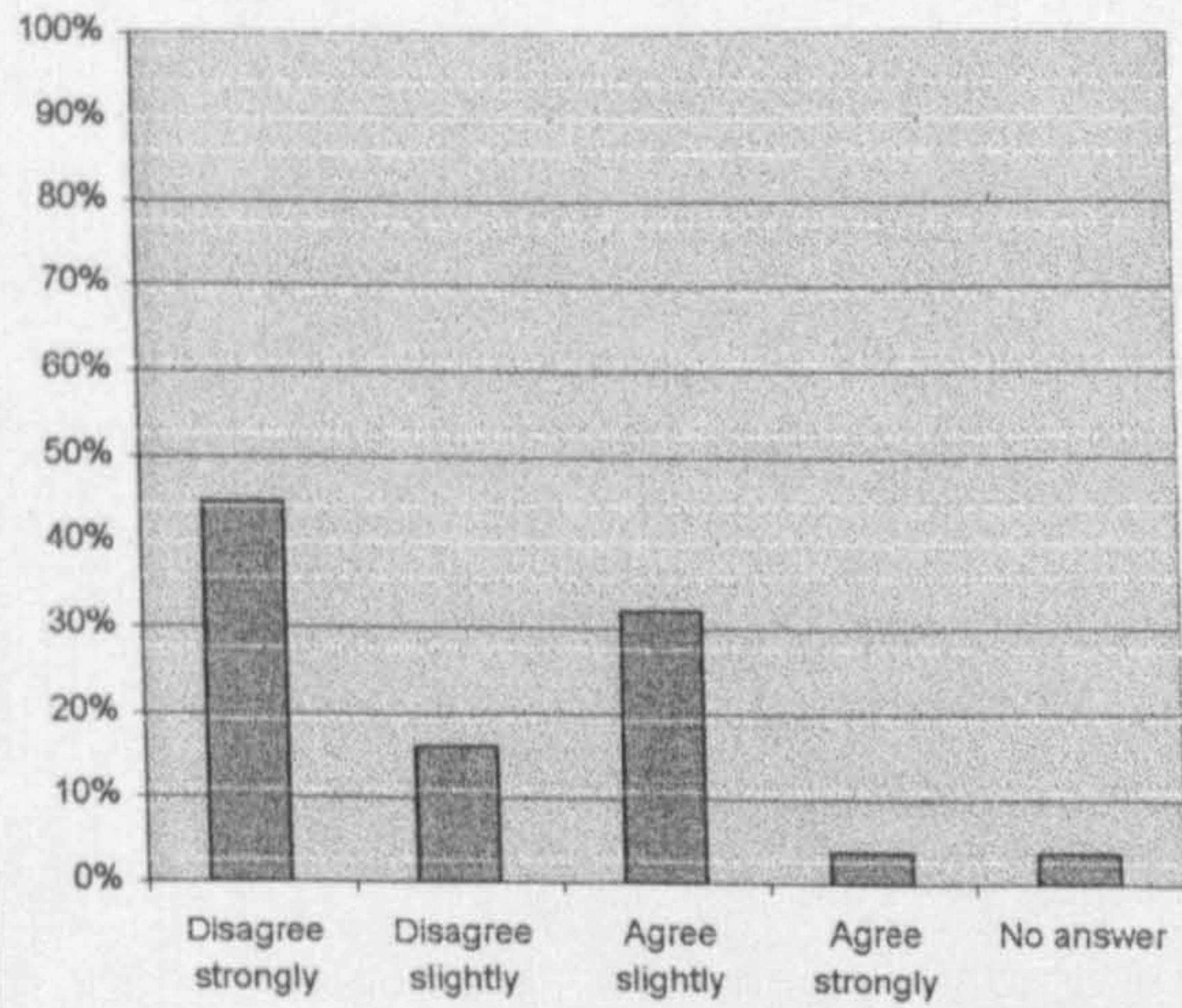
Collective Scheme Registration Has Had Deleterious Effect on Environmental Programmes



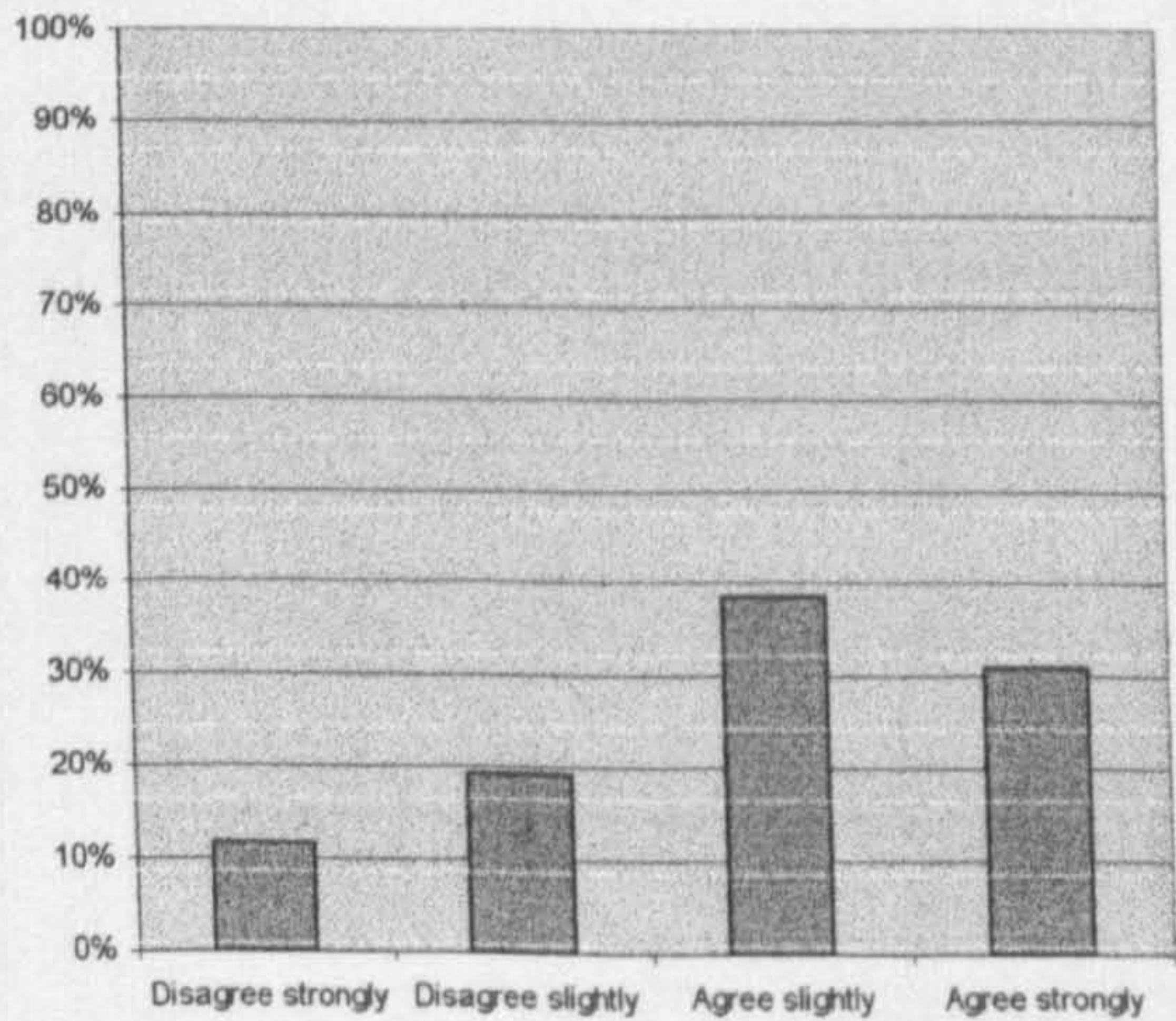
Individual Registration Has Significantly Driven Environmental Programmes



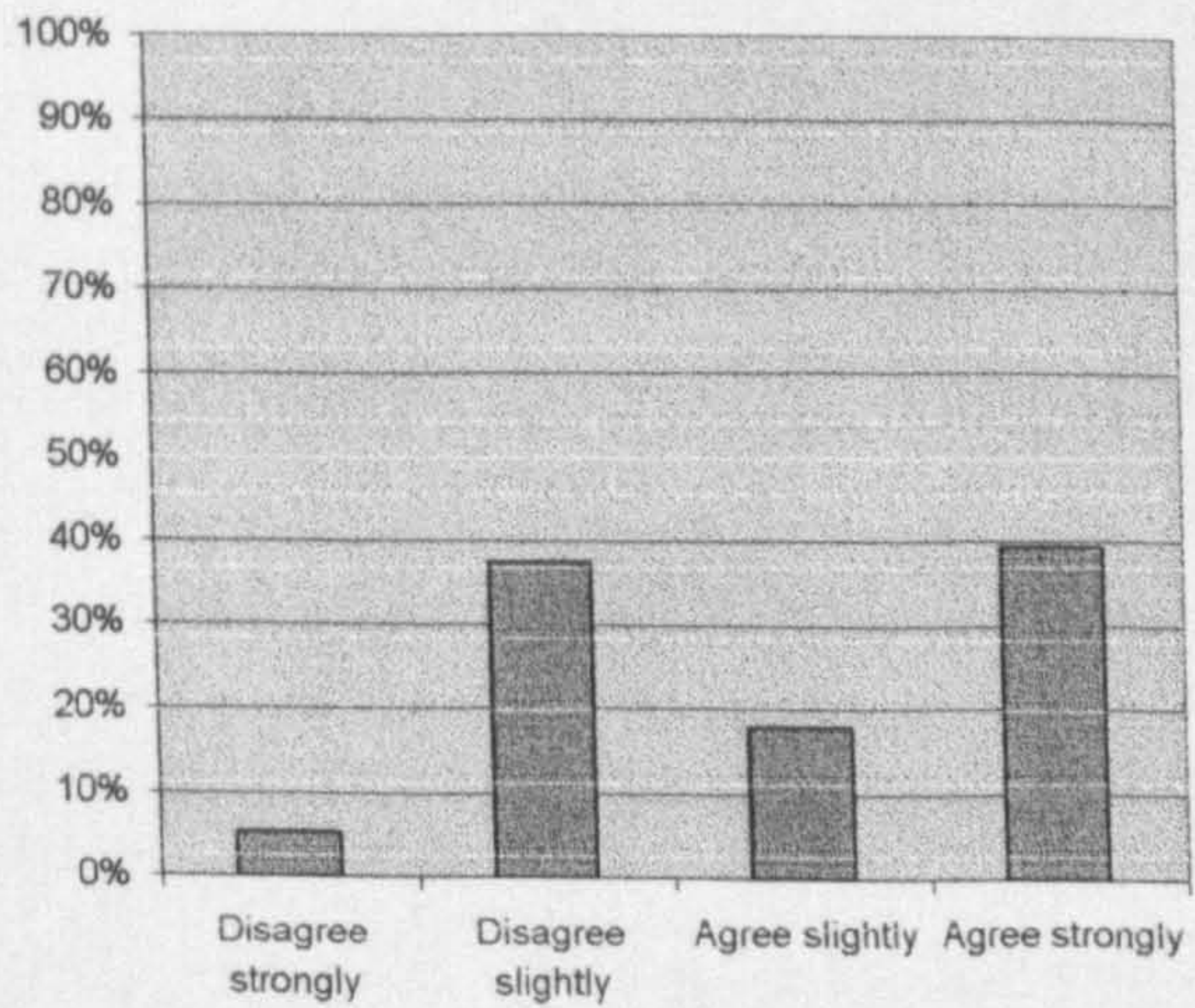
Collective Scheme Registration Has Significantly Driven Environmental Programmes



Individual Registration Has Not Had Any Effect on Environmental Programmes

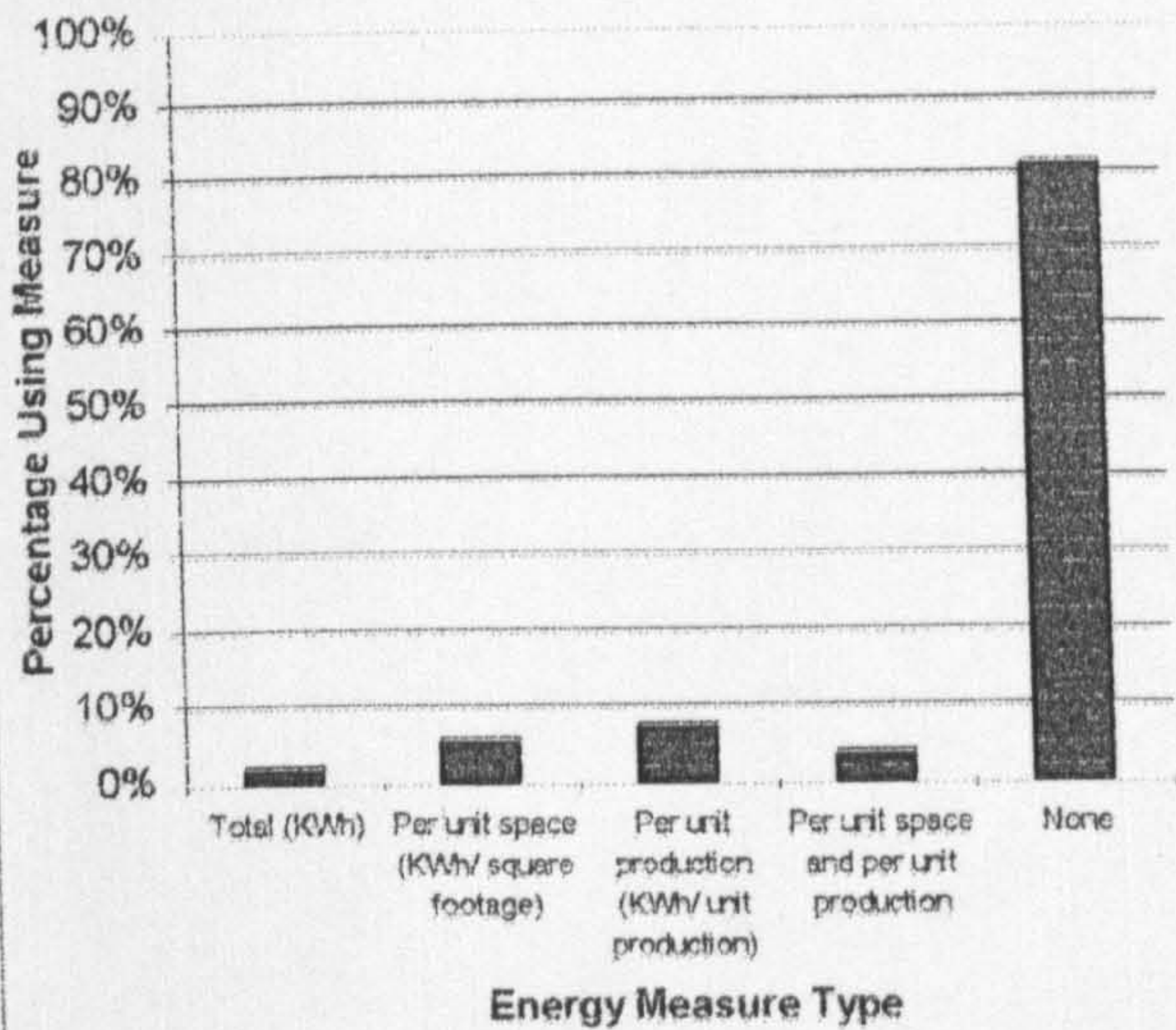


Collective Scheme Registration Has Not Had Any Effect on Environmental Programmes

