THE ECONOMICS OF FARM ACCIDENTS AND SAFETY IN NEW ZEALAND AGRICULTURE

K.L. Leathers
J.D. Williams

with contributions by

J.R. Rogers and G. Greer

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THE AGRICULTURAL ECONOMICS RESEARCH UNIT
Lincoln College, Canterbury, N.Z.

The Agricultural Economics Research Unit (AERU) was established in 1962 at Lincoln College, University of Canterbury. The aims of the Unit are to assist by way of economic research those groups involved in the many aspects of New Zealand primary production and product processing, distribution and marketing.

Major sources of funding have been annual grants from the Department of Scientific and Industrial Research and the College. However, a substantial proportion of the Unit's budget is derived from specific project research under contract to government departments, producer boards, farmer organisations and to commercial and industrial groups.

The Unit is involved in a wide spectrum of agricultural economics and management research, with some concentration on production economics, natural resource economics, marketing, processing and transportation. The results of research projects are published as Research Reports or Discussion Papers. (For further information regarding the Unit's publications see the inside back cover). The Unit also sponsors periodic conferences and seminars on topics of regional and national interest, often in conjunction with other organisations.

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CONTENTS

LIST OF TABLES

LIST OF FIGURES

PREFACE

A recent United Kingdom study has noted the high rate of accidental deaths in the U.K. farming world. The study pointed out that the majority of such accidents occur off, rather than on, the farm.

While it is possible a similar situation applies in New Zealand, the N.Z. Accident Compensation Corporation (ACC) pays out substantial monies each year for injuries stemming from on-farm accidents. Many more accidents where serious personal injury is not involved (and are therefore not reported to the ACC) also occur but little is known of their costs to farmers or to society as a whole. Little is known also about the frequencies of different types of farm accident over a range of farming systems, and whether some types of farm accidents are more preventable than others.

This report is aimed at providing information in this vein and concentrates on the potential costs associated with farm accidents.

The project was conceived, initiated and carried out in conjunction with the ACC. The involvement and support of the ACC, both professionally and financially, is gratefully acknowledged by the Unit.

P.D. Chudleigh
Director

SUMMARY

This report presents an economic analysis of farm accidents in New Zealand. Presently, the social costs of farm accidents are not well understood: their monetary importance to the farmer, hence the nation, has thus far not been quantified in a way meaningful to safety policy makers. Information about the relative magnitude of social costs resulting from accidents on farms is necessary to establish the potential social benefits attributable to safety. Such information is required if safety expenditures are to be rationally allocated to priority needs.

The objectives of the study were: (1) to develop a methodology for use in assessing social costs and benefits and the net benefits to farm accident prevention, and (2) to estimate empirically the social costs of farm accidents using a sample of actual accident cases.

The social costs of accidents can be classified into four general categories: the cost of uncertainty, the cost of suffering, the direct loss of output, and the indirect loss of output or "resource cost". These costs, when combined with predicted changes in the numbers and types of accidents, will provide estimates of the savings in accident costs attributable to a given safety programme. The optimal level of safety is achieved when the total costs of administering safety programmes is equal to the expected total savings in accidents to society. If individual farmers were fully aware of the private costs of accidents on their farms, in particular the output and resource costs for which the ACC does not compensate them, it is believed that this knowledge would provide an incentive for improved farm safety.

The empirical analysis was based on existing data and primary data obtained from a random sample of compensated farm accident cases in fiscal 1980. Approximately 75 percent of the 300 farm operators responded to the confidential mail questionnaire. The purpose of the survey was to obtain supplemental and corroborative information about the general nature of the accident, and to explore further its consequences to the farmer. In addition to collecting information about private costs (production and resource losses), the survey attempted to explore farmer attitudes towards safety and the precautions taken before and after the accident.

The results indicate a lower bound estimate of the annual social costs ranging between \$0.8 million and \$1.6 million (in March 1981 dollars) at the 95 percent level of confidence. This compares with \$2.7 million (the authors' estimate) of the actual compensation paid for the approximated 4,000 accidents which occurred on New Zealand farms in that year. The frequency distribution was found to be highly skewed (exponential), illustrating that in the majority of accidents the uncompensated costs to the farmer are quite small: apparently less than five percent of after-tax net farm income. The implication is that the uncertainty farmers experience in market prices, seasonal weather conditions, etc., far exceeds the expected probability of reduced income due to accidents. This inference is supported by the attitudinal data concerning safety measures, indicating that most

farmers in the sample considered these accidents unpreventable and generally unimportant. However, for those few farmers who experience significant uncompensated costs (20 percent of the accidents account for nearly 70 percent of the total social costs), the private costs can be considerable.

A number of implications for future safety policy and planning, and for extending this analysis in future research, are discussed in Chapter 4 of the report.

ACKNOWLEDGEMENTS

This study was made possible by a research grant from the New Zealand Accident Compensation Corporation (ACC). The authors wish to express their appreciation to the many individuals of the ACC who contributed their time and assisted with the study at various stages. In particular we are grateful for the able assistance of Michael Bruce-Smith, National Safety Co-ordinator, who was instrumental in all phases of the work: study conceptualisation and design, data acquisition and analysis, and over-all project co-ordination. The senior authors also wish to acknowledge the important contributions made by Joan Rogers and Glen Greer in the initial stages of the study. The safety analysis methodology (Chapter 2) is largely Joan's work, and the analysis of existing information and preparation of the survey was based on earlier contributions by Glen. The report also benefitted from useful comments and criticisms supplied by Graeme Robson, Wally Simmers, Lincoln Armstrong and several 'unknown' reviewers. The authors are responsible for any remaining errors and the views expressed.

CHAPTER 1

INTRODUCTION

1.1 The Problem Focus

In 1980 the Accident Compensation Corporation (ACC) paid out $2.7 million in injury claims for over 4,000 accidents on New Zealand farms. The number of accidents that occur but do not result in serious injury (i.e. defined as a disability which exceeds five working days) could be of the order of ten to twenty times that amount. The private and social costs of farm accidents are not presently known, since only a portion of the full costs is accounted for in the compensating payments for personal injury. Losses in productivity are not compensatible, and, if large, such losses would warrant close attention by farm policy makers. Farm safety programmes are aimed at prevention, and it is in the public interest that expenditures on safety are closely associated with the expected benefits. At the present time farm safety administrators and policy makers have little empirical evidence with which to evaluate the cost-effectiveness of specific safety measures, nor the level of funding that is appropriate for accident prevention.

Successful implementation of many safety policies and programmes requires the co-operation of farmers. A farmer will be more inclined to adopt a specific safety measure if it can be demonstrated to him that the benefits which he (including his family, employees and others) will derive, will exceed the costs of the safety measure to him. Often there are 'hidden' costs associated with a farm accident, for example, delays in performing timely operations, damage to uninsured resources, or loss of production, which are 'uncompensated' losses to the farmer and can only be recovered out of future net revenue. To the extent that such hidden costs also reduce social welfare, they should be counted as benefits to public safety. The problem is that the nature and magnitude of uncompensated accident costs are poorly understood, particularly in agriculture.

1.2 The Study Aims

Policy makers need a means of determining the economic impact of farm accidents on New Zealand society. A need also exists for a method of evaluating different types of farm safety policies and programmes in order to make rational decisions concerning the allocation of scarce public resources. The primary aim of this study was to develop a methodology which can be used to assess the economic impact of farm accidents in New Zealand, and to evaluate the cost-effectiveness of alternative safety policies. The methodology should be able to identify the social costs of farm accidents and the social benefits attributable to their prevention. Once identified, a suitable means for their quantitative measurement must be determined.

The second aim of the study was to obtain empirical estimates of the private costs of farm accidents to farmers. This was motivated by the belief that first, farmers are generally unaware of the private costs of accidents on farms, and second, that accidents would be reduced if farmers were made aware of these costs through farm safety programmes. Again, there is the conceptual problem of identifying the nature of accident costs using secondary and primary data sources. Empirical estimates of the private costs, while important to the promotion of on-farm safety, may considerably understate the social costs to society. Estimates of the full social costs and benefits of farm accident prevention, however, were beyond the scope of the present study.