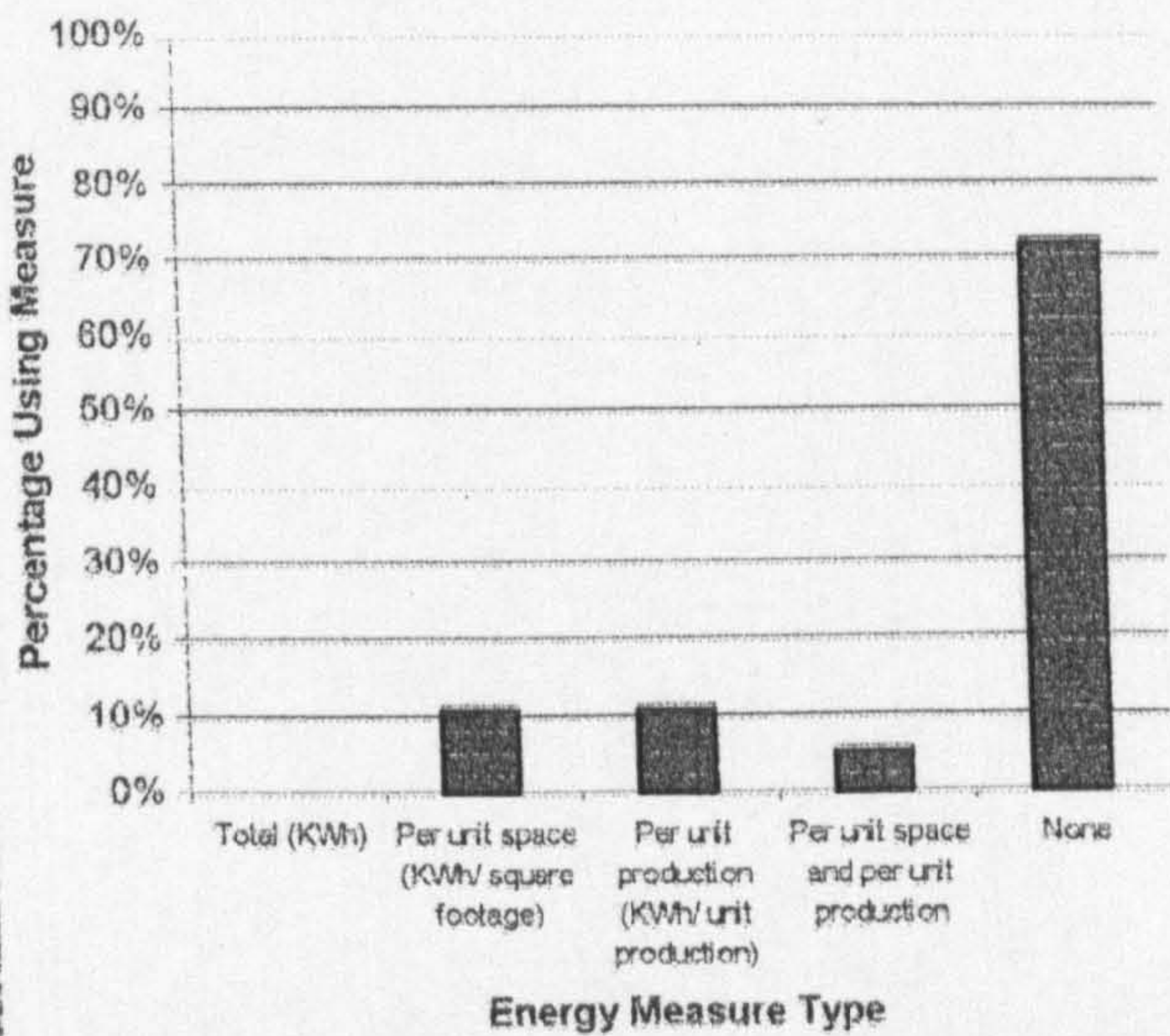




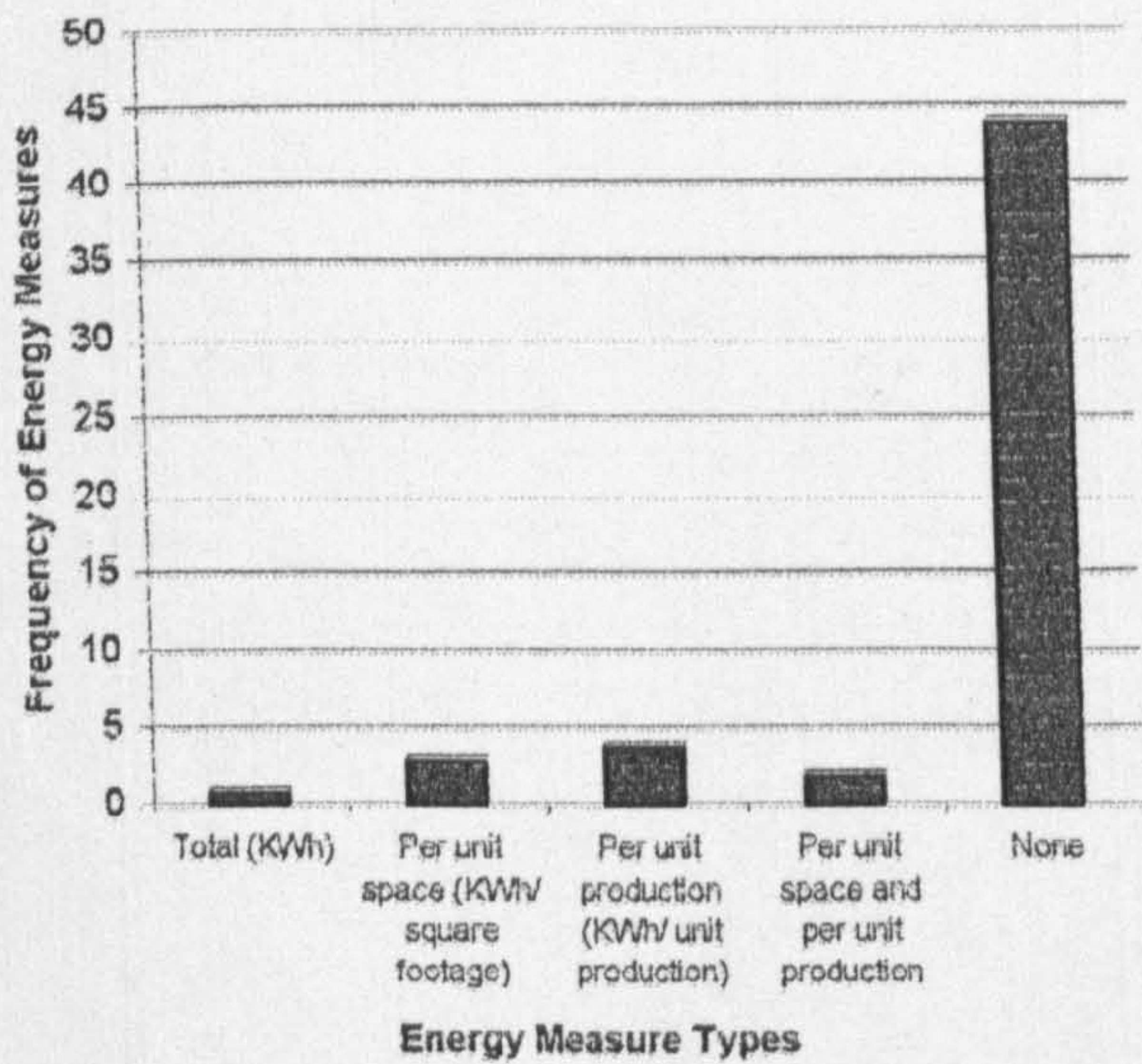
Percentage Energy Consumption Measures used by Companies in Collective Schemes



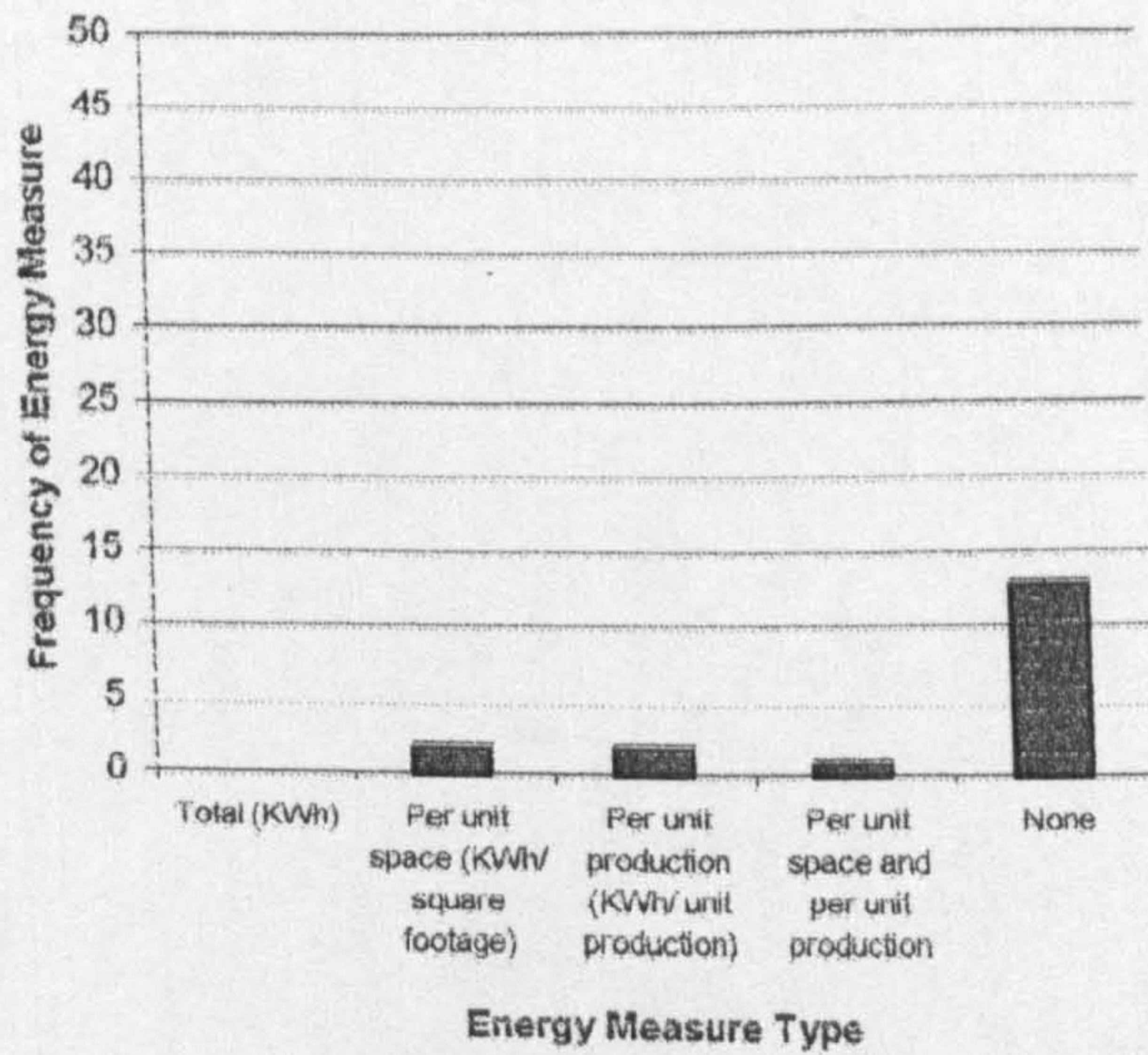
Percentage Energy Consumption Measures Used by Companies Registered with the EA



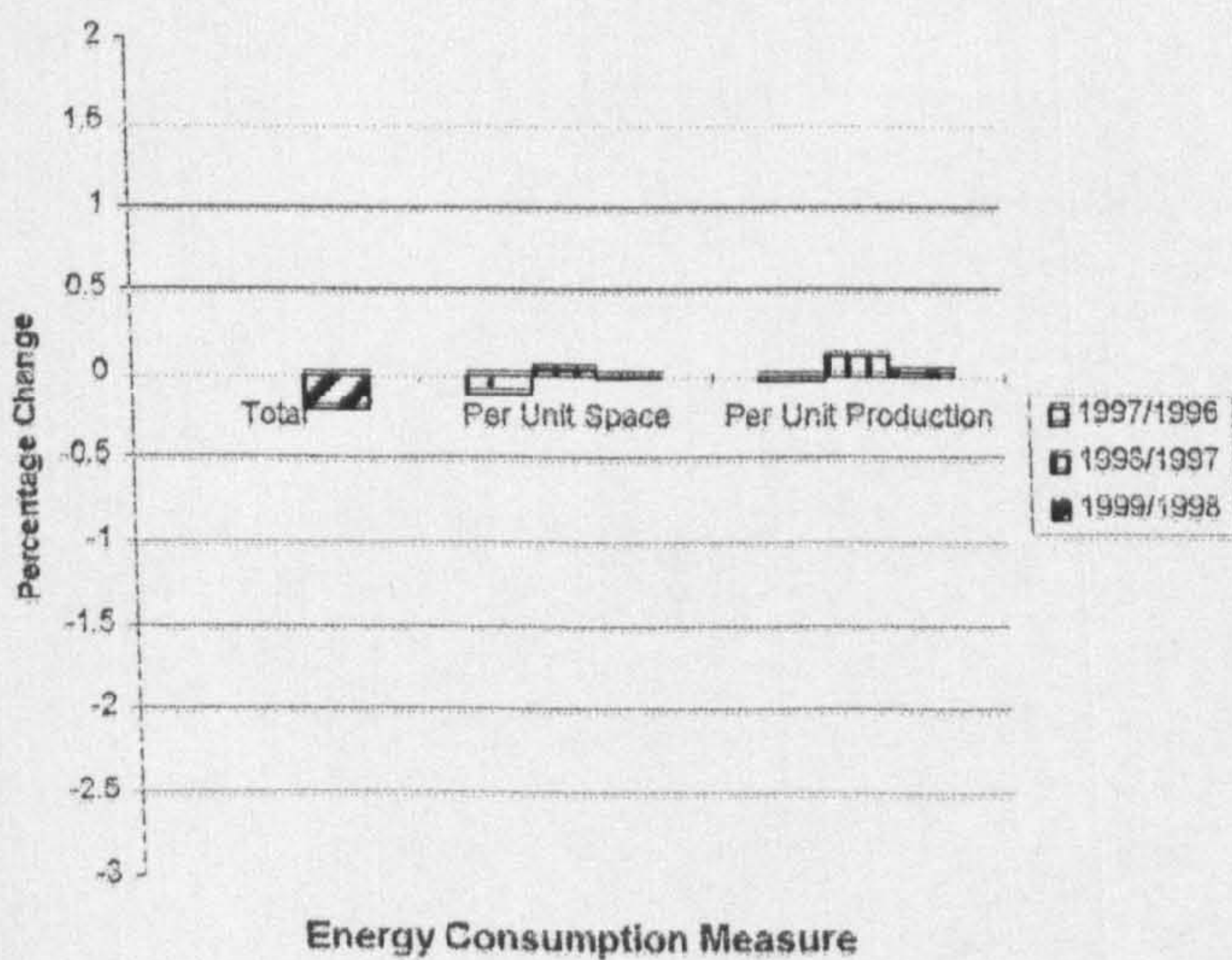
Frequency of Energy Consumption Measures Used by Collective Schemes



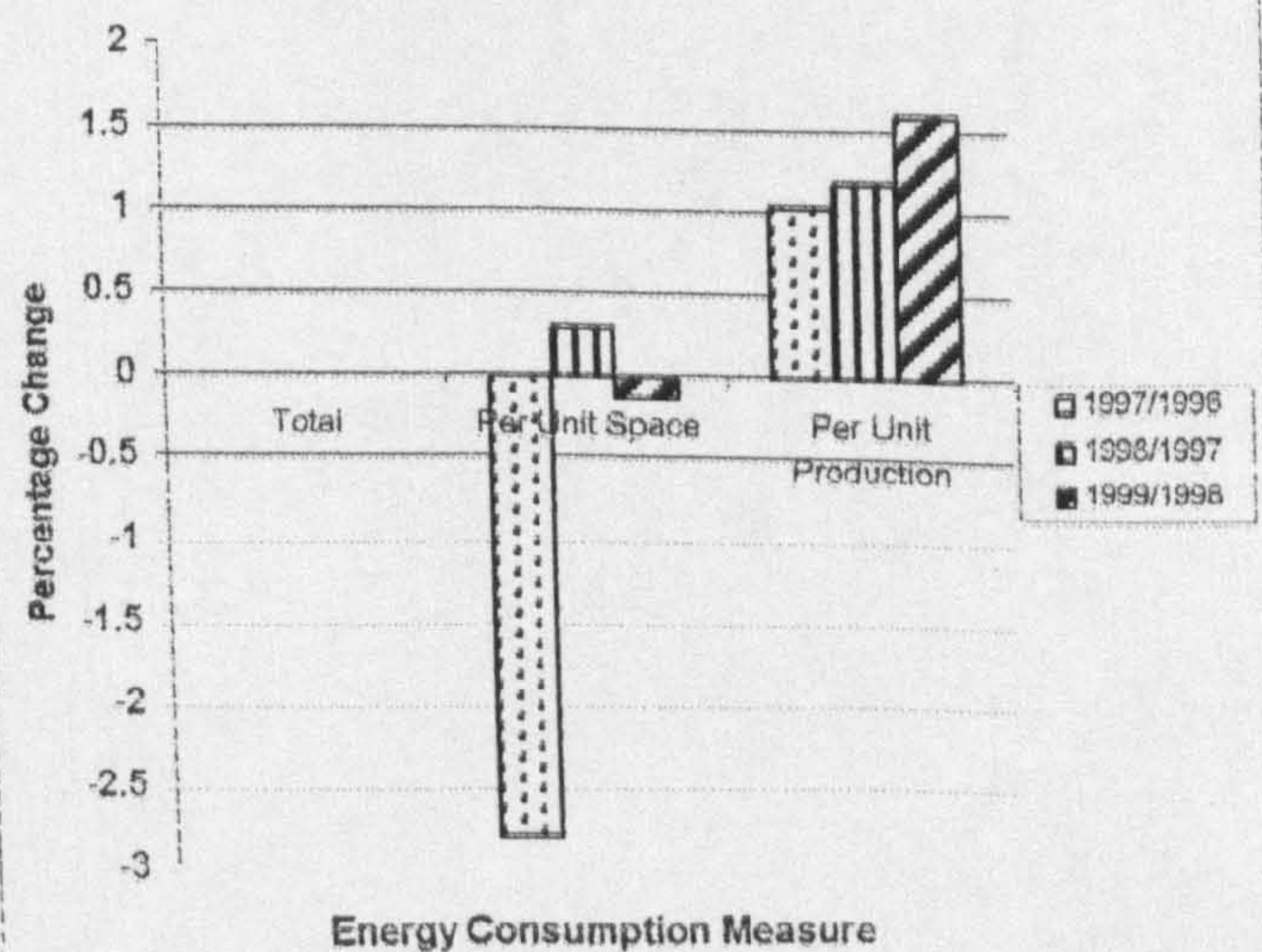
Frequency Energy Measure Types Used by Companies Registered with the EA