1.3 The Assessment Framework

The theoretical framework employed in this assessment assumes a Kaldor-Hicks welfare function, the Pareto welfare base of neoclassical allocation theory and benefit-cost analysis. Within this conceptualisation, an activity generates a social benefit if it increases the quantity of 'goods' available or reduces the quantity of 'bads' imposed upon society. Social benefits are comprised of private and external benefits, with the former arising out of market transactions and the latter external to the market. For example, the social benefits of wearing crash helmets consists of: (1) private benefits in the form of an individual's enhanced margin of safety in an accident; and (2) external benefits in the form of 'goods' which result from resources being saved in the treatment of accident victims. Social costs are defined similarly, with private costs representing the value of resources used in farming, rather than their next best alternative use, and external costs representing the 'bads' borne by the rest of society, such as any pollution associated with farming activities. Finally, transfer payments do not result in costs or benefits. Transfer payments simply redistribute existing 'goods' and 'bads' between members of society, consequently economic efficiency (social welfare in the Kaldor-Hicksian sense) is unchanged.

The Latin derivation of the word accident, *accidere,* means 'to happen'. While it is not easy to define what an accident is, it is usually possible to say when one has occurred. An accident tends to leave some physical evidence in the form of injury or damage to people or property, and its effect on the subsequent chain of events can be substantial. The classification of accident costs differs widely in the literature. Costs are most often classed according to which social group bears them: the individual, the employer, the State. They frequently are subdivided into subjective and objective costs; insurable and non-insurable; financial, resource and transfer costs; measurable and non-measurable, etc., depending on the use to which the results are to be put. In this study the authors distinguish between four categories of social cost which are broadly applicable to all accidents:

(1) The cost of uncertainty, as measured by the maximum amount people are willing to pay to avoid a risky situation or

(2) The cost of suffering, as measured by the sum of individual's compensating variations. This sum is either the minimum payment required to compensate for the suffering brought about, or the maximum willingness to pay to avoid the

suffering associated with accidents.

(3) The direct loss of output, or the reduction in farm products which would otherwise be available, as a result of reduced quantity or productivity of natural resources, labour or man-made resources. This loss is valued by consumers' compensating variations, or the maximum sum consumers would be willing to pay for these goods. If the reduction in output is relatively small, willingness to pay approximately equals market price times the quantity lost.

(4) The indirect loss of output, as measured by the opportunity cost of resources diverted away from productive employment elsewhere (i.e., the same criterion as (3) above). Were these resources idle (unemployed), then there is no marketable output foregone and the cost to society would be negligible.

In practice however, it is often impossible to quantify separate cost categories.

The social benefits of prevention, repair and replacement activities are the reductions which they effect in the costs of accidents. They do not create 'value-added' benefits to society. Hence, the net benefit to society of safety measures is appropriately measured by the direct and indirect (external) accident costs avoided, less the costs of administering safety programmes.

1.4 Survey Methods and Procedures

For purposes of this study, information was required to describe the types of farm accidents that occur, their incidence by type of farm or farm activity engaged in when the accident occurred, the cause of the accident and whether safety measures were taken (or could have been taken), and the costs of the accident, particularly the uncompensated losses in productivity. Since accident compensation in New Zealand is essentially a compulsory insurance scheme, detailed information is readily available on employer levies, and compensation paid to accident victims on a national basis. However, the information collected by the Accident Compensation Corporation on the applicant claims forms is limited and does not provide sufficient data for safety analysis purposes. Accordingly, a random sample of farm accident claims was used to generate additional information for this study.

A confidential mail questionnaire was developed and sent to 300 of the 4,000 claimants reporting farm accidents in 1980. The questions were addressed to the farm owner-operator (or manager), and requested information that was supplementary to what was already known about the accident. Among other things, the respondent was asked to appraise the consequences of the accident, including the repair and replacement costs net of insurance payments, the additional time and/or labour requirements, any delays in completing operations or other matters that might have reduced production revenues, and any related costs, especially of a long-term nature, that would require changes in farm (or family) planning. The respondents were also asked if they thought the accident could have been avoided, and if so, by what means.

Seventy-four percent of the questionnaires were returned with useable data.

1.5 Organisation of the Report

The methodology for assessing the economic costs and benefits of farm accident prevention is discussed in detail in Chapter 2. Implications of the conceptual framework with respect to data requirements and the types of analyses needed for safety policy assessment are also discussed. The survey and analysis of empirical results is presented in Chapter 3. In the concluding section (Chapter 4), the implications of the study for farm safety policy and programmes are summarised in light of the limitations of the data and study methods.

CHAPTER 2

A METHODOLOGY FOR ASSESSING ACCIDENT PREVENTION BENEFITS

2.1 Introduction

Public safety administrators need a means of determining the economic impact of farm accidents on New Zealand society. They need also a means of evaluating different types of farm safety programmes in order to make rational decisions about the allocation of available resources. Resources for farm safety are limited, and the level of taxpayer support depends on the demonstrated cost-effectiveness of such programmes. A primary objective of this study, therefore, was to produce a methodology which could be used to assess the economic impact of farm accidents in New Zealand, and hence to assist with the evolution of alternative programme options.

Such a methodology should identify, from a conceptual point of view, the social costs of farm accidents, and the appropriate measures of social costs and benefits attributed to farm safety programmes. Once the costs and benefits are identified, the next step is to determine a means by which they might be measured, for example, using market data or data obtained from direct interviews. Only after the concepts have been identified and a method of measurement determined, can a meaningful attempt be made to obtain quantitative estimates of either the social costs of farm accidents or of the costs and benefits to society of various farm safety programmes. As the measurement of some of these concepts is not easy, the following should be kept in mind: "there is more to be said for rough estimates of the precise concept than for precise estimates of economically irrelevant concepts" (Mischan, 1971).

A secondary objective of the study was to develop a method for evaluating the private costs of farm accidents to farmers. The underlying assumptions were, firstly that farmers are not aware of the private costs of farm accidents, and secondly that accidents would be reduced if farmers were made aware of the actual costs involved. Again there is not only the conceptual problem of identifying the costs of accidents to farmers, but also the problem of determining how these costs can be measured and from where the data are to be obtained.

2.2 The Theoretical Foundation for Social Cost-Benefit Analysis

For the purposes of this study the neoclassical tradition in economic thought is adopted as the conceptual framework for the analysis. A partial equilibrium approach is used, and changes in social welfare are evaluated within the 'Pareto-improvement' theoretical basis of public policy impact assessment.

2.2.1 Social Welfare.

The basic premises which underlie the neo-classical concept of social welfare and public betterment (via public policy actions) are:

(1) Social welfare is a function of the welfares of the individuals who make up society;

(2) The individual is the best judge of his own welfare; and

(3) The appropriate measure of social welfare change is obtained using the Kaldor-Hicks social welfare function. According to the Kaldor-Hicks principle, social welfare is increased as a result of an activity if those who benefit from it could compensate those who lose, and still be better off than they would be in the absence of the activity. There is no suggestion that compensation actually be paid, so a Kaldor-Hicksian increase in social welfare amounts to a potential Paretian improvement. The normal criterion for evaluating a project is the discounted sum of net benefits to society. If this value is positive, then the gainers could compensate the losers and still be better off themselves. This criterion is consistent with the Kaldor-Hicks social welfare function.

The above assumptions make up "the Pareto base of existing allocation theory and benefit-cost analysis" (Mischan, 1971, p.687). They imply that increases in social welfare occur as a result of improvements in economic efficiency; the distribution of real income within a society is ignored. The concept of social welfare is often extended to make social welfare a function of equity as well as efficiency. The most common approach is to treat the two factors separately, first analysing its effect on the distribution of real income. This study will follow the same approach.

2.2.2 Social Benefits, Costs and Transfer Payments.

An activity generates a benefit to society if:

(1) It increases the quantity of "goods" available to society, where a "good" is defined as something which creates utility for someone; or

(2) It reduces the quantity of "bads" imposed upon society, where a "bad" is defined as something which creates disutility for someone.

Social benefits comprise private benefits and external benefits. Private benefits arise out of market transactions while external benefits are external to the market. For example, the social benefits of seat belts consist of:

(1) The "private" benefits to the individuals who purchase and wear seat belts, namely the reduced probability of being injured in an automobile accident; and

(2) The "external" benefits to individuals resulting from other people wearing seat belts. For example, seat belts reduce the demand for certain types of medical facilities. External benefits of seat belts include the "goods" which could be produced by medical personnel who no longer need to be employed in the treatment of road accident victims.