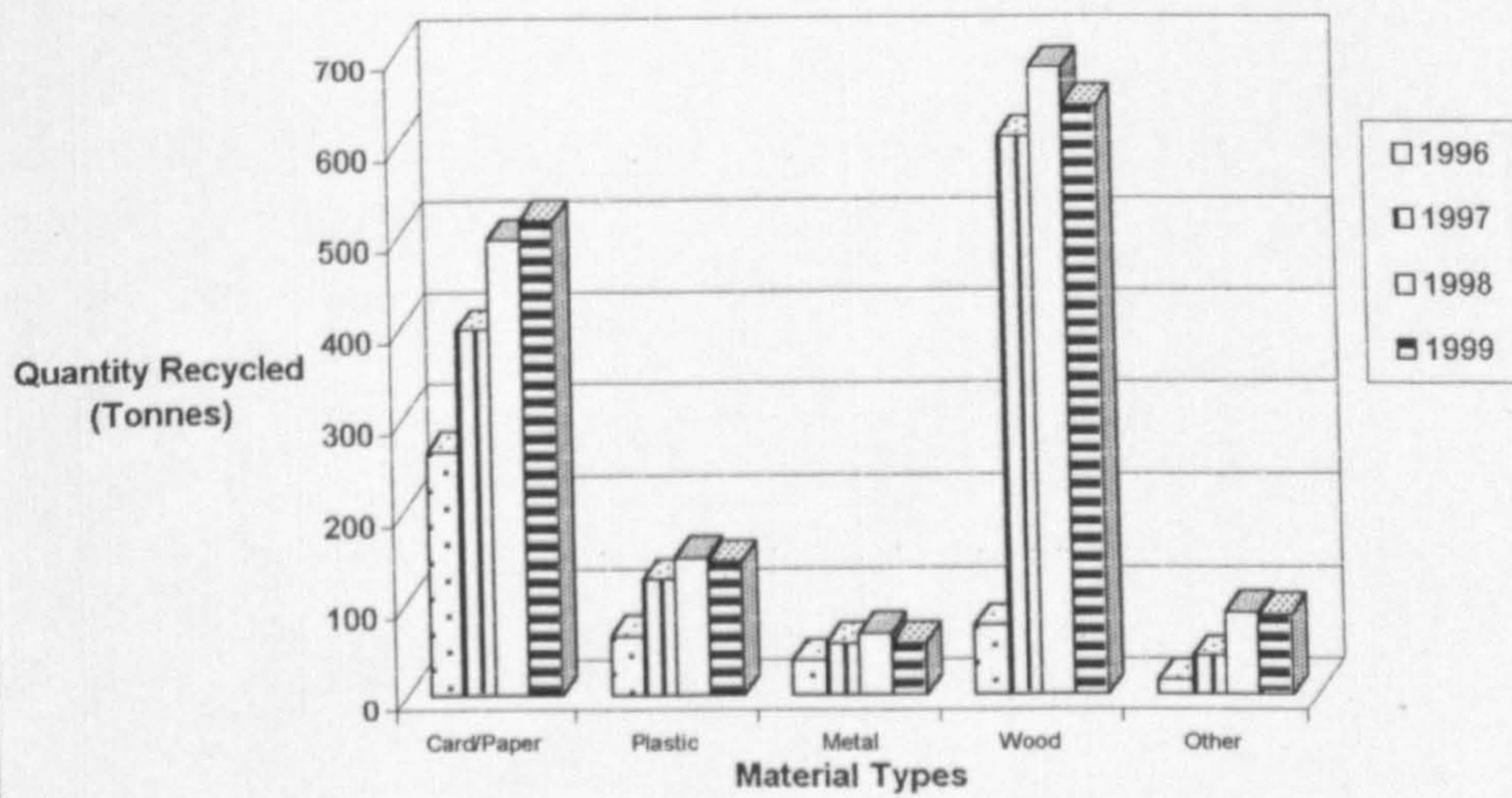
Percentage Change in Energy Consumption by Companies in Collective Schemes



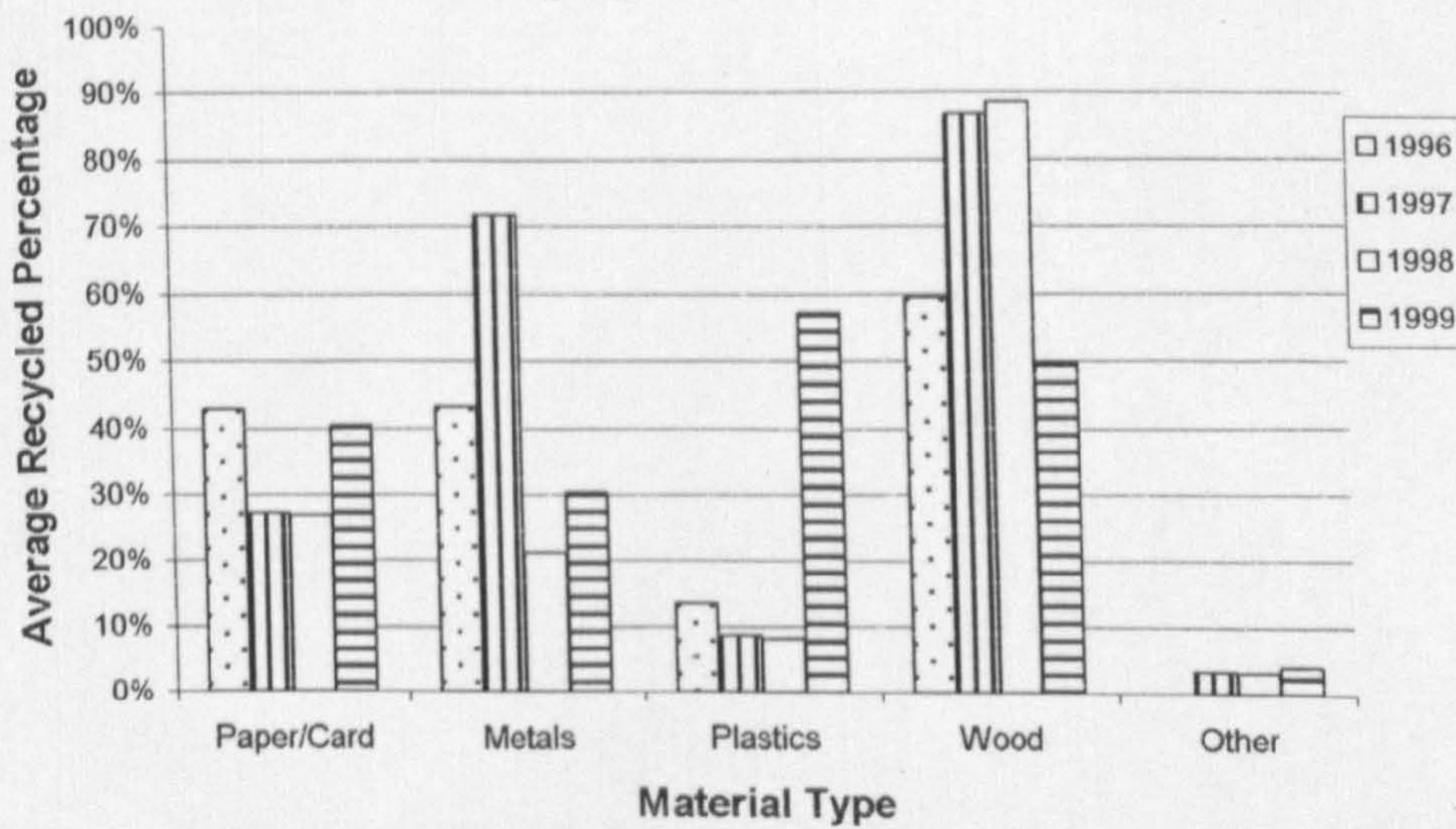
Percentage Change in Energy Consumption by Companies Registered with the Environment Agency



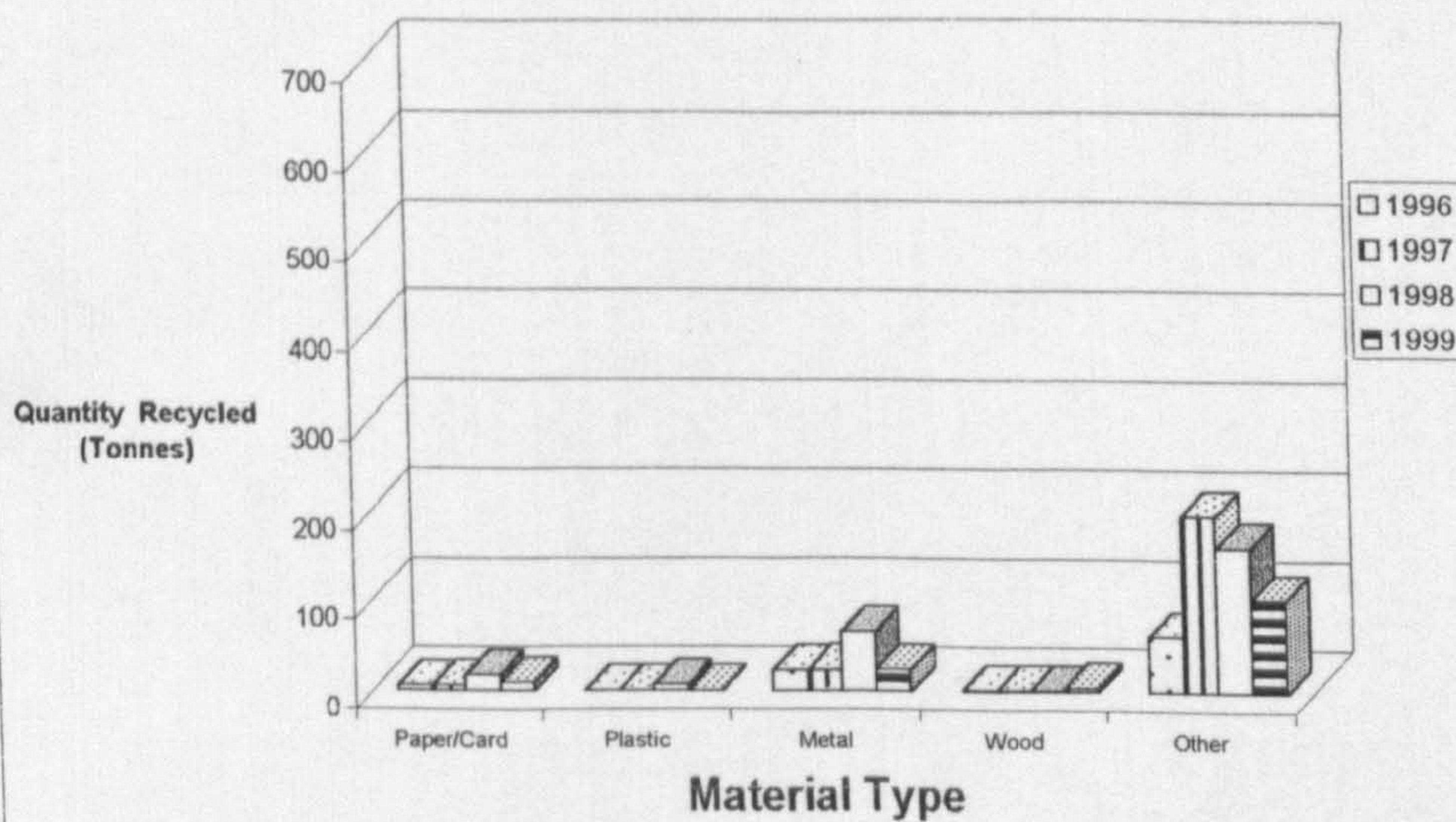
**Average Quantities of Packaging Recycled**



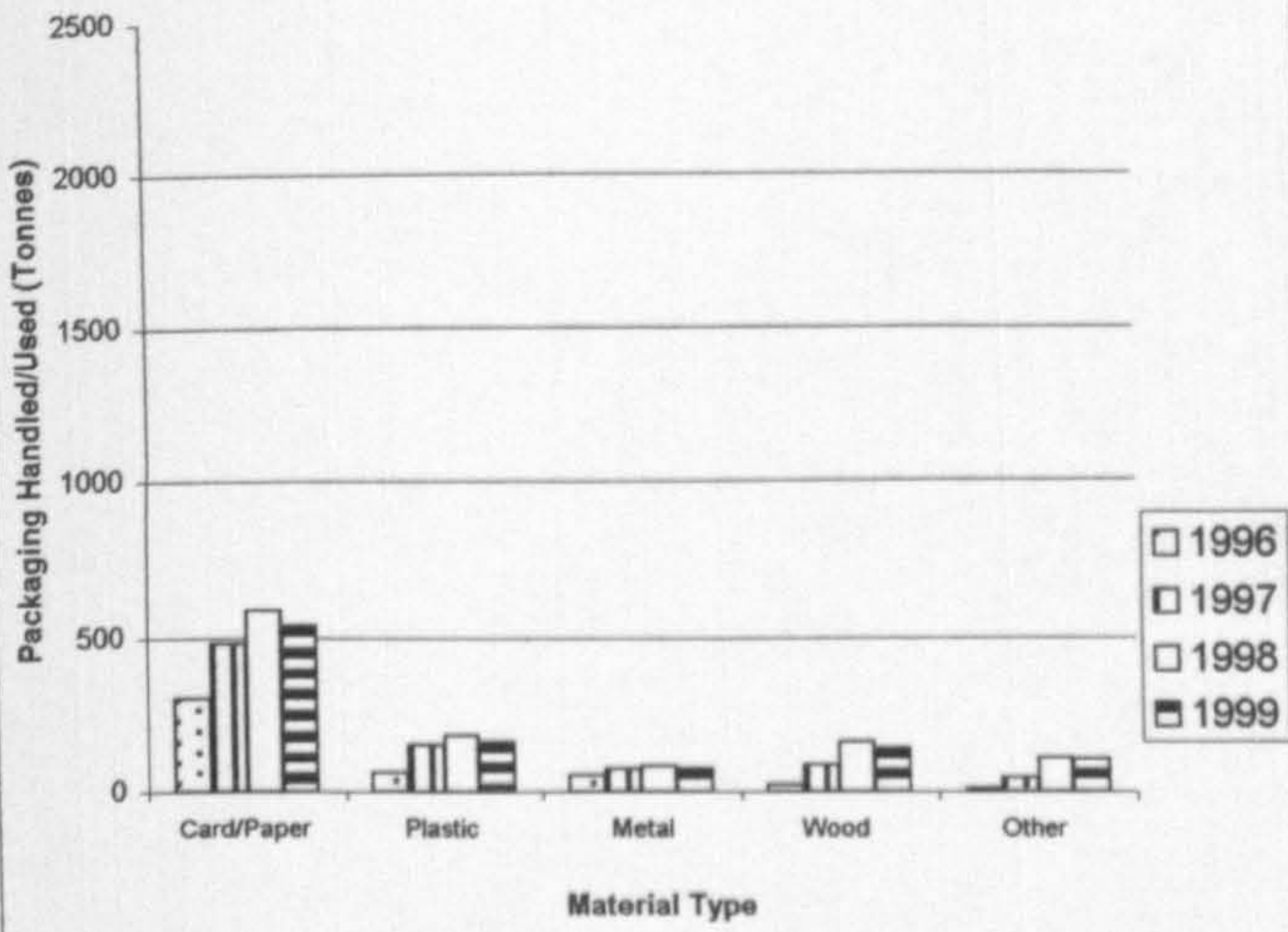
**Average Material Recycling as a Percentage of Packaging Material Handled**



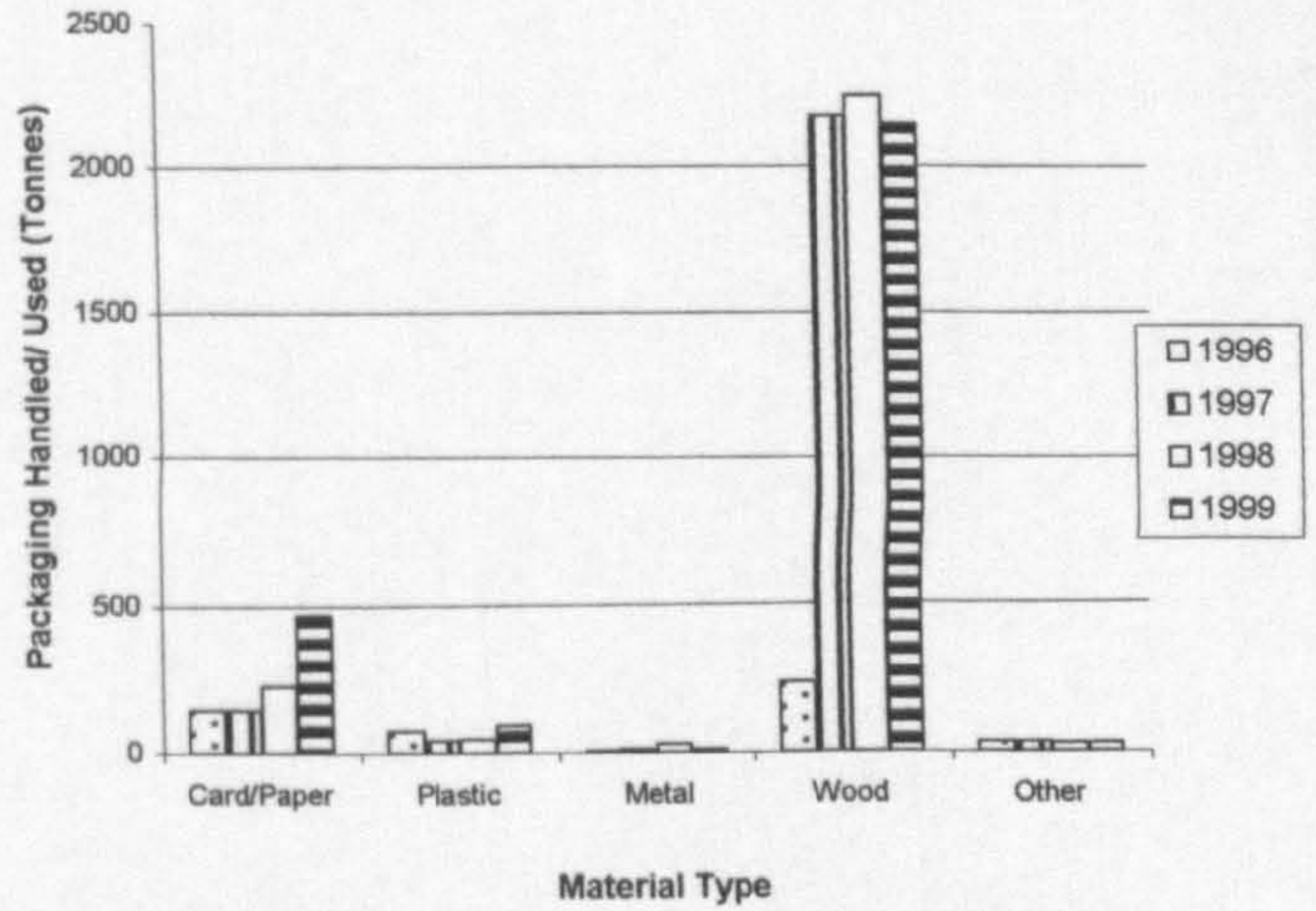
**Average Quantities of Non-packaging Recycled**



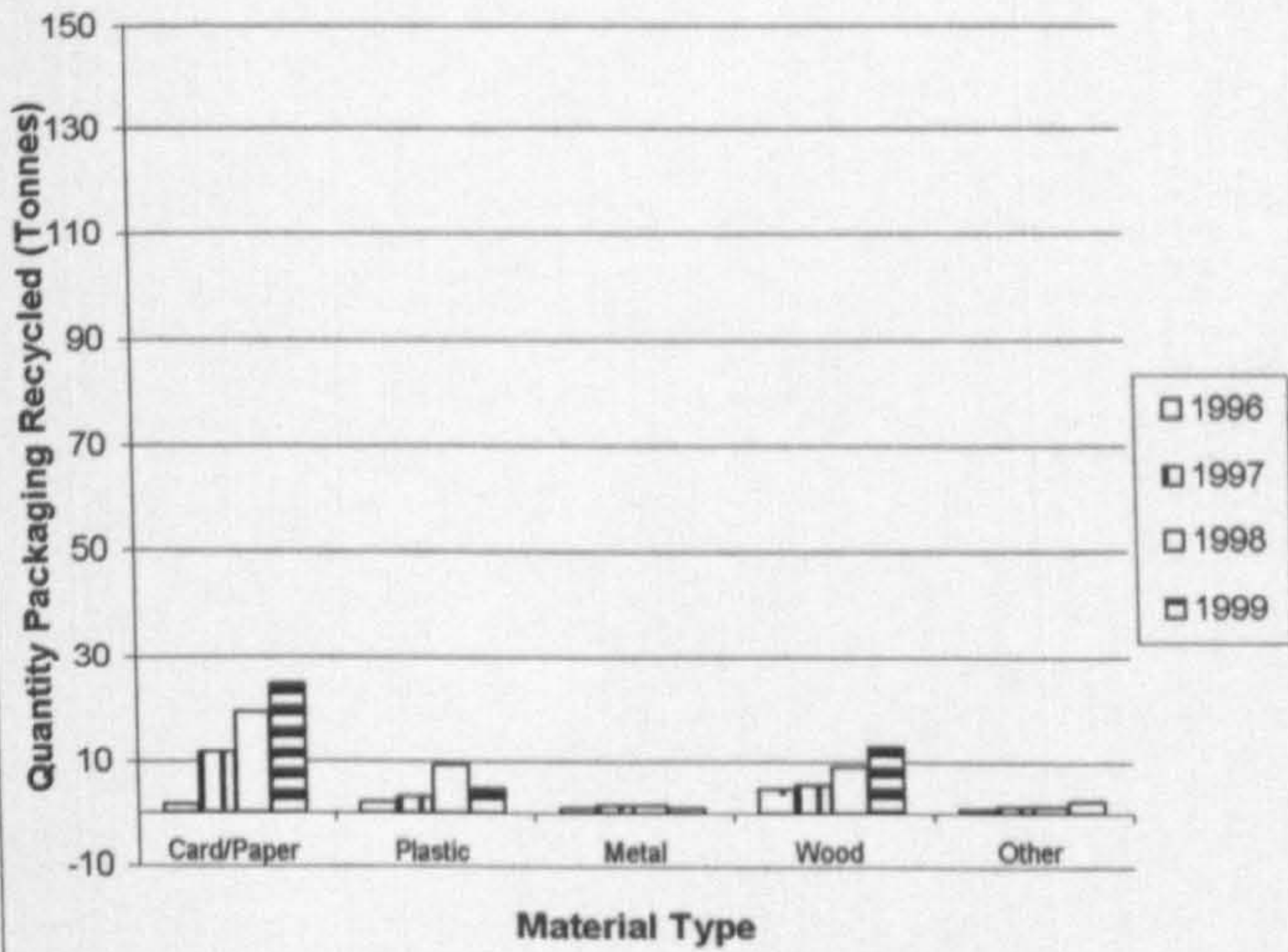
**Packaging Handled/ Used by Companies in Collective Schemes**



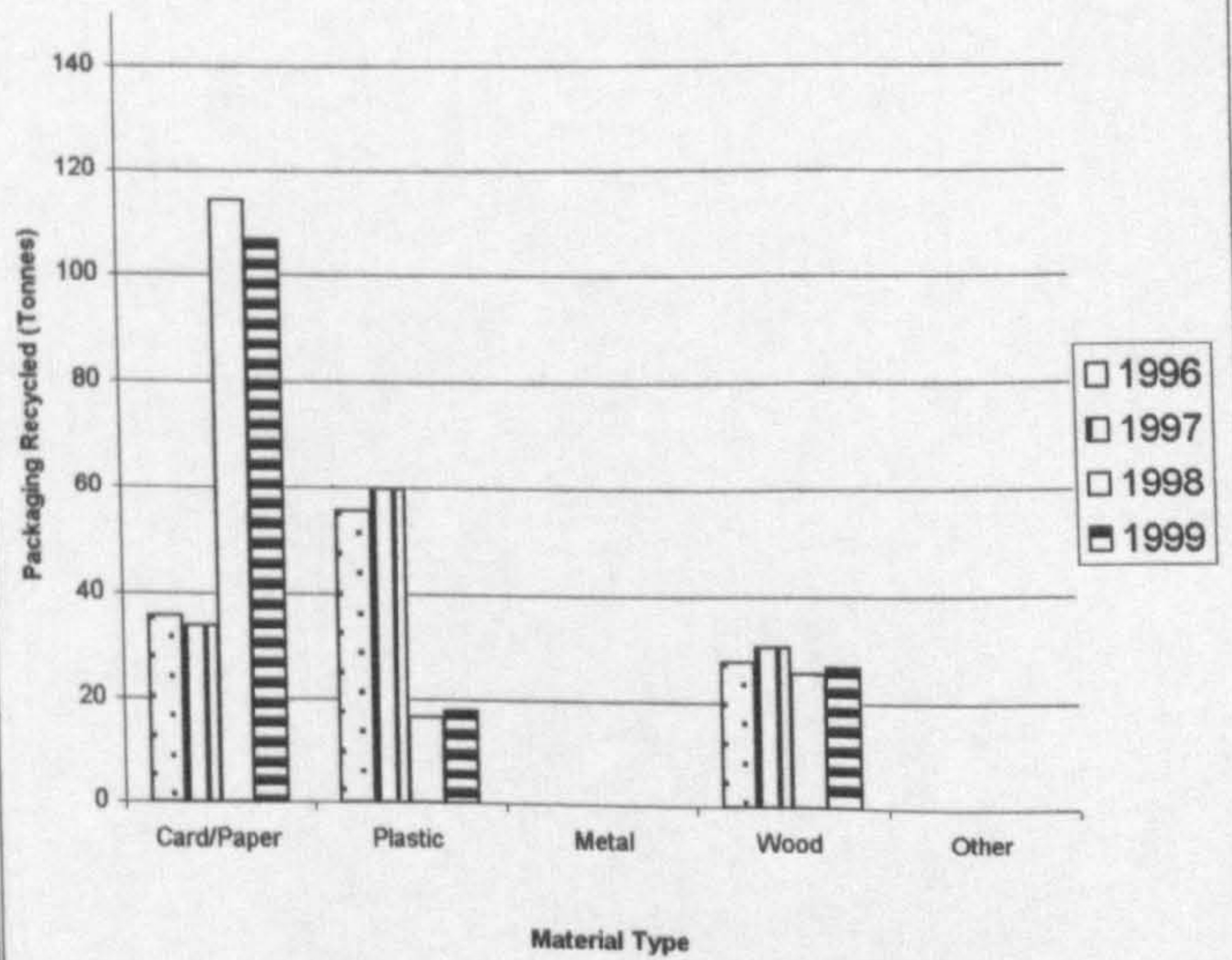
**Packaging Handled/ Used by Companies Registered with the EA**



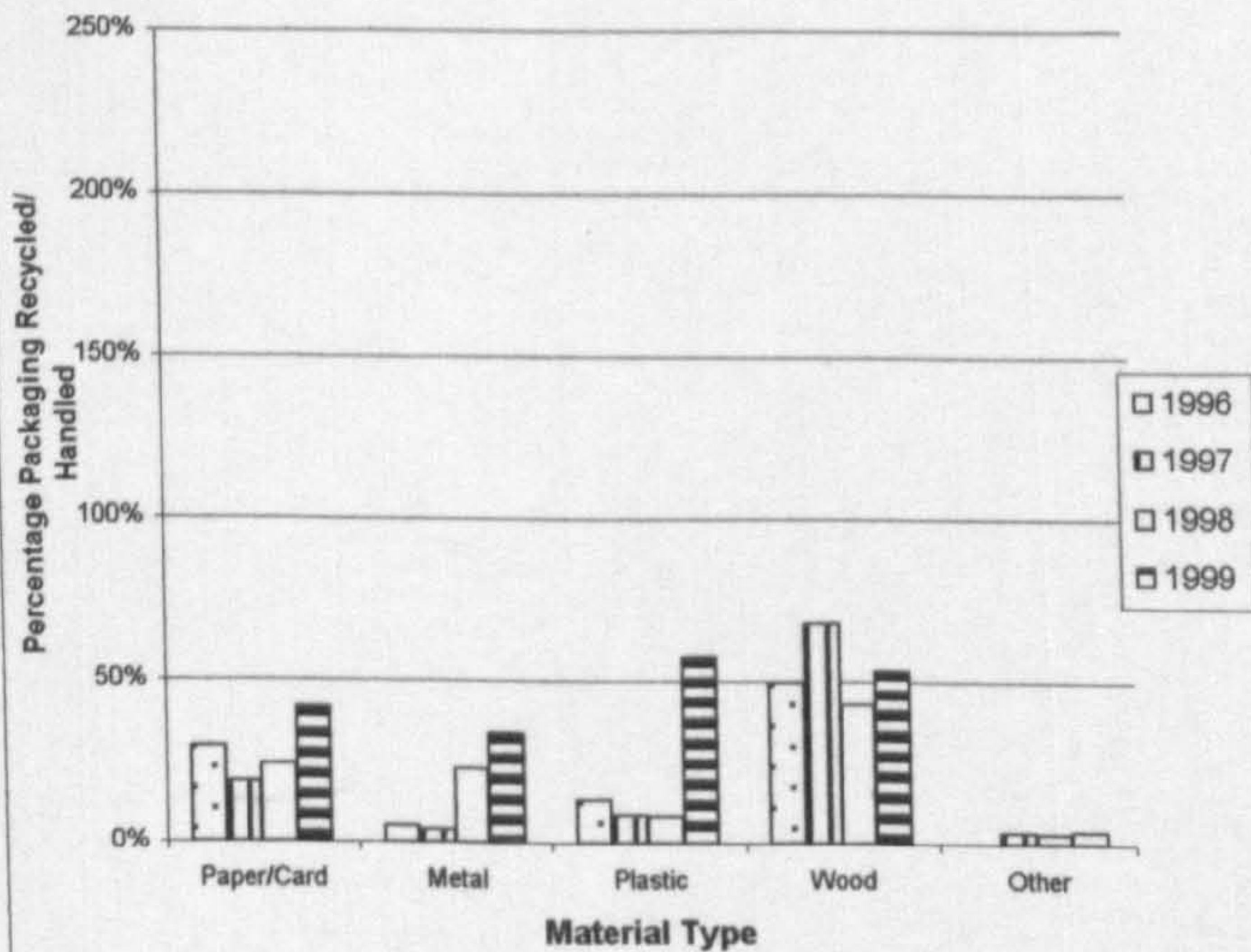
**Packaging Recycled by Collective Scheme Members**



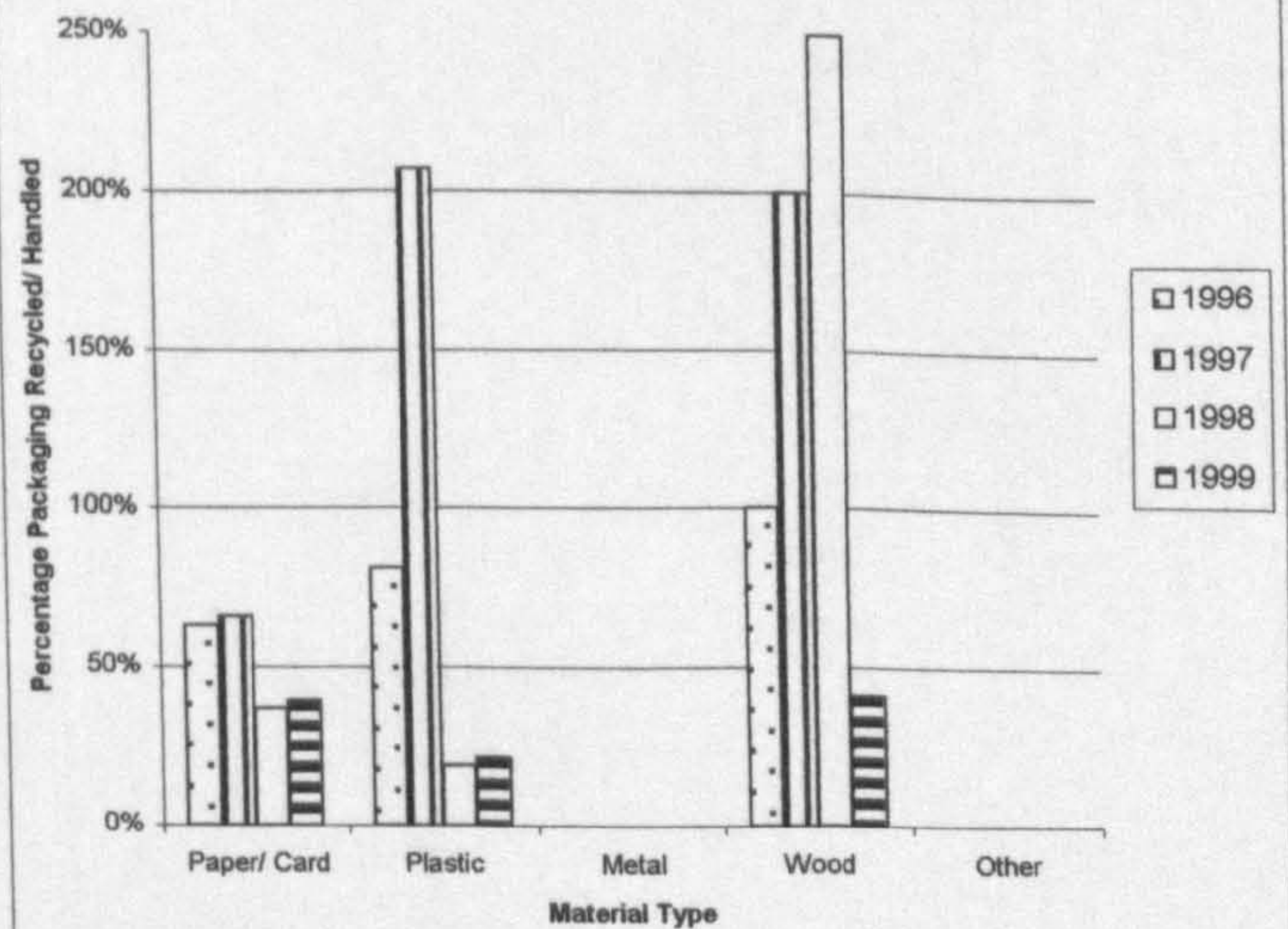
**Packaging Recycled by Environment Agency Registered Companies**