An activity generates a cost to society if:

(1) It increases the quantity of "bads" which are imposed upon society, thereby creating disutility for one or more members of society; or

(2) It reduces the quantity of "goods" which otherwise would be available to society, and thereby reduces the utility of one or more members of society.

Similarly, social costs are made up of private costs and external costs. Private costs are incurred as a result of some market transactions, while external costs are external to the market. For example, the social costs of farming consist of:

(1) The (private) costs paid by farmers for the resources used in producing agricultural commodities. If there are no market imperfections the private costs will reflect the opportunity cost of farming. This consists of the goods and services foregone as a result of resources being employed in farming rather than in their next best alternative use; and

(2) The (external) costs borne by the rest of the community, such as any pollution which is associated with farming activities.

A transfer payment does not result in a cost or a benefit to society. A transfer payment simply redistributes "goods" (or "bads") from one member of society to another. The recipient experiences an increase in utility (or disutility), while the original owner of the "good" (or "bad") experiences a reduction in utility (or disutility). Although the individuals experience private costs and benefits as a result of the transfer, there is no change in the quantity of "goods" (or "bads") available to society as a whole. Consequently, economic efficiency (and social welfare in the Kaldor-Hicksian sense) is unchanged. Of course, the distribution of real income has changed and so social welfare in its broader sense is changed. However, a conclusion that social welfare has either increased or decreased must be based either upon a value judgement or alternatively upon assumptions about the marginal utility of income functions of the individuals involved; this is an exercise which most cost-benefit analysts eschew unless definite rules are provided by the policy maker upon which such distributive changes are to be judged.

2.3 Social Costs and Benefits of Farm Safety

This section identifies conceptually, at the most fundamental level, the social costs of farm accidents and the social costs and social benefits of accident compensation and farm safety programmes.

These are difficult concepts and so they are developed gradually in this discussion using a series of four case examples. The first case considers the economic impact of farm accidents occurring in a world where the individual has no means of obtaining compensation. In the second case, people involved in farm accidents can seek compensation through a system of private insurance markets. In case three the private insurance markets are replaced by a compulsory insurance scheme, run by the public sector. Finally, in case four, the public sector's compulsory accident compensation scheme is augmented with a farm safety programme. It is assumed in all four case examples that various services are available to ameliorate the effects of farm accidents, such as medical services with which to treat the injured, facilities to repair damage to property, and so on.

Each case is an abstraction from the real world, a device which avoids many of the real world complications which tend to obscure the basic issues. However, the cases build upon one another, each one being more realistic than those which precede it. They culminate in case four. The first three cases are important, however, because it is in these that many of the basic issues are encountered for the first time, and it is here that they are discussed at length.

The exercise involves analysing the effects on society of all accidents which occur during some specific period of time. However accidents which occur during a given time period may have effects which are spread over a number of time periods. For example, an accident occurring in year x may result in a loss of farm output in year x, x+1, x+2, ... The problem of assessing the impact of farm accidents involves determining the effect which farm accidents occurring in some past time period have had on New Zealand society. The more complex problem of evaluating a farm safety programme involves predicting the effect which farm accidents of some future time period will have on society, in the presence and in the absence of the safety programme.

2.3.1 Conceptual Issues in Measuring Safety Benefits

Accidents may cause injury, or even death, to people. This raises the problem of placing a value on human life. Societies such as that of New Zealand do not readily admit that it is possible to value human life. However, individuals implicitly place a value on their own lives whenever they take risks for gain, and whenever they[1] make voluntary payments in order to reduce or avoid personal risk. Furthermore, as Fromm (1965, p.193) has pointed out "our society is continually making economic decisions that place an implicit value on human life, even though no explicit judgements are voiced". The fact that society is not prepared to devote all its resources to activities which save lives implies that at some stage a point is reached where the cost of saving an extra life outweighs the benefits of so doing. This is not to say however that with better knowledge of the risks and the real social costs public expenditures might be better allocated than at present.

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1. This is the line of argument which underlies Melinek's method of valuing human life (Melinek, 1974).

Society displays very different attitudes towards the death of an unidentified person and the death of someone who is personally known. For example, vast sums will be spent on rescuing a specific person from virtually certain death, whereas there is a reluctance to spend lesser amounts on projects which are certain to save lives, but the lives of people who cannot be identified in advance. In the former case it is a question of an individual life, whereas in the latter the question involves "statistical lives".

This study is concerned with <u>statistical accidents</u>; it is not concerned with accidents which involve identified individuals. To evaluate the cost of a particular person's injury or death evokes sentiments which are absent when a marginal change in injury or mortality statistics is considered. As Schelling (1968, p.298) says: "Programs that affect death statistically...whether they are safety regulations, programmes for health and safety, or systems that ration risk among classes of people...need not evoke these personal, mysterious, superstitious, emotional or religious qualities of life and death. These programmes can probably be evaluated somewhat as we evaluate the commodities we spent money on."

Taking an ex ante approach, it is impossible to know which specific individuals will be involved in accidents, although it may be possible to predict, with a high degree of confidence, that x members in a community of n people will be injured, perhaps fatally. Nor is it possible to designate in advance the particular persons who will be saved from death or injury as a result of a farm safety programme, although it may be possible to predict, with a high degree of precision, that a farm safety programme will reduce the number of accidents by a certain amount.

Even if historical data are used to estimate the social cost of accidents which occurred during some past time period, it would not be useful to take into account knowledge of the specific individuals involved. An historical analysis should be conducted <u>as if</u> it were from the point of view of the society which was in existence prior to the occurrence of the accidents. The following examples may help to explain why these conceptually different issues must be considered in empirical analyses directed at practical policy prescriptions.

<u>Case I: "Without" Public Compensation</u>. This example assumes that there is no mechanism through which an individual, who is involved in an accident, may receive compensation for his or her loss, and further that there is no safety programme in effect which might reduce the accident incidence in society-at-large. Under these assumptions there are four categories of cost associated with accidents on the farm:

(1) <u>The Cost of Uncertainty</u>: Individuals, who are risk averse, experience a reduction in utility when faced with a risky situation. People who enjoy additional risk (called risk lovers), experience an increase in utility, while those who are risk neutral experience no change in utility, when placed in an uncertain environment. It is widely believed that most people are risk averse. Consequently, the existence of an uncertain

environment generates a cost for society as a whole.[2]

Living in an environment where accidents occur affects all people because of the uncertainty which accidents generate. The risk of an accident, if it is perceived as being large enough, leads to anxiety. This anxiety is quite distinct from the disutility associated with the impact of the accident itself. Schelling, (1968, p.308) maintains that the disutility associated with the actual outcome of an unpleasant event is often less than the disutility of waiting. He draws attention to the fact that many people will bring forward an unpleasant, but inevitable, event, such as a surgical operation, in order to avoid the suspense associated with waiting. People will act in this way even if it increases the probability of an unsuccessful outcome. For example, students often display the same type of reaction to examinations: they will vote to bring the date of an examination forward, even though this reduces their study time and so reduces their chances of doing well.

The degree of anxiety generated by the possible occurrence of an accident is directly related to both the perceived probability of an accident occurring, and the perceived probability distribution of costs, any one of which could be incurred, given that an accident does occur. An unlikely accident with serious consequences, and a more likely accident with less serious consequences, may generate about the same degree of anxiety. Uncertainty, and thus anxiety, can be reduced either by reducing the probability of an accident occurring, or by reducing the likely costs which will be incurred, if an accident does occur.

If individuals are the best judge of their own welfare, the cost of uncertainty is measured by the maximum amount which people would be willing to pay to avoid a risky environment.

(2) Suffering: Accidents are "bads". They create disutility for the accident victims, and for others who suffer as a result of their suffering. The aggregate suffering incurred by these individuals is a social cost of accidents.

The type of suffering considered here is that which is associated with the impact of the accident itself, not that which stems from the possibility of an accident occurring. It is also suffering which is psychic in nature; suffering due to a loss of real income is covered in (3) and (4) below.

Assuming that each individual is the best judge of his own welfare (or lack of it), the decline in social welfare is measured by the sum of individuals' compensating variations. This sum is either the minimum amount which people would require to compensate them

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2. Those who gain utility from the uncertain environment would not be able to compensate those who experience disutility, without making themselves worse off. Hence, in the Kaldor-Hicksian sense society is worse off.

for the suffering brought about by accidents, or it is the maximum amount which people would be 'willing to pay' to avoid the suffering associated with accidents.