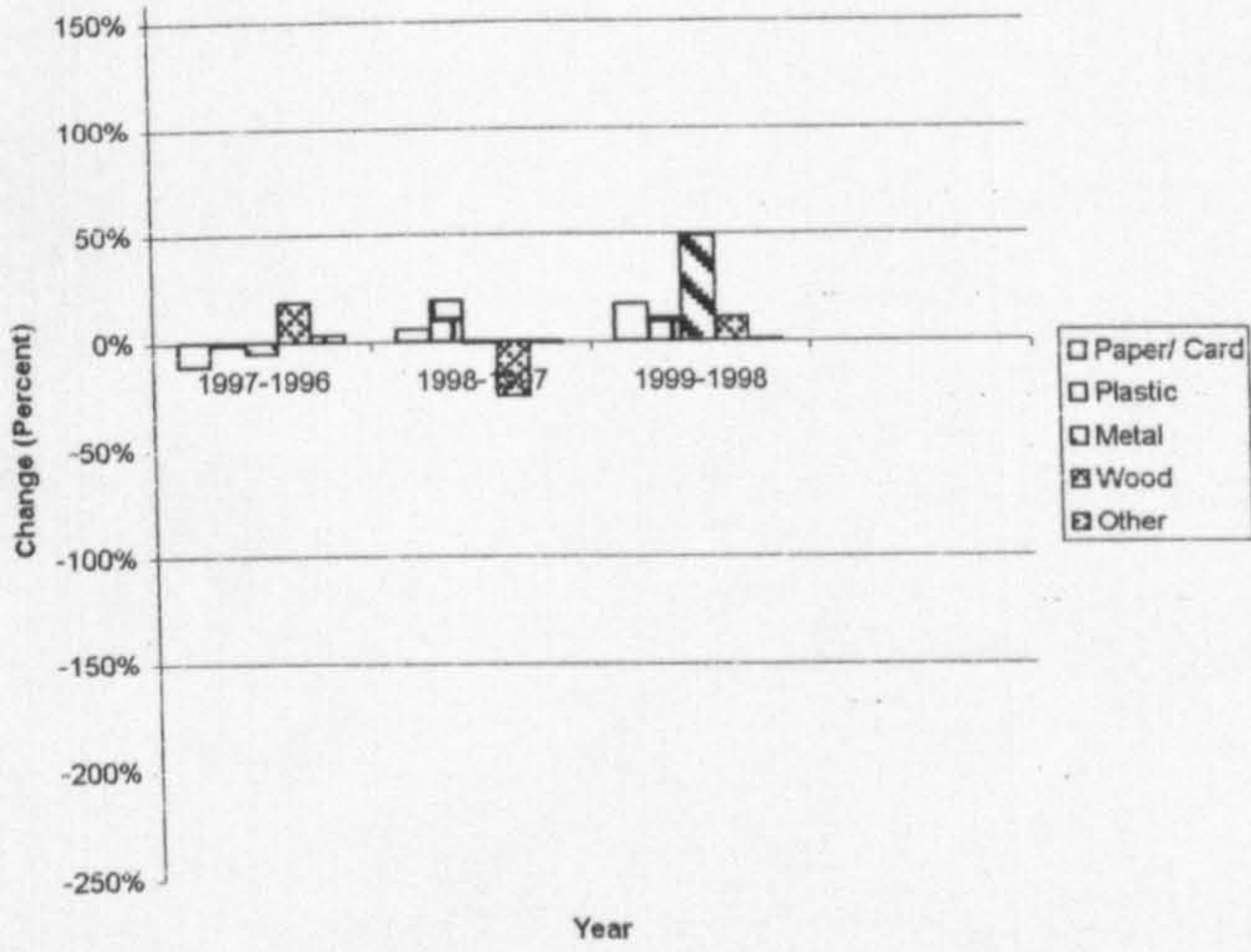
**Packaging Recycled as a Percentage of Packaging Handled by Collective Scheme Members**



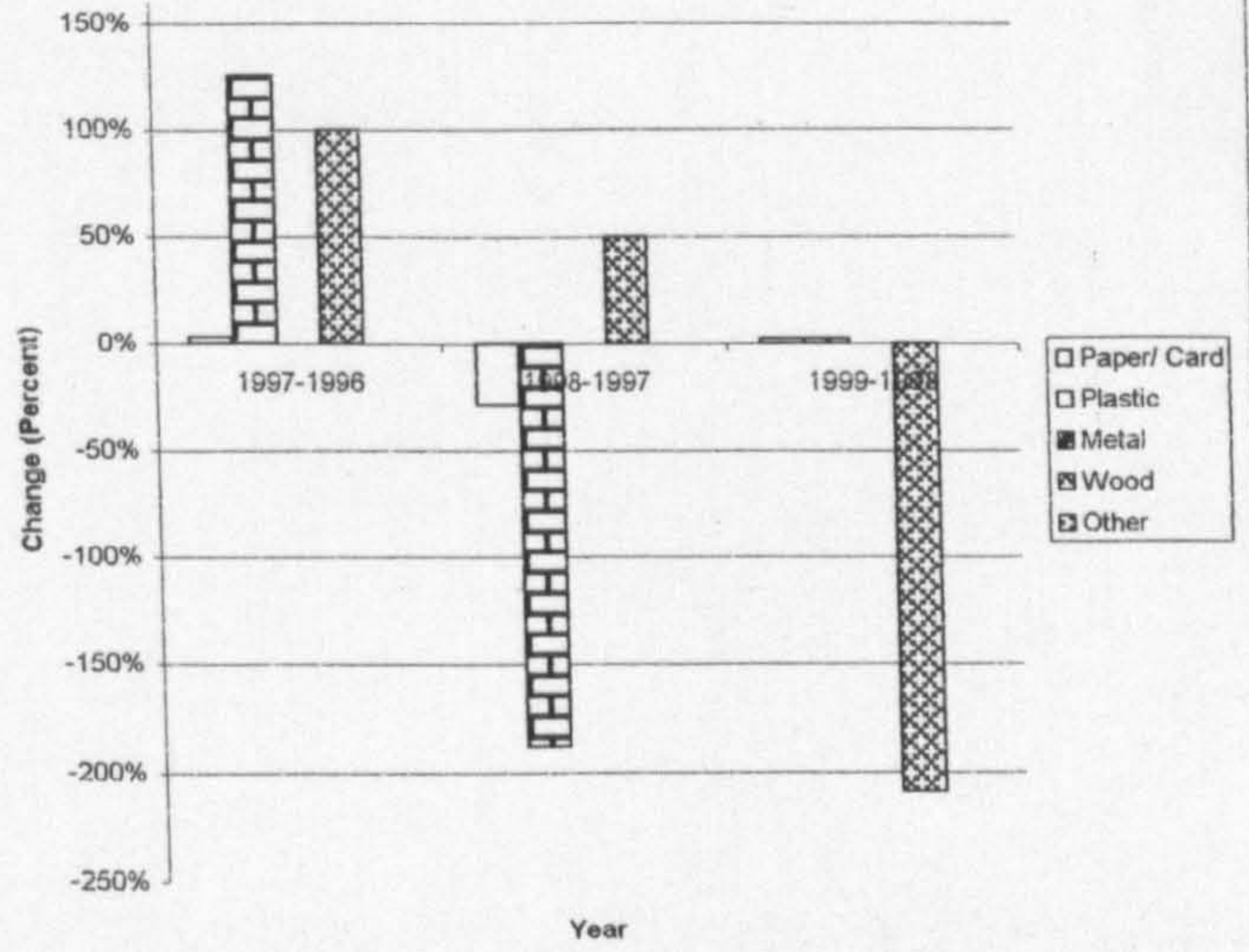
**Packaging Recycled as a Percentage of Packaging Handled by EA Registered Companies**



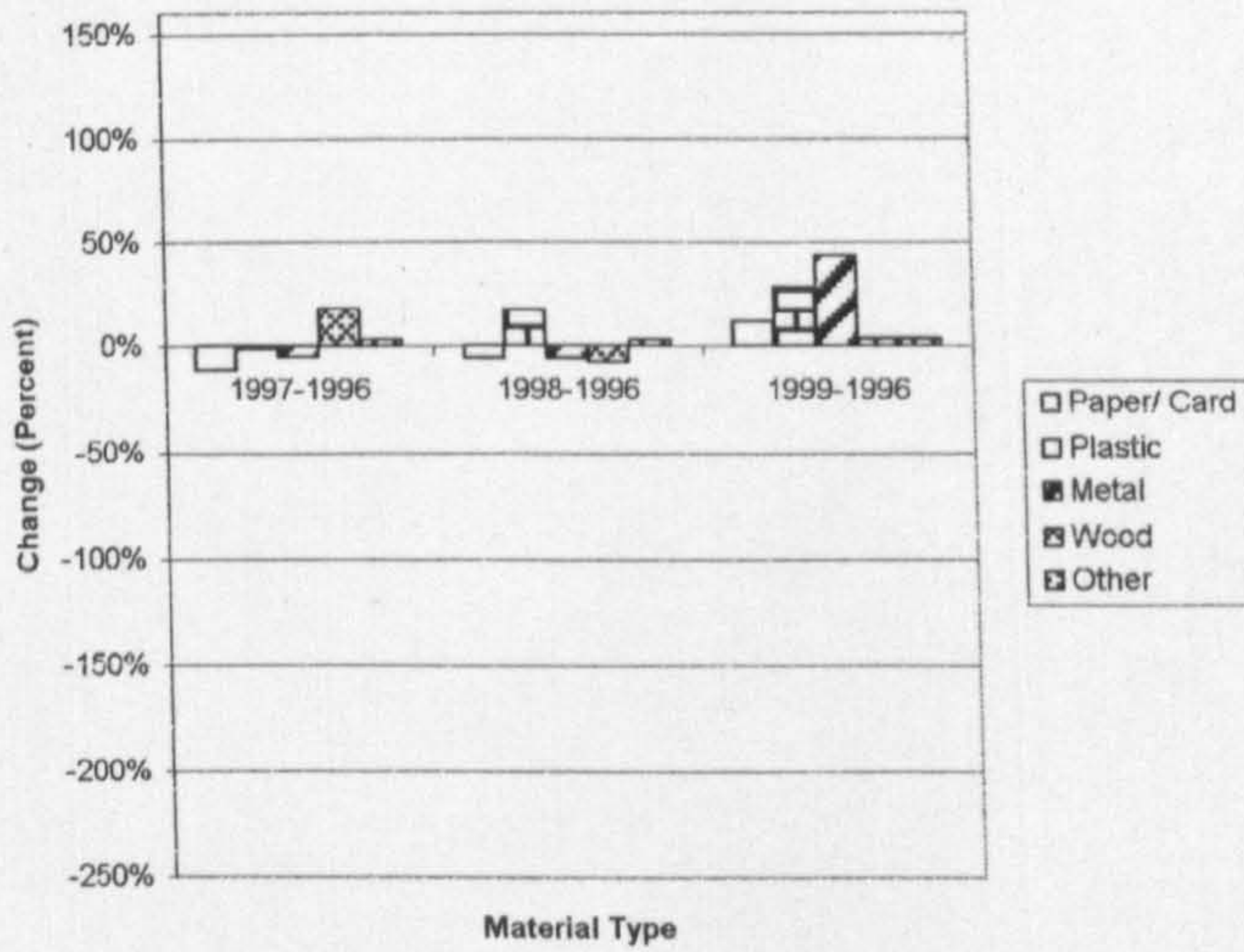
Annual Change in Packaging Recycling as a percentage of Packaging Handled by Companies Registered with Collective Schemes



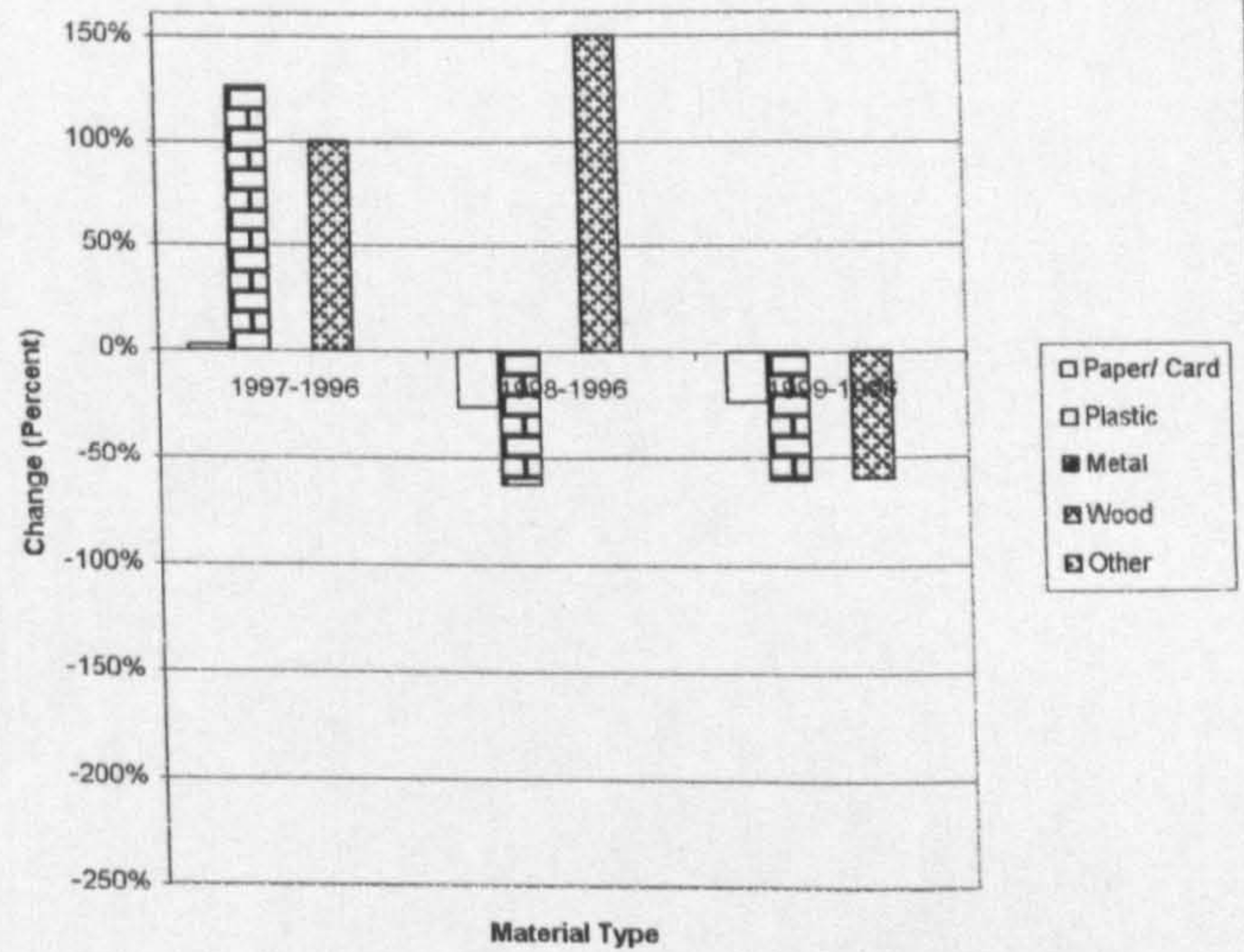
Annual Change of Packaging Recycled as a Percentage of Packaging Handled by EA Registered Companies



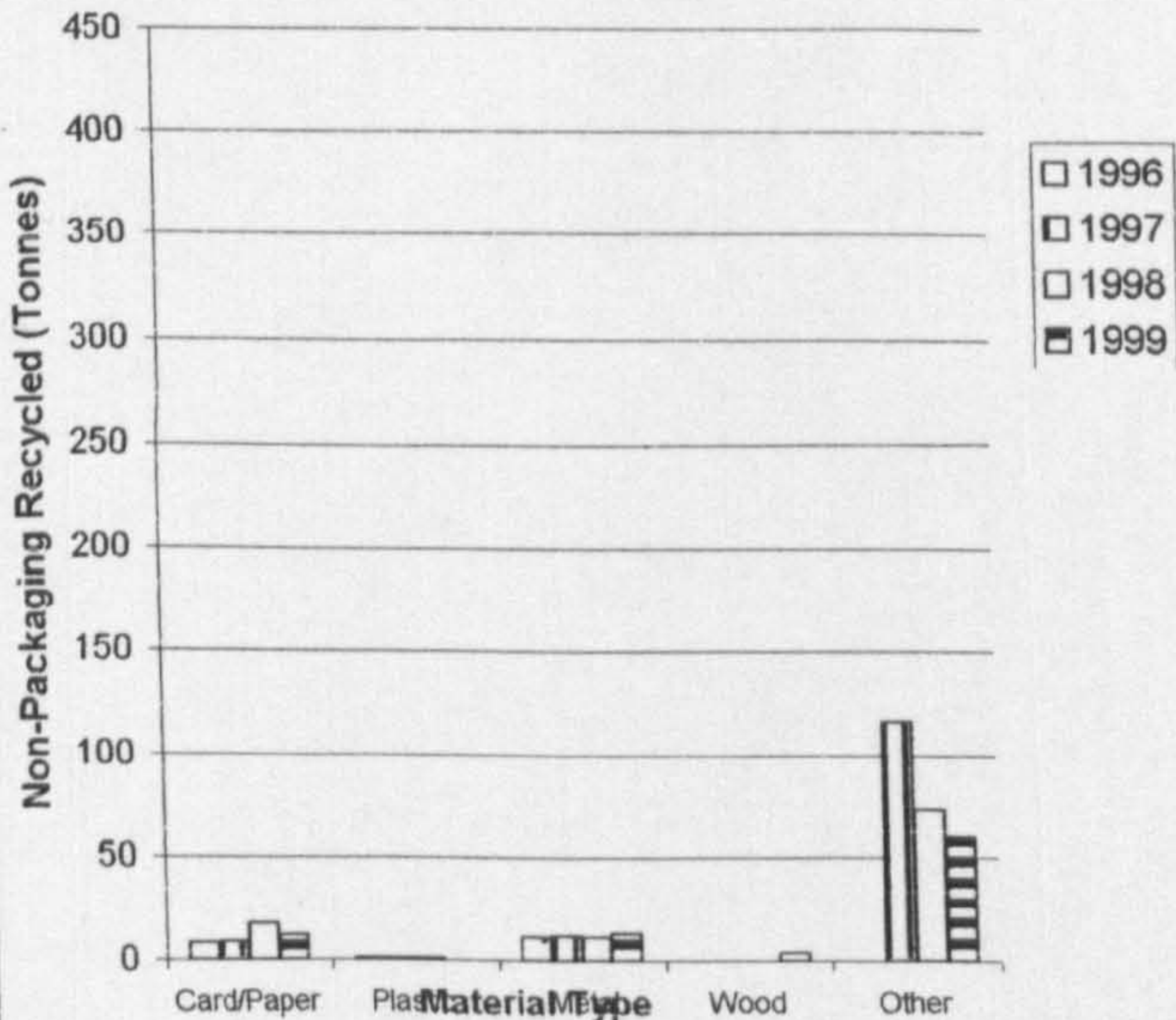
Average Change in Packaging Recycled as a Percentage of Packaging Handled Compared with 1996 by Companies Registered with Collective Schemes



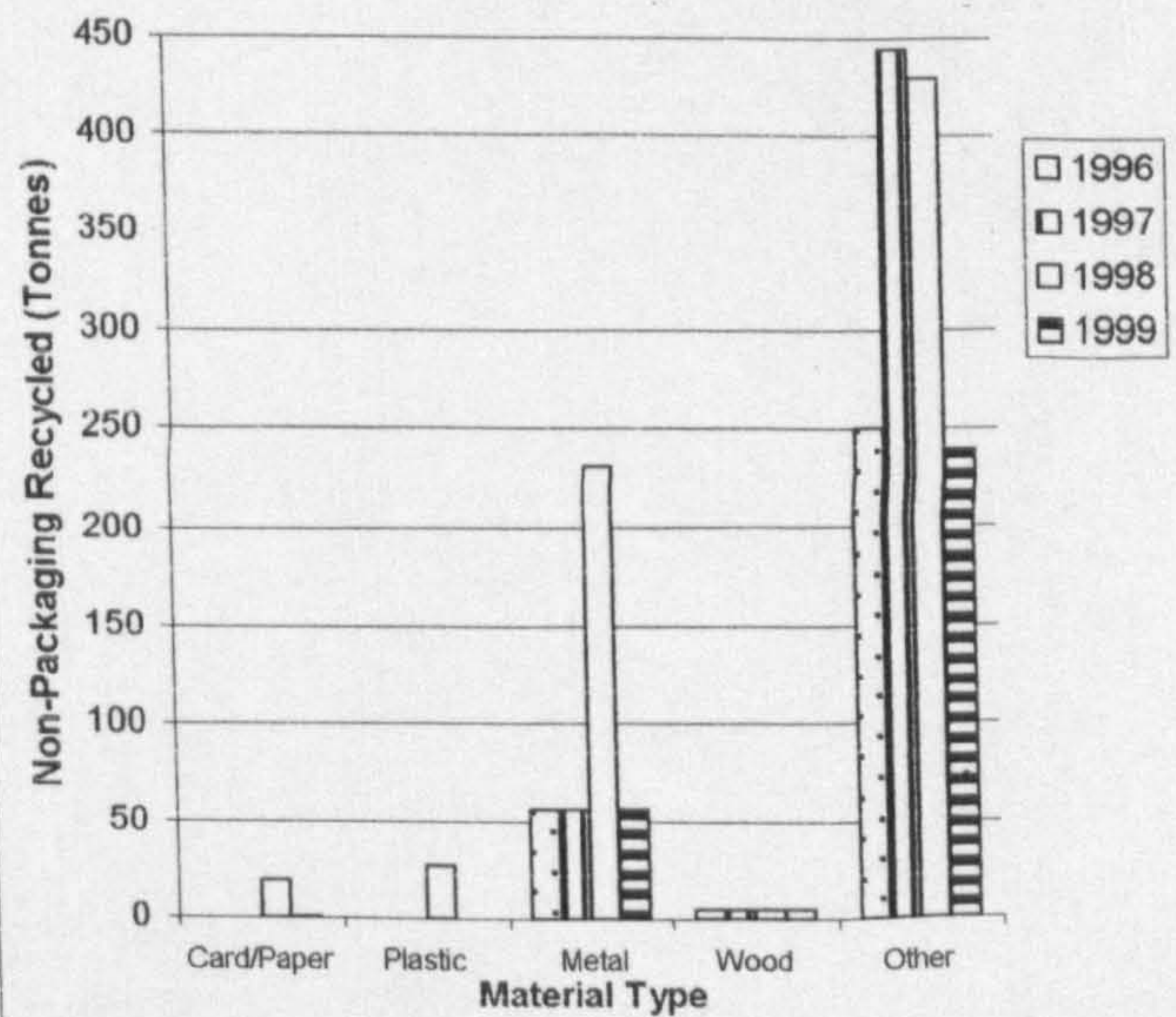
Average Change in Packaging Recycled as a Percentage of Packaging Handled Compared with 1996 by Companies Registered with the EA



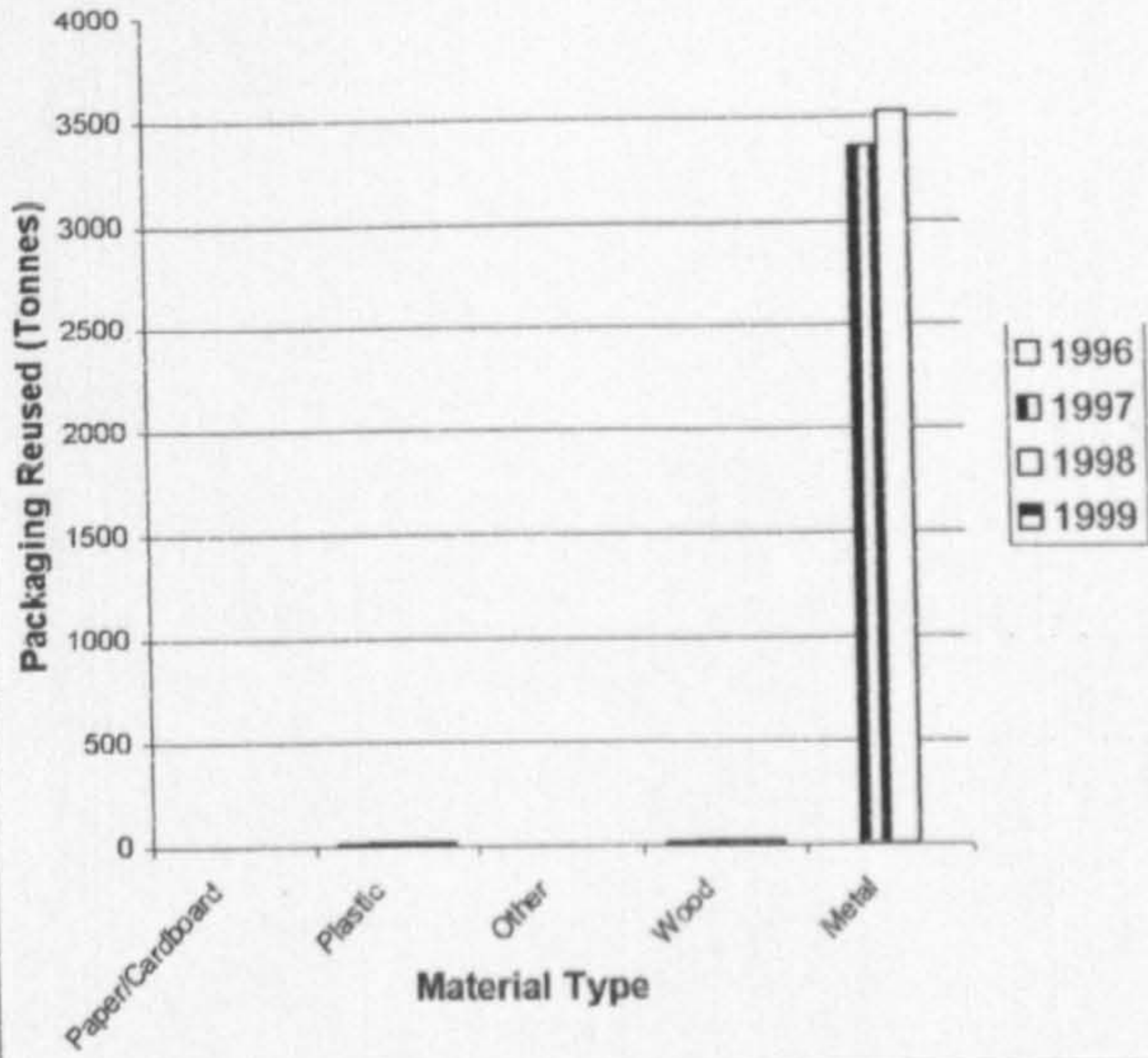
Non-Packaging Recycled by Companies Registered with Collective Schemes



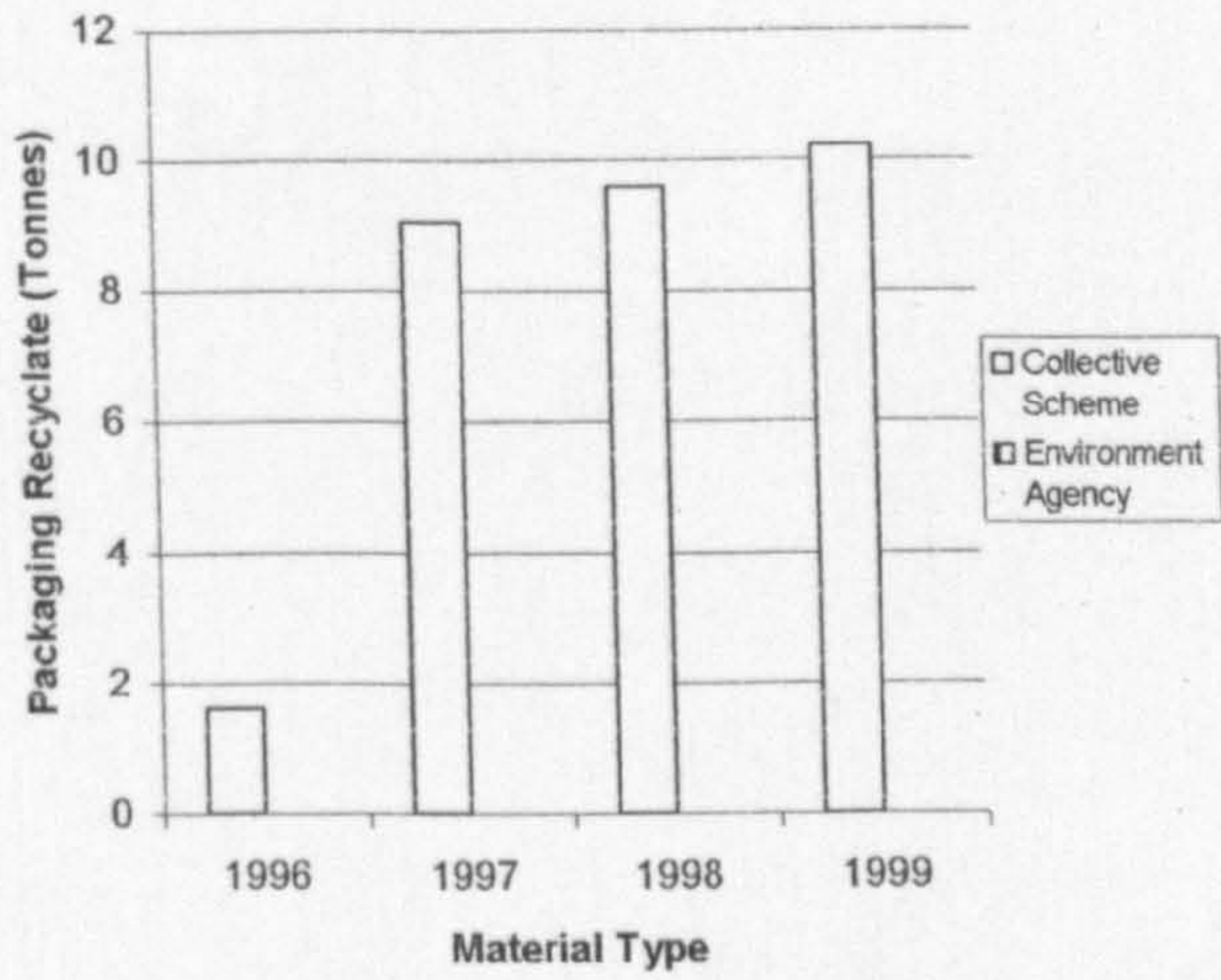
Non-Packaging Recycled by EA Registered Companies



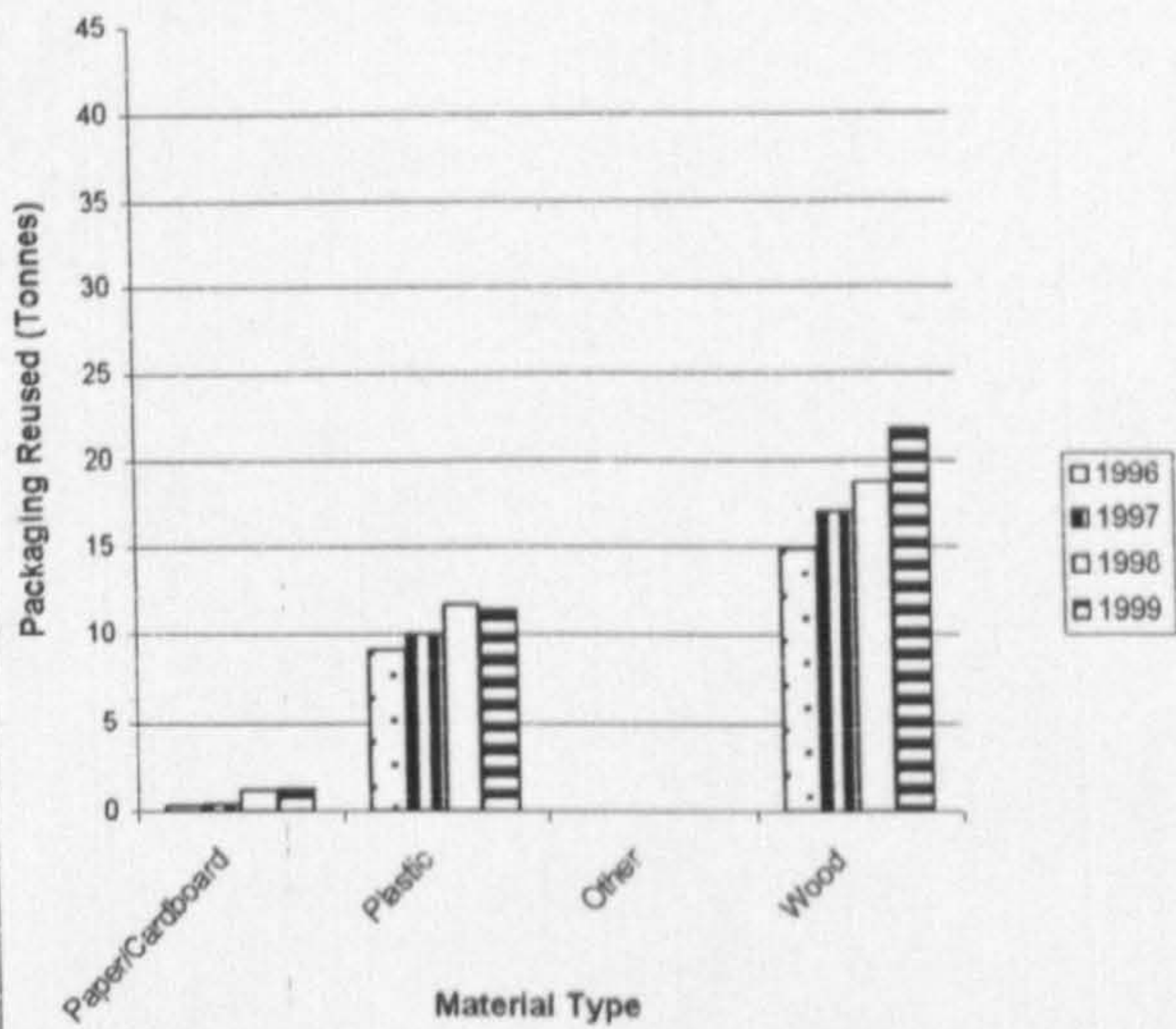
**Packaging Reused by Companies in Collective Schemes**