(3) Direct Loss of Output: Farm accidents result in a loss of output if the quantity or productivity of natural resources, human resources or man-made resources are reduced as a result of their occurrence. Consequently, there is a reduction in the quantity of "goods" (namely, farm produce) which otherwise would be available to society. The loss of these "goods", or more fundamentally, of the utility derived from them, is a social cost of accidents. This may be called "the output cost".

The value of these "goods" is given by consumers' compensating variations, that is, by the maximum sum which consumers would willingly pay for the goods. If there are no serious market imperfections, this sum is given by the area under the relevant portions of demand curves for these goods. However, if a reduction in output is small, then willingness to pay approximately equals market price times quantity of output lost. Hence, the market value of the direct loss of output is a reasonable measure of this category of social cost.

(4) Indirect Loss of Output: Farm accidents result in an indirect loss of output if resources are diverted away from the production of other "goods" into the accident environment. These resources may be used within the accident environment to reduce human suffering, to prevent damage to factors of production or farm output, or to repair or replace natural, human or man-made resources which are damaged in the accident. Resources used to reduce human suffering and to "repair" labour include emergency services which take the victims to hospital and medical services which treat their injuries. In any particular accident, labour may be hired to replace that which has been injured. Resources may be used to repair equipment, to produce replacement equipment, or to repair damage to land. Alternatively, capital may be hired as a temporary replacement for equipment which has been damaged and is undergoing repair. Fire fighting services may be called in to minimize property damage. These are examples of the uses to which resources may be put within an accident environment. The indirect loss of "goods", or more fundamentally of the utility derived from them, resulting from using resources to deal with the effects of accidents, is a cost to society. This may be called "the resource cost".

Assuming no major market imperfections, the value of this indirect loss of output is given by consumers' willingness to pay for it. If the loss of output is small, willingness to pay is approximated by market value. If it is further assumed that there is no unemployment among resources which are directed into the accident environment, the market value of this indirect loss of output can be approximated by actor payments which are necessary to induce these resources to carry out preventive, repair and replacement activities. For example, if society employs doctors to treat accident victims, the social cost is the output which is foregone because doctors are employed in this way, rather than in their next best alternative employment. The value of this lost output is approximated by the payments which need to be made to induce these people to the doctors dealing with the effects of farm accidents. If there are market imperfections, each per unit factor payment does not equal its marginal value product, in which case the latter is the relevant concept of social cost. If resources which are directed into the accident environment would otherwise be unemployed, then there is no (marketable) output foregone as a result of directing them into the accident environment. The cost to society is the value of their unemployment activities, which is likely to be close to zero.

Finally, there is the problem of deciding how to account for changes in accident and safety services already in place. It would appear that accidents create social benefits in the form of employment of people in activities which prevent damage, and in activities which repair or replace resources which are damaged in accidents. For example, labour is employed in emergency services which take accident victims to hospital. A reduction in accidents would reduce the demand for such services and therefore create unemployment.

In a neoclassical world work creates disutility (at least at the margin), which is why people need to be paid to do it. Hence, work is a "bad", not a "good". Factor payments to labour give the recipients access to "goods", and this compensates them for the disutility of work. Furthermore, if people are employed to deal with the effects of accidents, then they cannot be employed elsewhere, so society incurs a loss in the form of output foregone. This is the opportunity cost of (employment in) these activities. If a person would otherwise be unemployed, then the output foregone is (close to) zero.

Strictly speaking, the opportunity cost of unemployed labour is equal to the compensating variation necessary to induce the person to give up his unemployment activities. This may not be zero, but it is usually small and positive. It could be negative if he strongly resents being unemployed, but this would imply that he would be prepared to pay to work. In this latter case, it could be argued that employment creates social benefits.

In a partial equilibrium framework, there would appear to be only two other arguments that employment creates social benefits, one of which is based upon the notion of a static externality and the other relates to dynamic externalities. The first argument is based upon the premise that the people concerned would otherwise be unemployed and, as a result of their unemployment, would engage in anti-social activities such as vandalism, which would create disutility for other members of society. This argument states that there are external benefits associated with employment since employment reduces the quantity of "bads" which otherwise would be imposed upon society. The second argument is based upon the assumption that one of the consequences of being unemployed is that, with time, one becomes unemployable. The reverse assumption is that people who are employed, remain employable, and, with time, may develop skills which make them even more employable. Hence, a fully employed workforce today leads to a more productive workforce tomorrow and consequently an increase in the "goods" available to tomorrow's society.

If any of the above arguments are to be used to support the contention that farm accidents create social benefits because they provide employment for people in prevention, repair or replacement activities, it must first be established that these people would be unemployed if farm accidents were eliminated. Since the people involved in dealing with the effects of farm accidents are usually highly skilled,[3] it is unlikely that they would remain unemployed (for long) if farm accidents were to disappear. Therefore, it is unlikely that any of the above arguments apply.

Even if it could be argued that these people would be unemployed if there were no farm accidents, it would still be necessary to establish either that they would be prepared to pay in order to work, or that there would be external costs (static or dynamic) associated with their being unemployed.

Finally, one might suggest that if employment in prevention, repair and replacement activities creates social benefits then, presumably, employment in other activities also generates social benefits. If so, it may be worthwhile employing people to cause accidents so that other people can be employed to deal with their effects!

Another argument might be that prevention, repair and replacement activities create benefits in the form of value added, and this should be subtracted from the costs of accidents in order to arrive at a final figure for the costs of accidents. The social benefits of prevention, repair and replacement activities are the reductions which they effect in the costs of accidents. These activities do not produce "goods"; they either:

(1) reduce the quantity of "bads" which otherwise would be imposed upon society, for example, suffering is reduced as a result of medical treatment, property damage is reduced as a result of fire services, etc.; or

(2) they reduce the quantity of "goods" which society would have to forego if these activities did not take place, for example, the repair of equipment enables less agricultural output to be lost.

The social benefits of these activities have already been 'netted out' of the cost of suffering and the direct loss of farm output, as discussed above. The suffering and the direct loss of output which do occur, occur in the presence of these activities and are influenced by them. Hence, the cost of suffering and the direct loss of output are already net of any reductions which have resulted from medical

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3. Some of these people, for example doctors, are highly skilled. There may be some changes in the type of work these people are employed to do, if farm accidents were eliminated, but it is unlikely that they would not be able to find alternative employment of some sort.

services, repair and replacement of resources etc. To subtract these benefits again would be double counting. The social costs of prevention, repair and replacement activities are the indirect losses of output, as defined in the fourth cost category above.

Case II: "With" Private Insurance. As in Case I, it is assumed that there is no safety programme in existence, but a simple system of insurance markets is introduced into the analysis. Private insurance gives the individual the option of paying an annual premium in return for a payout of a certain size, should an accident occur. In this way, individuals who are insured can receive compensation (in the form of a payout) if they are involved in an accident.

The institutional arrangement characterized by a set of private insurance markets is compared below with Case I, where there is no mechanism through which an individual may receive compensation if he or she is involved in an accident. Throughout the analysis the social costs of accidents will be separated as much as possible from the social costs and social benefits of insurance markets.

The social costs of farm accidents can be categorized according to the same scheme which was used in the previous case, namely:

(1) uncertainty,
(2) suffering,
(3) direct loss of output, and
(4) indirect loss of output.

The categories may be the same, but the relative magnitudes of the four types of costs will be affected by the existence of the system of insurance markets.

The most important change is that the cost of uncertainty will be reduced substantially when private insurance is available. After all, people take out insurance in order to reduce uncertainty. Taking out insurance does not reduce the probability of an accident occurring, but it does change the (private) costs which the individual incurs if an accident does or does not occur. Indeed, if the individual is fully insured so that, if an accident occurs, full compensation is paid, he will incur the same cost regardless of whether an accident occurs. In this extreme case uncertainty is eliminated and the first category of social cost listed above completely disappears. This is demonstrated in the following algebraic example:

Let p be the probability of an accident occurring during a given time period,

c be the (private) cost of an accident to the individual,

y be the insurance premium for the given time period,

x be the payout by the insurance company, if an accident occurs.

(1) Consider an individual who does not take out insurance. If an accident occurs he (or she) will incur a cost of c. If no

accident occurs the cost would be zero. Hence the individual's expected cost is:

{1} $E\ (cost) = cp$

and the variance of cost is:

{2} $Var\ (cost) = c^2p - c^2p^2 = p\ (1-p)\ c^2$

(2) Now, consider an individual who takes out insurance. If an accident occurs he (or she) will incur a cost of $c + y - x$. If no accident occurs the cost will be y. Hence, the individual's expected cost is:

{3} $E\ (cost) = (c + y - x)\ p + y\ (1-p)$

with a variance of cost:

{4} $$Var\ (cost) = (c + y - x)^2p + y^2\ (1-p) - \{(c + y - x)\ p + y\ (1-p)\}^2 = p\ (1-p)\ (c - x)^2$$

It can be seen, from the above two expressions for Var (cost), equations 2 and 4, that the variation in cost with insurance is less than the variation in cost without insurance, provided the payout, x, is less than twice the cost of the accident, 2c. Furthermore, when full compensation is paid (that is, when x=c) the variation in cost is zero, and the insured individual incurs the same cost (namely y) regardless of whether or not an accident occurs.

The existence of insurance markets may also change the relative magnitudes of the other types of social costs associated with farm accidents. The prospect of receiving compensation may influence the way in which the farmer deals with the effects of an accident. For example, the farmer is more likely to repair or replace equipment which is damaged in an accident, and in so doing minimize the direct loss of production, if he expects to receive compensation. In general, the direct loss of output is expected to be smaller, and the indirect loss of output is expected to be larger, when insurance is available.

It was stated earlier that taking out insurance does not reduce the probability of an accident occurring. In fact, the existence of insurance markets may lead to an increase in the number of accidents, owing to the problem of 'moral hazard'.[4] The extent of moral hazard will depend upon the type of insurance taken out, in particular, whether or not the claimant is obliged to pay on the first dollar of any claim, and whether or not he or she is required to demonstrate

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4. The term 'moral hazard' is open to several different legal interpretations. In the present instance the authors' use of the term is synonymous with the "free rider" problem in the provision of publicly funded services; namely that some individuals stand to gain "something for nothing". If the State underwrites a share of the cost of farm accidents, then it is likely that the farmer will be less safety-conscious since the full costs of an accident are not entirely borne by the individual.

The cost to society of a system of private insurance markets is the output which is foregone as a result of resources being employed in the administration of the insurance programme, rather than being employed in their next best alternative function. Assuming that there is no unemployment among these resources this cost can be approximated by the factor payments which are necessary to induce these resources to remain in the insurance business.[5]

The social benefits of private insurance consist of the resulting reduction in the cost of uncertainty. It has already been shown that, by taking out insurance, an individual can reduce the variation in the costs which he or she must incur, depending upon whether or not an accident occurs.

A measure of the social benefits of insurance is given by people's willingness to pay for the reduction in uncertainty, a measure known in the literature as the "cost of risk-bearing' (for example, see Oi (1974), p.671)). This measure is illustrated diagrammatically using Figure 1 below. A risk averse individual experiences diminishing marginal utility of income and so the total utility of income function increases at a decreasing rate as shown. The notation used in this example is the same as before, namely that:

p = the probability of an accident occurring during a given time period,

c = the (private) cost of an accident to the individual,

y = the insurance premium for the given time period,

x = the payout by the insurance company if an accident occurs, and

z = the individual's earnings during the given time period.

First, consider an individual who does not take out insurance. If an accident occurs he (she) will receive z-c. If no accident occurs he (she) will receive z. Hence the individual's expected income is:

{5} $E(y) = p(z-c) + (1-p)z = z-pc$

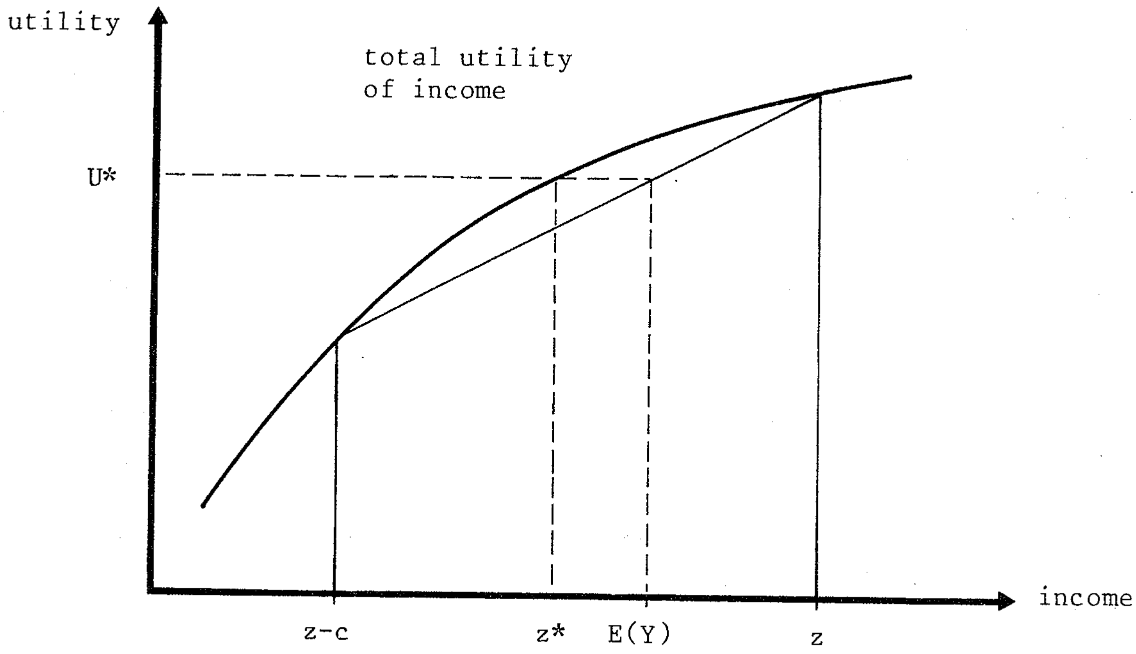
and is indicated in Figure 1. The utility derived from this uncertain income is also indicated in Figure 1.

{6} $U(E(y)) = pU(z-c) + (1+p)U(z) = U^*$

5. Strictly speaking, the opportunity cost of the insurance programme is measured by society's willingness to pay for the output which is foregone. This is approximated by the market value of output foregone, which in turn is approximated by the cost of resources employed in the programme.

FIGURE 1

Total Utility of Income for the Risk-Averse Individual



The (certain) income which also has the same utility as E(y) is z*, known as the 'certainty equivalent' of E(y). The cost of risk-bearing equals E(y) - z*, that is, the difference between expected income and its certainty equivalent.

Now consider an individual who takes out insurance. If an accident occurs he (she) will receive z-y-c+x, and if the individual is fully insured then x=c and he (she) will receive z-y. If no accident occurs the person receives z-y. Hence, an individual who has full insurance cover faces no uncertainty for he (she) receives the same income regardless of whether or not an accident occurs. The individual will not take out insurance unless the certain income with insurance is at least equal to the certainty equivalent of the uncertain income without insurance. That is, a rational person would not take out insurance unless z-y is at least as large as z*. Therefore, the largest premium which an individual would be prepared to pay is z-z*, an amount that will give a certain income with insurance of z-(z-z*) = z*.

However, the cost of risk-bearing equals the maximum premium which the individual is willing to pay, minus the expected cost of the accident. In algebraic terms:

$$\{7\} \quad z-z^* = (z-E(y)) + (E(y)-z^*)$$
$$= pc + (E(y) - z^*)$$

hence, $E(y)-z^* = (z-z^*) - pc$. Given full insurance cover, x=c and the cost of risk-bearing equals the maximum premium minus the expected payout from the insurance company.

Assuming there are no externalities associated with insurance,[6] the social benefits will equal the sum of all private benefits. Hence, the social benefits of insurance equal the maximum amount which people are willing to pay in insurance premiums less the expected payouts to all individuals. This measures the benefits which society receives from spreading the risks of accidents among its members. If insurance markets are competitive, the difference between premiums and payouts will equal the cost of running the insurance programme. Of course, in aggregate, people will be willing to pay more than they actually do pay in premiums, so the benefits of insurance will be <u>in excess of</u> administrative costs.