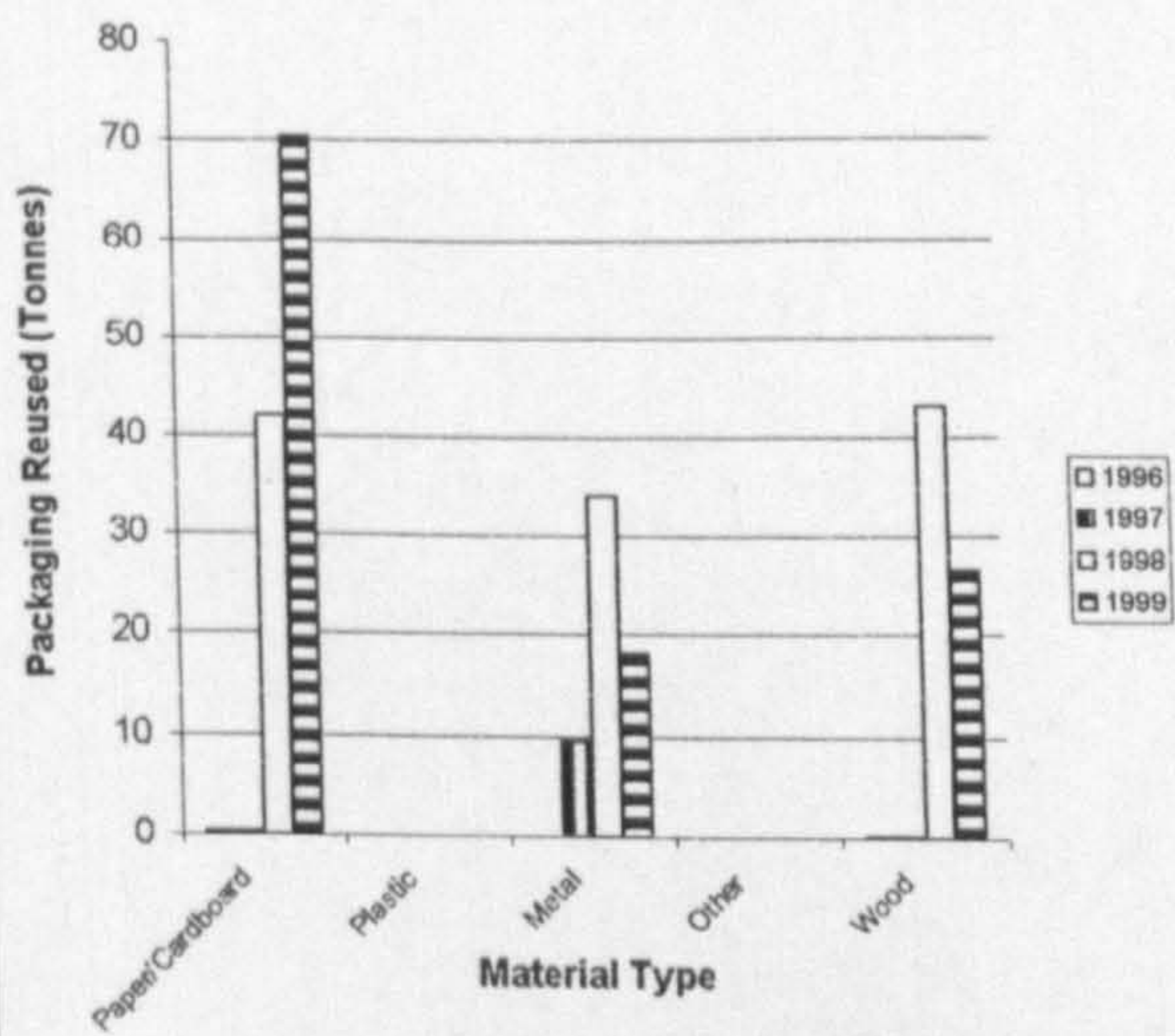
**Packaging Recyclate Purchased/ Used**



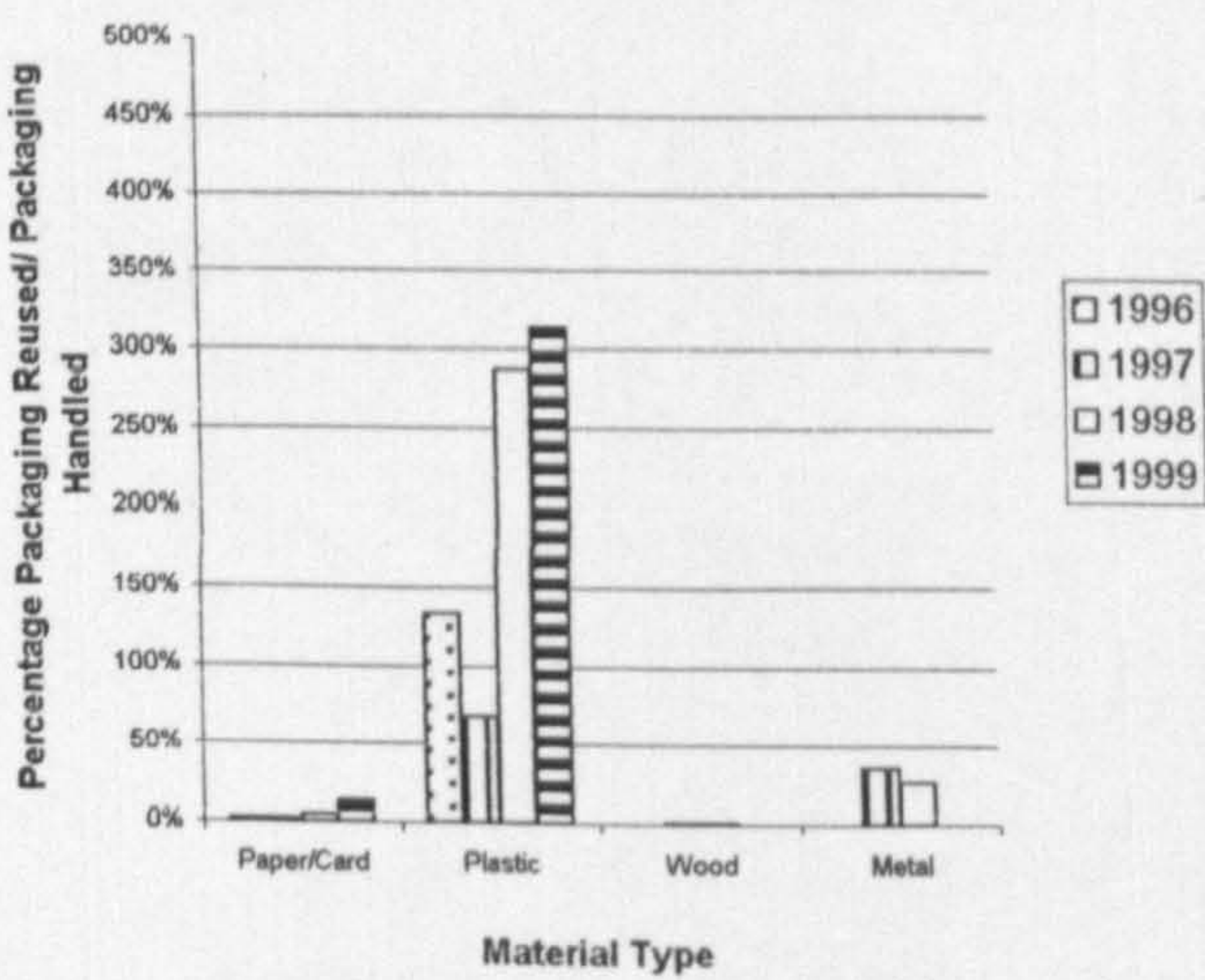
**Packaging Reused by Companies in Collective Schemes**



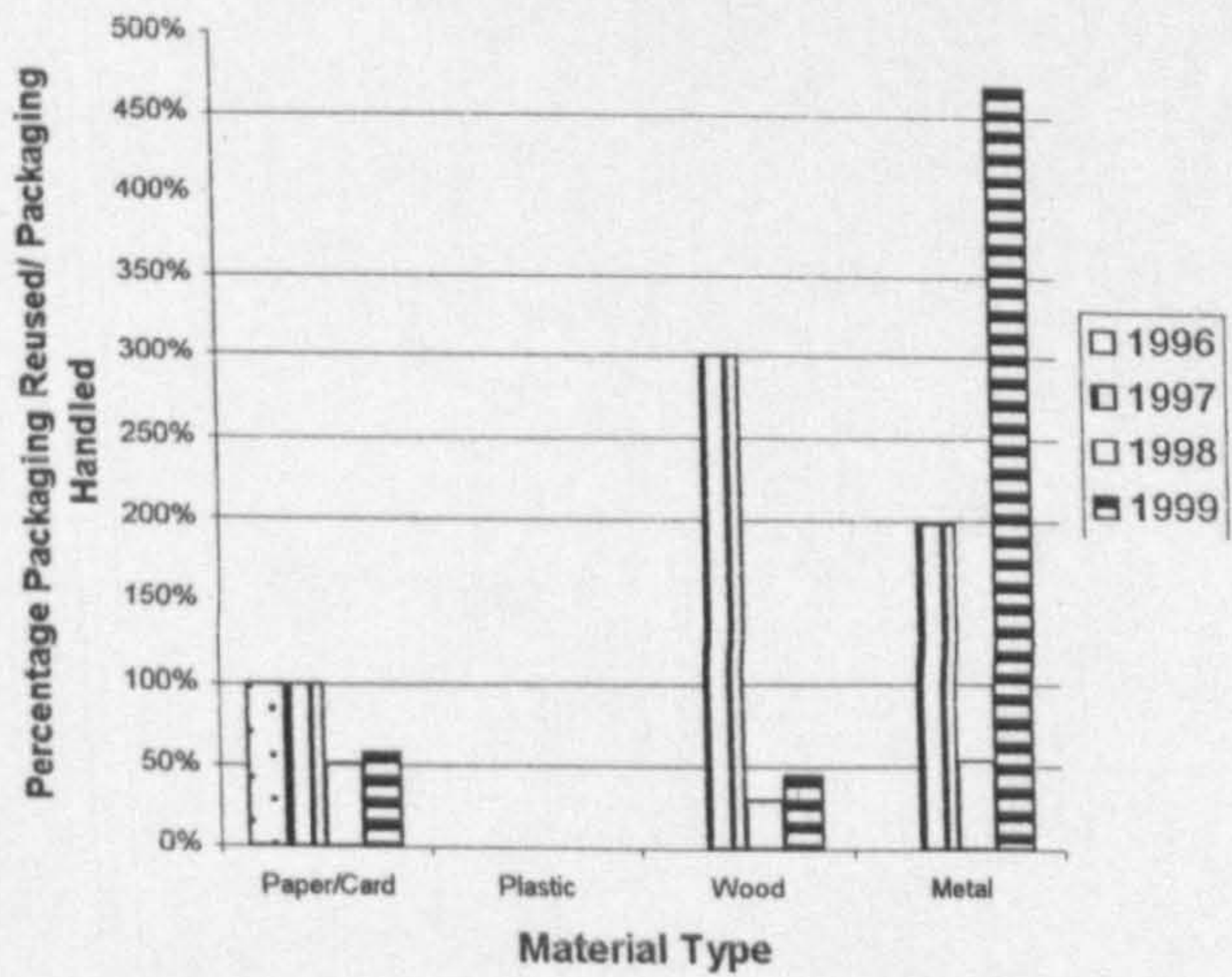
**Packaging Reused by Companies Registered with EA**



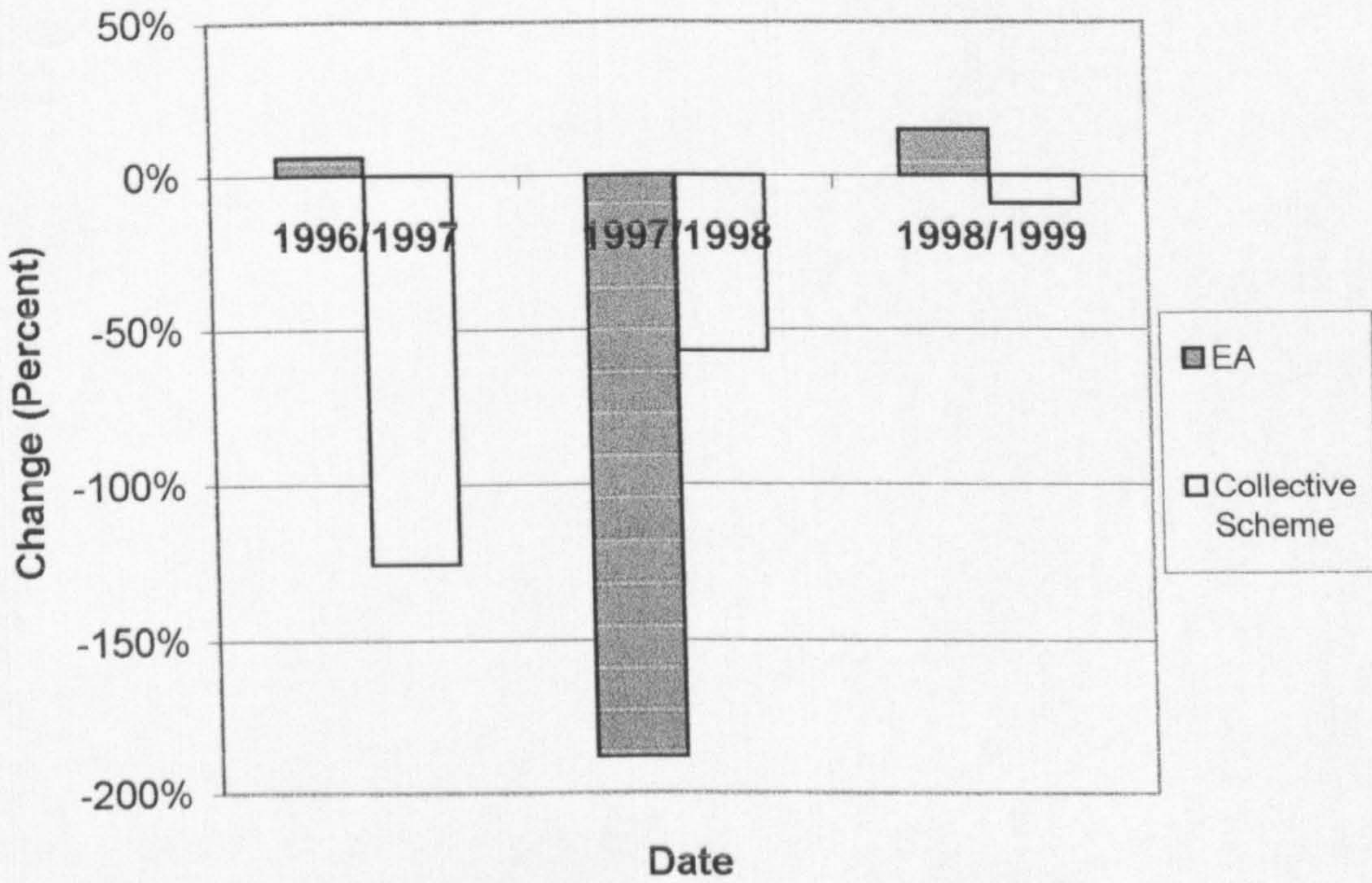
**Packaging Reused as a Percentage of Packaging Handled by Companies in Collective Schemes**