It is important to note that the compensation which people receive if they have an accident is neither a cost nor a benefit to society; it is a transfer payment. When people pay insurance premiums they give up access to goods and services. When people receive compensation payouts, they gain access to goods and services. However, the quantity of goods and services produced by society is unaffected as a result of the transfer payment, so economic efficiency is unchanged. This is not to deny that social welfare in its broader sense has changed, since there has been a redistribution of income, possibly in favour of one which society prefers.

By way of comparison with Case I, one must be careful not to double count the benefits to society from private insurance markets. These benefits can either be represented by a lower cost of accidents than would occur if there were no insurance programme, or they can be represented separately, but not both. Since the cost of accidents, to a society which has constructed a system of private insurance markets in order to reduce the cost of uncertainty, is already <u>net</u> of the benefits of insurance, the former method is preferred. That <u>is,</u> if

CAC = is the cost of accidents in a society where no compensation is available (Case I),

CAC^{pi} = is the cost of accidents in a society with private insurance (Case II),

B^{pi} = is the benefit of private insurance (i.e the cost of risk bearing), and

CAD^{pi} = is the cost of administering the private insurance

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6. If there are externalities associated with insurance, then the amount which individuals are prepared to pay to reduce other people's uncertainty, should be included in the social benefits.

then the sum of CAC^{pi} and B^{pi} is approximately equal to CAC, since CAC includes the cost of uncertainty which is largely removed from CAC^{pi}. The net benefits of Case II over Case I equal the reduction in the cost of accidents, owing to insurance, minus the cost of running the insurance programme: $(CAC - CAC^{pi}) - CAD^{pi}$.

Case III: "With" Public Compensation. The system of private insurance markets, discussed under Case II, is now dropped in favour of a system of compulsory insurance, run by the public sector and providing no-fault, accident compensation. There is still no safety programme in existence. The compulsory insurance programme will be compared with Case I, where no compensation is available, and with Case II, where compensation can be obtained through private insurance. The effects of accidents will be distinguished from the effects of the system of compensation.

The public accident compensation scheme will have much the same effect on the costs of accidents as private insurance. Firstly, it will reduce the cost of uncertainty, compared with a situation where no compensation can be obtained if an accident occurs. Secondly, it is likely to result in a smaller direct loss of farm output, but a larger indirect loss of output, than would be the case if compensation for accident costs could not be obtained. Finally, there may be an increase in the number of accidents because of the problem of 'moral hazard' in a no-fault accident compensation scheme.

However, more people are covered by compulsory accident insurance than by private insurance, so a greater reduction in the cost of uncertainty is expected under the public insurance programme. Provided the problem of moral hazard is not exacerbated by compulsory (no fault) insurance, compared with private insurance, the total cost of accidents is expected to be lower under public accident compensation than under a system of private insurance. These assertions, however, while consistent with accepted economic theory, deserve confirmation based on a careful examination of empirical data.

The cost of the accident compensation system to society is the opportunity cost of the resources used to administer it. This is equal to the output which is foregone by employing resources in the accident compensation system, rather than in their next best alternative use. Assuming that these resources would not be unemployed if accidents were eliminated, their opportunity cost can be approximated by the factor payments necessary to induce them to remain employed in running the compulsory insurance scheme.

The accident compensation system will have the same type of social benefit as a system of private insurance markets, namely, a reduction in the cost of uncertainty. Like private insurance, compulsory accident insurance does not reduce the probability of an accident occurring, but it does reduce the variation in costs given that an accident does or does not occur.

The appropriate measure of social benefits is peoples' willingness to pay for the reduction in uncertainty, brought about by the accident compensation scheme, that is, by the 'cost of risk bearing'. It was argued previously that in a system of private insurance markets, the cost of risk is an amount in excess of the total value of premiums which people willingly do pay, minus the compensation which they expect to receive. However, when insurance is compulsory, the premiums (or levies) are mandatory, so it is more difficult to argue that benefits exceed total levies minus expected payouts.

In order to avoid the potential problem of double counting the benefits of accident compensation, accidents are envisaged as occurring in a world which has an accident compensation scheme. Their costs are taken, therefore, to be net of the reduction in uncertainty brought about by the compulsory insurance system. That is, if:

CAC = the cost of accidents in a society where no compensation is available (Case I),

CAC^{ci} = the cost of accidents in a society which has a compulsory insurance scheme (Case III),

B^{ci} = the benefit of compulsory insurance, (i.e. the reduced cost of uncertainty), and

CAD^{ci} = the cost of administering the compulsory insurance system,

then CAC^{ci} plus B^{ci} is approximately equal to CAC, since the cost of uncertainty has been largely removed from CAC^{ci}. The net benefits of introducing a system of accident compensation into a world where no compensation is available, is equal to the reduction in the cost of accidents, minus the cost of running the accident compensation programme: $(CAC - CAC^{ci}) - CAD^{ci}$.

The net benefits of introducing a system of accident compensation into a world of private insurance markets is equal to the reduction in the cost of accidents resulting from the replacement of private insurance with compulsory insurance, plus the reduced cost of administering the compulsory insurance scheme rather than the private insurance scheme: $(CAC^{ci} - CAC^{ci}) + (CAD^{ci} - CAD^{ci})$. If the cost of accidents is approximately the same under both systems, then most of the net benefit of introducing public accident compensation and abolishing private insurance markets is attributable to the saving in the cost of administration.[7]

<u>Case IV: Public Compensation "With" Safety</u>. This case analyses the incremental effects of introducing a safety program into a system of no-fault, compulsory insurance, run by the public sector. Although the social costs of farm accidents fall into the same categories as in the previous cases - namely: uncertainty, suffering, direct loss of output, and indirect loss of output, their magnitudes will be affected by a safety programme.

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7. This may not be too far from the truth in the case of New Zealand's Accident Compensation Corporation, the major (net) benefit of its introduction being the reduced cost, particularly of litigation, compared with the system which operated prior to its introduction.

Safety programmes come in two basic types:

(1) Those which aim to reduce the probability of an accident occurring without having any effect on the severity of those accidents which do occur. For example, a programme which trains farmers in the use of farm equipment may lead to fewer accidents occurring; and
(2) Those which aim to reduce the severity of accidents, without affecting the probability of an accident occurring. For example, a campaign to persuade farmers to wear protective clothing may not reduce the number of accidents but it should reduce the severity of injuries.

Some safety programmes may achieve both a reduced probability of an accident and a reduction in its likely severity. Either type of safety programme, if effective, will reduce the social costs of all farm accidents occurring within a given time period, either by reducing the number of accidents which are expected to occur, or by reducing the average cost per accident. This reduction in the cost of accidents is the social benefit of the safety programme.

The cost to society of introducing a safety programme into a system of compulsory accident insurance is the opportunity cost of the extra resources which are involved in administering these programmes. Assuming that these resources would be employed elsewhere if there was no safety programme, their opportunity cost is approximately equal to the factor payments which are required to induce them to be employed in the administration of safety.

The safety programme has two effects on resource costs. Firstly, since the number of farm accidents and/or the severity of farm accidents is expected to fall as a result of the safety programme, the cost of administering accident compensation is expected to fall also. Secondly, there is the cost of running the safety programme itself. The additional cost of the safety programme may or may not outweigh the reduced cost of administering compensation.

The social benefits of the safety programme have been discussed earlier in this section. They are the reduced costs of farm accidents brought about by the implementation of the safety programme.

2.3.2 The Evaluation of a Farm Safety Programme.

An evaluation of the net benefits of farm safety in New Zealand requires a comparison between a system of compulsory insurance with no safety programme and a system of compulsory insurance where there is a safety programme. The net social benefits of introducing a safety programme into a system of compulsory insurance equal the reduced cost of accidents "with" and "without" safety. That is, if

CAC^{ci} = the cost of accidents in a system which has a compulsory insurance scheme (Case III), and

CAC^{cis} = the cost of accidents in a system with both a compulsory insurance scheme and a safety programme, then CAC^{ci} - CAC^{cis} is the net benefit of the safety programme to society. The cost of introducing a safety programme into a system of compulsory accident insurance equals the cost of administering the safety programme, net of any cost savings in the administration of accident compensation. That is, if

CAD^{ci} = the cost of administering the compulsory insurance system when there is no safety programme (Case III),

CAD^{cis} = the cost of administering the compulsory insurance system when there is a safety programme (CAD^{cis} may be smaller than CAD^{ci}), and

CS = the cost of administering the safety programme,

then the cost of introducing safety into the accident compensation system is equal to CS - (CAD^{ci} - CAD^{cis}).

Therefore, the net benefit (NB) of the safety programme equals the reduction in the costs of accidents, resulting from the safety programme, minus the cost of running the programme, net of any costs saved in administration. This is given by the expression:

$$\{8\} \quad (CAC^{ci} - CAC^{cis}) - CS + (CAD^{ci} - CAD^{cis}) = NB$$

If the saving in accident costs exceeds the extra costs of administration, then the safety programme will increase economic efficiency.

Alternatively, any saving in the cost of administering the compensation programme can be regarded as a benefit of the safety programme. The total benefits of the safety programme, under this approach, consist of the saving in accident costs plus the saving in the cost of administering compensation. The costs of safety consist of the cost of resources involved in the safety programme itself. The safety programme will increase economic efficiency if the saving in accident costs plus the saving in the costs of administering compensation exceed the cost of running the safety programme.

2.4 The Optimal Level of Farm Safety

In the preceding section the social costs and benefits of a farm safety programme were identified. The social benefits consist of the expected reductions in the social costs of farm accidents and in the costs of administering accident compensation, which are brought about by the safety programme. The social costs of the safety programme are the costs of its implementation. Both the social benefits and the social costs of a particular safety programme may be spread over a number of years. Accordingly, the numerical estimates should be discounted back to present day values before being aggregated. A safety programme is not worthwhile implementing unless the present value of its social benefits exceeds the present value of its social costs. The optimal level of safety is examined in more detail in this section.

It is clear that all safety programmes, farm and non-farm, which are run by the Accident Compensation Corporation, compete with each other for public finance. In other words, there is no separate pool of funds which is available for farm safety only. A "safety programme" therefore, is to be interpreted to mean any type of safety programme operated by the ACC.

Two possible arrangements for financing safety are examined. One is a situation where the ACC competes with government departments for Treasury funds with which to implement its safety programmes. Therefore, it has to justify each programme, not only in comparison with other safety programmes, but also in comparison with other public sector projects. The second situation is where the ACC has a predetermined budget to allocate among various safety programmes, farm and non-farm. Each programme must be evaluated alongside other safety programmes, but does not have to compete for funds with projects put forward by other public sector organisations. Under current arrangements, safety programmes are financed from levies paid to the ACC by employers and the self-employed. Levies are used to finance compensation payments, rehabilitation costs and services, safety programmes, and to cover the cost of administering the ACC itself. Hence, the predetermined budget arrangements closely approximates current financing procedures, but in the interest of generality, Treasury funding is also discussed.

Attention has already been drawn to the fact that different safety programmes differ in their basic objective. Some safety measures may aim to reduce the number of accidents, while others may aim to make the consequences of accidents less dramatic. In fact, some programmes may achieve a reduction in both the frequency and the severity of accidents. Where appropriate the nature of the safety programme will be taken into account in the discussion. Unless specified to the contrary, however, a safety programme may be of either type.

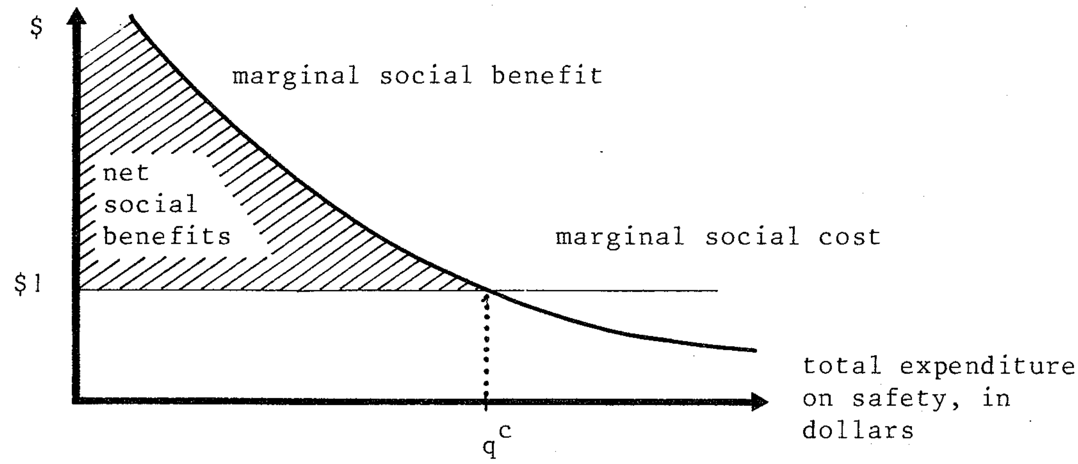
2.4.1 Divisible Safety Programmes.

Suppose that the ACC has a number of potential safety programmes, each of which is perfectly divisible and so can be implemented on any one of an infinite number of scales. This can be illustrated as follows.

Expenditure on each safety programme can be broken down into infinitely small units. For present purposes consider units of one dollar. For each successive dollar of expenditure on a given programme, the resulting social benefit can be measured. Bringing together all one dollar units of expenditure on all safety programmes, their associated social benefits can be arranged in descending order of magnitude. These marginal social benefits can be graphed as a continuous function against total expenditure on safety. Marginal social costs are graphed as a linear function, parallel to the horizontal axis and passing through the point \$1 on the vertical axis. Both functions appear on Figure 2 below.

FIGURE 2

The Optimal Level of Safety Expenditure With an Unlimited Budget

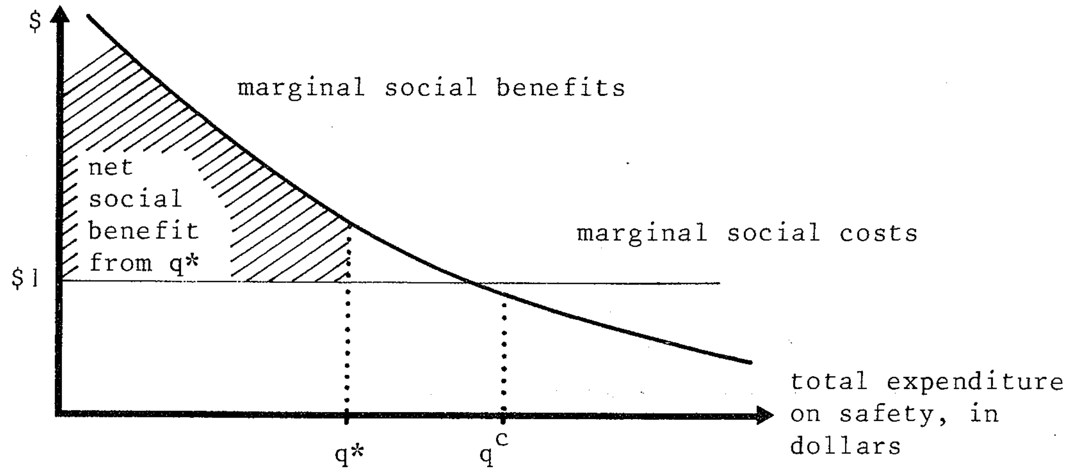


It is worthwhile spending an extra dollar on safety if the value of the resulting social benefit exceeds one dollar. Hence, the socially optimal level of expenditure on all safety programmes is q^c in Figure 2. The social benefit from the last dollar spent just equals one dollar, and the net social benefits from safety are maximized.

If the ACC has to compete with other public sector organisations for Treasury funds, then it may receive less than q^c in funds. Treasury should evaluate safety programmes, along with other projects, on the basis of social benefits per dollar expended. If other projects are attractive on this basis then not all economically viable safety programmes may be able to be implemented. Suppose funds equal to q^* are made available for safety (see Figure 3 below). These should be allocated to safety programmes with the largest social benefits. Total social benefits from safety are represented by the area under the marginal social benefit curve up to the point q^*. Total social costs are given by the area under the marginal social cost curve up to the point q^*. Net social benefits are represented by the shaded area.