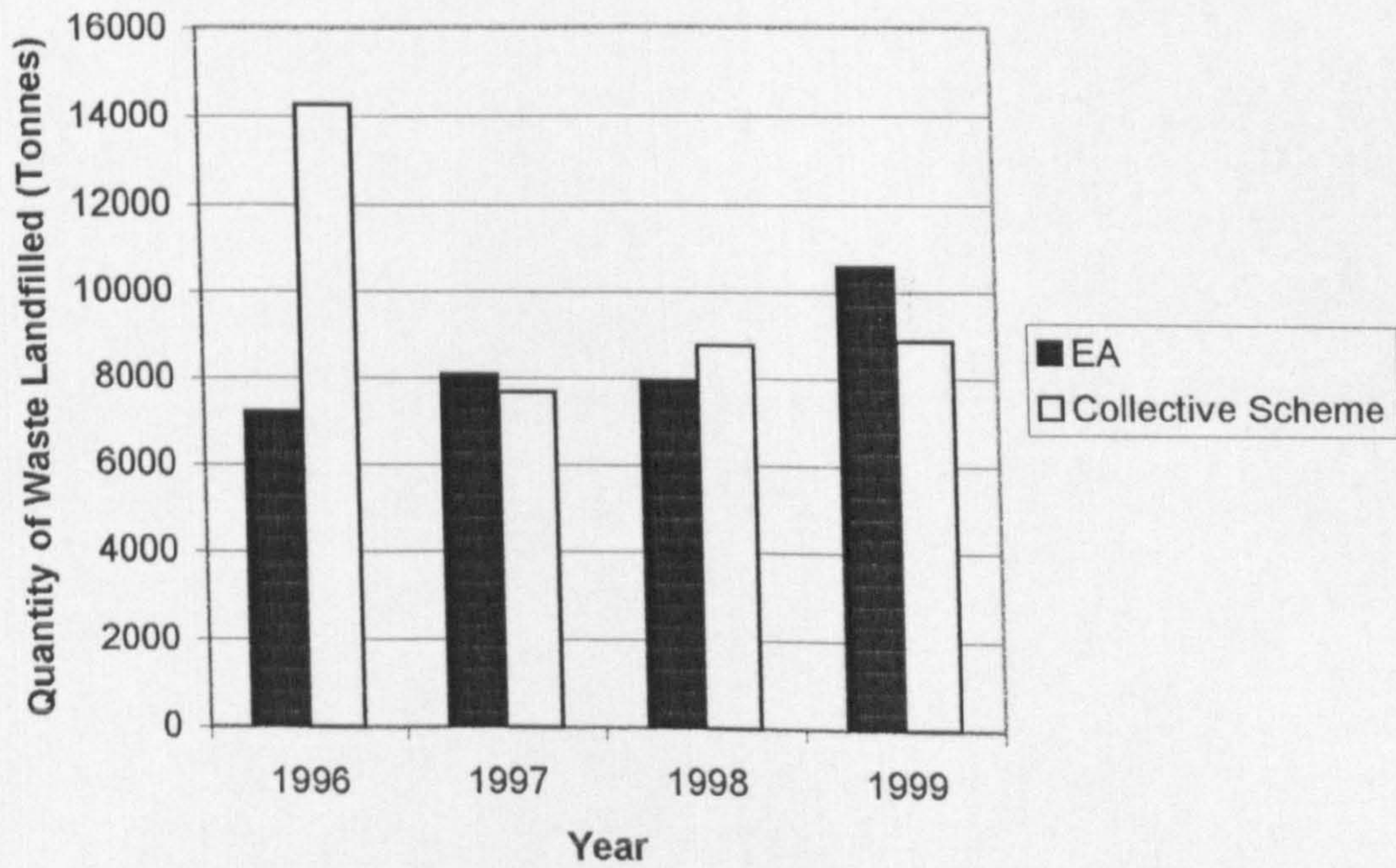
**Packaging Reused as a Percentage of Packaging Handled by Companies Registered with the EA**



**Annual Change in Landfilled Waste**



**Total Quantities of Landfilled Waste by Registration Status**



# NPar Tests

## Chi-Square Test

### Frequencies

#### COLL/EA

	Observed N	Expected N	Residual
EA Registered	18	36.0	-18.0
Collective Scheme	54	36.0	18.0
Total	72		

#### DRIEP

	Observed N	Expected N	Residual
Disagree strongly	28	14.4	13.6
Disagree slightly	17	14.4	2.6
No answer	3	14.4	-11.4
Agree slightly	17	14.4	2.6
Agree strongly	7	14.4	-7.4
Total	72		

#### NILDRIEP

	Observed N	Expected N	Residual
Disagree strongly	13	14.4	-1.4
Disagree slightly	18	14.4	3.6
No answer	3	14.4	-11.4
Agree slightly	16	14.4	1.6
Agree strongly	22	14.4	7.6
Total	72		

#### NEGRIEP

	Observed N	Expected N	Residual
Disagree strongly	47	12.0	35.0
Disagree slightly	16	12.0	4.0
No answer	4	12.0	-8.0
Agree slightly	3	12.0	-9.0
Agree strongly	1	12.0	-11.0
Undecided	1	12.0	-11.0
Total	72		

#### NEGCOST

	Observed N	Expected N	Residual
Disagree strongly	11	14.4	-3.4
Disagree slightly	16	14.4	1.6
No answer	2	14.4	-12.4
Agree slightly	31	14.4	16.6
Agree strongly	12	14.4	-2.4
Total	72		

**CDREP**

	Observed N	Expected N	Residual
Disagree strongly	25	9.3	15.7
Disagree slightly	9	9.3	-.3
No answer	1	9.3	-8.3
Agree slightly	18	9.3	8.7
Agree strongly	2	9.3	-7.3
Undecided	1	9.3	-8.3
Total	56		

**CNIDREP**

	Observed N	Expected N	Residual
Disagree strongly	3	14.0	-11.0
Disagree slightly	21	14.0	7.0
Agree slightly	10	14.0	-4.0
Agree strongly	22	14.0	8.0
Total	56		

**IDREP**

	Observed N	Expected N	Residual
Disagree Strongly	10	5.8	4.3
Disagree slightly	6	5.8	.3
Agree slightly	5	5.8	-.8
Agree strongly	2	5.8	-3.8
Total	23		

**INIDREP**

	Observed N	Expected N	Residual
Disagree strongly	3	6.5	-3.5
Disagree slightly	5	6.5	-1.5
Agree slightly	10	6.5	3.5
Agree strongly	8	6.5	1.5
Total	26		

**INEDREP**

	Observed N	Expected N	Residual
Disagree strongly	11	6.0	5.0
Disagree slightly	11	6.0	5.0
No answer	1	6.0	-5.0
Agree slightly	1	6.0	-5.0
Total	24		

**Test Statistics**

	COLL/EA	DRIEP	NILDRIEP	NEGDRIEP	NEGCOST	CDREP	CNIDREP
Chi-Square <sup>a,b</sup>	18.000	26.611	14.250	135.667	31.194	55.000	17.857
df	1	4	4	5	4	5	3
Asymp. Sig.	.000	.000	.007	.000	.000	.000	.000



### Test Statistics

	IDREP	INIDREP	INEDREP
Chi-Square <sup>a,b</sup>	5.696	4.462	16.667
df	3	3	3
Asymp. Sig.	.127	.216	.001

- a. 0 cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 36.0.
- b. 0 cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 14.4.
- c. 0 cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 12.0.
- d. 0 cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 9.3.
- e. 0 cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 14.0.
- f. 0 cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 5.8.
- g. 0 cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 6.5.
- h. 0 cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 6.0.

Correlations

			COLL/EA	INFENVP	DRIEP	NILDRIEP
Kendall's tau_b	COLL/EA	Correlation Coefficient	1.000	-.031	-.108	-.024
		Sig. (2-tailed)	.	.777	.321	.825
		N	72	72	72	72
	INFENVP	Correlation Coefficient	-.031	1.000	.584**	-.541**
		Sig. (2-tailed)	.777	.	.000	.000
		N	72	72	72	72
	DRIEP	Correlation Coefficient	-.108	.584**	1.000	-.569**
		Sig. (2-tailed)	.321	.000	.	.000
		N	72	72	72	72
	NILDRIEP	Correlation Coefficient	-.024	-.541**	-.569**	1.000
		Sig. (2-tailed)	.825	.000	.000	.
		N	72	72	72	72
	NEGDRIEP	Correlation Coefficient	.071	-.190	-.146	.061
		Sig. (2-tailed)	.532	.070	.160	.555
		N	72	72	72	72
NEGCOST	Correlation Coefficient	.078	.063	.053	-.082	
	Sig. (2-tailed)	.472	.531	.599	.405	
	N	72	72	72	72	
INIDREP	Correlation Coefficient	.485**	-.335	-.320	.401*	
	Sig. (2-tailed)	.009	.053	.060	.017	
	N	26	26	26	26	
INEDREP	Correlation Coefficient	-.418*	.129	.316	.037	
	Sig. (2-tailed)	.038	.499	.087	.840	
	N	24	24	24	24	
IDREP	Correlation Coefficient	-.374	.629**	.449*	-.441*	
	Sig. (2-tailed)	.059	.001	.014	.014	
	N	23	23	23	23	
CNEDREP	Correlation Coefficient	-.182	-.030	-.053	.101	
	Sig. (2-tailed)	.151	.796	.650	.378	
	N	56	56	56	56	
CDREP	Correlation Coefficient	-.164	.475**	.650**	-.377**	
	Sig. (2-tailed)	.192	.000	.000	.001	
	N	56	56	56	56	
CNIDREP	Correlation Coefficient	.137	-.440**	-.600**	.555**	
	Sig. (2-tailed)	.278	.000	.000	.000	
	N	56	56	56	56	
Spearman's rho	COLL/EA	Correlation Coefficient	1.000	-.034	-.118	-.026
		Sig. (2-tailed)	.	.780	.324	.827
		N	72	72	72	72
	INFENVP	Correlation Coefficient	-.034	1.000	.656**	-.617**
		Sig. (2-tailed)	.780	.	.000	.000
		N	72	72	72	72
DRIEP	Correlation Coefficient	-.118	.656**	1.000	-.609**	
	Sig. (2-tailed)	.324	.000	.	.000	
	N	72	72	72	72	
NILDRIEP	Correlation Coefficient	-.026	-.617**	-.609**	1.000	
	Sig. (2-tailed)	.827	.000	.000	.	
	N	72	72	72	72	
NEGDRIEP	Correlation Coefficient	.074	-.215	-.162	.064	
	Sig. (2-tailed)	.536	.070	.174	.592	
	N	72	72	72	72	

**Correlations**

			COLL/EA	INFENVVP	DRIEP	NILDRIEP
Spearman's rho	NEGCOST	Correlation Coefficient	.085	.072	.064	-.098
		Sig. (2-tailed)	.476	.546	.595	.413
		N	72	72	72	72
	INIDREP	Correlation Coefficient	.525**	-.387	-.349	.458*
		Sig. (2-tailed)	.006	.051	.080	.019
		N	26	26	26	26
	INEDREP	Correlation Coefficient	-.433*	.140	.364	.046
		Sig. (2-tailed)	.035	.513	.080	.831
N		24	24	24	24	
IDREP	Correlation Coefficient	-.403	.687**	.501*	-.494*	
	Sig. (2-tailed)	.056	.000	.015	.016	
	N	23	23	23	23	
CNEDREP	Correlation Coefficient	-.194	-.043	-.055	.111	
	Sig. (2-tailed)	.152	.755	.689	.417	
	N	56	56	56	56	
CDREP	Correlation Coefficient	-.176	.555**	.742**	-.445**	
	Sig. (2-tailed)	.195	.000	.000	.001	
	N	56	56	56	56	
CNIDREP	Correlation Coefficient	.146	-.508**	-.656**	.614**	
	Sig. (2-tailed)	.282	.000	.000	.000	
	N	56	56	56	56	

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**NUMBERING**

**AS ORIGINAL**

Correlations

			NEGDRIEP	NEGCOST	INIDREP	INEDREP
Spearman's rho	NEGCOST	Correlation Coefficient	.198	1.000	.415*	.020
		Sig. (2-tailed)	.096	.	.035	.928
		N	72	72	26	24
	INIDREP	Correlation Coefficient	-.168	.415*	1.000	-.301
		Sig. (2-tailed)	.411	.035	.	.154
		N	26	26	26	24
	INEDREP	Correlation Coefficient	-.101	.020	-.301	1.000
		Sig. (2-tailed)	.637	.928	.154	.
		N	24	24	24	24
IDREP	Correlation Coefficient	.090	-.170	-.773**	.325	
	Sig. (2-tailed)	.683	.437	.000	.130	
	N	23	23	23	23	
CNEDREP	Correlation Coefficient	.512**	-.030	-.851**	.806**	
	Sig. (2-tailed)	.000	.827	.001	.009	
	N	56	56	11	9	
CDREP	Correlation Coefficient	.022	.128	-.522	.968**	
	Sig. (2-tailed)	.870	.348	.099	.000	
	N	56	56	11	9	
CNIDREP	Correlation Coefficient	.075	-.019	.716*	-.833**	
	Sig. (2-tailed)	.582	.890	.013	.005	
	N	56	56	11	9	

Correlations

			IDREP	CNEDREP	CDREP	CNIDREP
Kendall's tau_b	COLL/EA	Correlation Coefficient	-.374	-.182	-.164	.137
		Sig. (2-tailed)	.059	.151	.192	.278
		N	23	56	56	56
	INFENVP	Correlation Coefficient	.629**	-.030	.475**	-.440**
		Sig. (2-tailed)	.001	.796	.000	.000
		N	23	56	56	56
	DRIEP	Correlation Coefficient	.449*	-.053	.650**	-.600**
		Sig. (2-tailed)	.014	.650	.000	.000
		N	23	56	56	56
	NILDRIEP	Correlation Coefficient	-.441*	.101	-.377**	.555**
		Sig. (2-tailed)	.014	.378	.001	.000
		N	23	56	56	56
	NEGDRIEP	Correlation Coefficient	.079	.481**	.018	.076
		Sig. (2-tailed)	.677	.000	.881	.527
		N	23	56	56	56
	NEGCOST	Correlation Coefficient	-.138	-.027	.114	-.020
	Sig. (2-tailed)	.445	.819	.325	.866	
	N	23	56	56	56	
INIDREP	Correlation Coefficient	-.721**	-.823**	-.451	.686*	
	Sig. (2-tailed)	.000	.005	.122	.018	
	N	23	11	11	11	
INEDREP	Correlation Coefficient	.298	.776*	.933**	-.789*	
	Sig. (2-tailed)	.126	.023	.006	.018	
	N	23	9	9	9	
IDREP	Correlation Coefficient	1.000	.625	.936**	-.560	
	Sig. (2-tailed)	.	.054	.004	.079	
	N	23	9	9	9	
CNEDREP	Correlation Coefficient	.625	1.000	.023	-.023	
	Sig. (2-tailed)	.054	.	.844	.844	
	N	9	56	56	56	
CDREP	Correlation Coefficient	.936**	.023	1.000	-.722**	
	Sig. (2-tailed)	.004	.844	.	.000	
	N	9	56	56	56	
CNIDREP	Correlation Coefficient	-.560	-.023	-.722**	1.000	
	Sig. (2-tailed)	.079	.844	.000	.	
	N	9	56	56	56	
Spearman's rho	COLL/EA	Correlation Coefficient	-.403	-.194	-.176	.146
		Sig. (2-tailed)	.056	.152	.195	.282
		N	23	56	56	56
	INFENVP	Correlation Coefficient	.687**	-.043	.555**	-.508**
		Sig. (2-tailed)	.000	.755	.000	.000
		N	23	56	56	56
DRIEP	Correlation Coefficient	.501*	-.055	.742**	-.656**	
	Sig. (2-tailed)	.015	.689	.000	.000	
	N	23	56	56	56	
NILDRIEP	Correlation Coefficient	-.494*	.111	-.445**	.614**	
	Sig. (2-tailed)	.016	.417	.001	.000	
	N	23	56	56	56	
NEGDRIEP	Correlation Coefficient	.090	.512**	.022	.075	
	Sig. (2-tailed)	.683	.000	.870	.582	
	N	23	56	56	56	

**Correlations**

			IDREP	CNEDREP	CDREP	CNIDREP
Spearman's rho	NEG COST	Correlation Coefficient	-.170	-.030	.128	-.019
		Sig. (2-tailed)	.437	.827	.348	.890
		N	23	56	56	56
	INIDREP	Correlation Coefficient	-.773**	-.851**	-.522	.716*
		Sig. (2-tailed)	.000	.001	.099	.013
		N	23	11	11	11
	INEDREP	Correlation Coefficient	.325	.806**	.968**	-.833**
		Sig. (2-tailed)	.130	.009	.000	.005
N		23	9	9	9	
IDREP	Correlation Coefficient	1.000	.722*	.969**	-.700*	
	Sig. (2-tailed)	.	.028	.000	.036	
	N	23	9	9	9	
CNEDREP	Correlation Coefficient	.722*	1.000	.035	-.030	
	Sig. (2-tailed)	.028	.	.801	.827	
	N	9	56	56	56	
CDREP	Correlation Coefficient	.969**	.035	1.000	-.768**	
	Sig. (2-tailed)	.000	.801	.	.000	
	N	9	56	56	56	
CNIDREP	Correlation Coefficient	-.700*	-.030	-.768**	1.000	
	Sig. (2-tailed)	.036	.827	.000	.	
	N	9	56	56	56	

\*\* . Correlation is significant at the .01 level (2-tailed).

\* . Correlation is significant at the .05 level (2-tailed).

**Annex 4**

**Modules**



**Annex 4**

**Appendix 1**

**EngD and Elective Module Marks**

**Table of EngD Module Assignment Results**

Year	Title	Grade	Mark
1	Presentation Skills and Teamwork	B	6
1	Project Management	C	3
1	Sociology I	B-	5
1	Risk Perception	B	6
1	Life Cycle Analysis	B	6
1	Environmental Auditing	A+	10
1	Environmental Measurement	C	3
2	Environmental Law	B	6
2	Clean Technology	B+	7
2	Risk Communication	B+	7
2	Sociology II	B+	7
2	Environmental Economics	C+	4
3	Advanced Leadership	Pass	Pass
3	Risk Management	B	6
3	Materials	A	9
4	Finance	B	6
4	Marketing	B+	7
4	Talking to the Media	A+	10

**Marks Table**

A+	10	80-100%
A	9	75-79%
A-	8	70-74%
B+	7	65-69%
B	6	60-64%
B-	5	55-59%
C+	4	50-54%
C	3	45-49%
C-	2	40-44%
Fail	1	Under 40%

Year	Elective Title	Description	Mark
2	Associate Membership of the Institute of Environmental Management	Open book exam	Pass
3	Advanced Environmental Auditing	EARA Approved 5-day course	78%
4	Presentation Skills	ICL Training Course	Pass

**Average (of graded modules):      B+      7**