FIGURE 3

The Optimal Level of Safety Expenditure
With a Budget Constraint

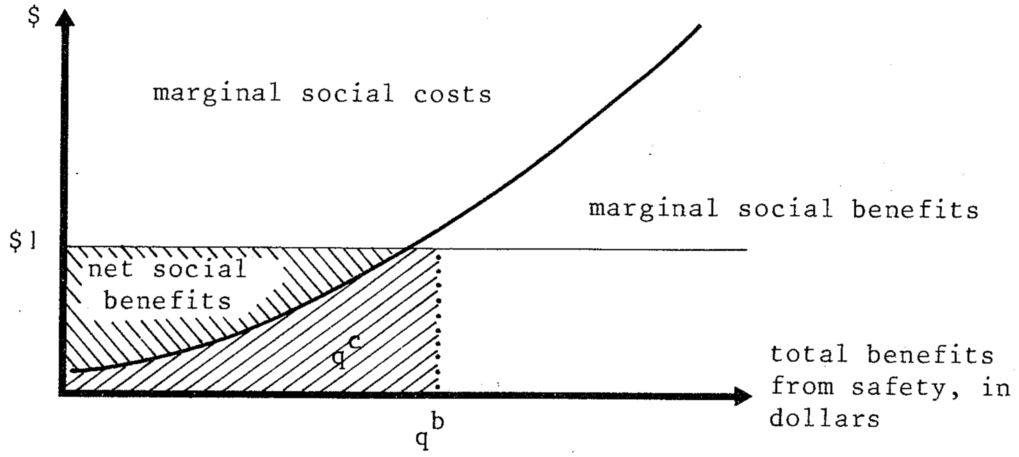


If the Accident Compensation Corporation has its own budget which is equal to q^c or more, then all q^c dollars should be spent on safety. If the quantity of available funds is less than q^c, then dollars should be allocated to safety in descending order of social benefit until the budget is exhausted.

An alternative interpretation of divisible safety can be given, which is perfectly consistent with that given above. Instead of considering successive one dollar units of expenditure on safety and their associated social benefits, consider successive one dollar units of social benefits from safety and the social costs which must be expended to achieve them. These marginal social costs can be arranged in ascending order of magnitude and graphed as a smooth function against total social benefits from safety, as illustrated in Figure 4. Marginal social benefits are represented by a straight line, drawn through $1 on the vertical axis and parallel to the horizontal axis.

FIGURE 4

Marginal Social Costs and Benefits in the Determination of Optimal Safety Expenditure



An extra dollar's worth of social benefits from safety is worthwhile, providing the cost of obtaining it is less than one dollar. Hence, the optimal level of safety is q^b in Figure 4, where the social cost of obtaining the last dollar's worth of social benefit just equals one dollar. Net social benefits are represented by a shaded area marked on Figure 4, and equal those marked in Figure 2. Total expenditure on safety, represented by q^c in Figure 2, is given by the area under the marginal cost curve to the left of q^b in Figure 4.

2.4.2 Indivisible Safety Programmes.

In practice, safety programmes are not perfectly divisible; they are discrete and "lumpy" in nature. For a given social cost outlay, a certain level of social benefits is expected, either because the number of accidents is expected to decrease, or because their severity is expected to be lower, or both. Alternatively, in order to achieve a given level of social benefits, it is expected that a certain social cost must be paid. A means for evaluating indivisible safety programmes is therefore needed.

Suppose that there are a certain number of safety programmes under consideration, some of which relate to farm accidents while others relate to non-farm accidents. Each programme can be implemented on a predetermined number of scales and associated with each scale of each programme there is a social cost and an expected social benefit. For example, a programme to prevent on-farm accidents resulting in burns may consist of distributing leaflets to farmers on the benefits of wearing protective clothing, or it may involve an extensive and intensive educational campaign, using television and radio advertisements. Both programmes have the same aim, but are likely to have different social benefits, and will certainly have different social costs. The analysis will be facilitated if programmes which have the same basic objective, but different scales, are treated as separate safety programmes.

Consider k known safety programmes. Programme i has a social cost of c_i, a social benefit of b_i, a net social benefit of $b_i - c_i$, and a benefit-cost ratio of $(b/_{c_i})$. Programmes can be arranged in descending order of magnitude of their benefit-cost ratios and these ratios can be graphed against total expenditure on safety. For example, suppose there are five safety programmes to be evaluated with details as follows:

Programme 1: $c_1=5$; $b_1=25$; $b_1-c_1=20$; $(b/c)_1 = 5$;

Programme 2: $c_2=2$; $b_2=8$; $b_2-c_2=6$; $(b/c)_2 = 4$;

Programme 3: $c_3=6$; $b_3=18$; $b_3-c_3=12$; $(b/c)_3 = 3$;

Programme 4: $c_4=3$; $b_4=6$; $b_4-c_4=3$; $(b/c)_4 = 2$;

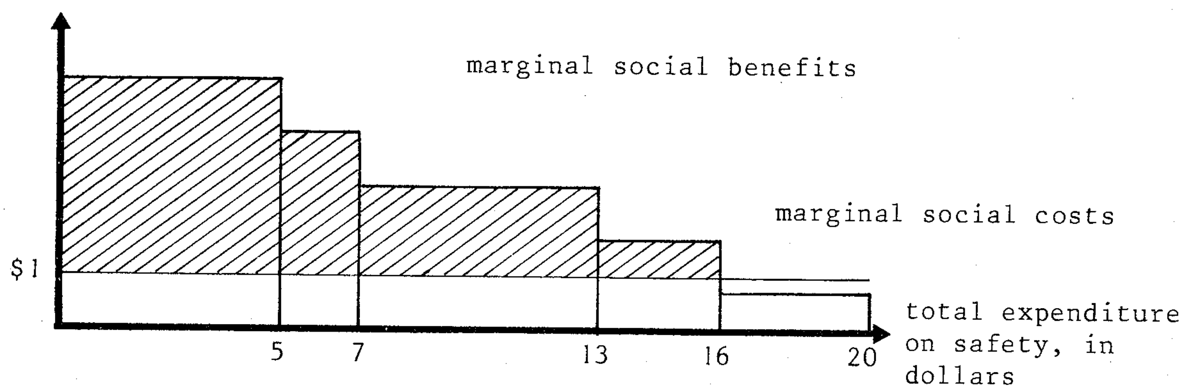
Programme 5: $c_5=4$: $b_5=2$; $b_5-c_5=2$; $(b/c)_5 = 1/2$.

Where c = cost, b = benefit

Each benefit-cost ratio equals the social benefits per dollar spent on the alternative safety programme. The "marginal social benefit" function can be graphed as a step function, as in Figure 5. Marginal social costs are represented by a linear function as in the previous figures.

FIGURE 5

Sequencing Safety Programme Alternatives to Achieve an Optimal Programme Mix



A safety programme should not be undertaken unless its social benefits exceed its social costs. This implies that its benefit-cost ratio must exceed unity. Provided sufficient funds are available, either from Treasury or from a fixed, internally funded budget, programmes 1 to 4, in the above example, should be implemented, but programme 5 should not. The optimal level of expenditure on safety is 16 dollars, and net social benefits are represented by the shaded area in Figure 5. This is rather similar to the analysis conducted earlier with the aid of Figure 2.

The fact that different safety programmes have different social costs complicates the problem of determining the optimal level of safety when a (binding) budget constraint is imposed. The objective is to allocate the fixed budget among potential safety programmes so as to maximise net social benefits from all the programmes which are to be implemented. Unfortunately, this is not necessarily achieved simply by allocating funds to safety projects in descending order of magnitude of their net social benefits, nor in descending order of magnitude of their benefit-cost ratios. The first point is illustrated by the following example involving four safety programmes:

Programme 1: $c_1=5$; $b_1=10$; $b_1-c_1=5$; $(b/c)_1=2$;

Programme 2: $c_2=4$; $b_2=8$; $b_2-c_2=4$; $(b/c)_2=2$;

Programme 3: $c_3=3$; $b_3=6$; $b_3-c_3=3$; $(b/c)_3=2$;

Programme 4: $c_4=2$; $b_4=4$; $b_4-c_4=2$; $(b/c)_4=2$.

If a budget constraint of ten dollars is imposed, then allocation in order of magnitude of net social benefits would lead to the choice of programmes 1 and 2. Net social benefits from all chosen programmes would be nine dollars and one dollar would be left unallocated. However, an aggregate net social benefit of ten dollars can be obtained by allocating all ten dollars of fund to programmes 1, 3 and 4, even though programmes 3 and 4 have lower net social benefits than programme 2.

Allocation in descending order of benefit-cost ratios does not work either, as is illustrated by the following example involving four programmes:

Programme 1: $c_1=5$; $b_1=20$; $b_1-c_1=15$; $(b/c)_1=4$;

Programme 2: $c_2=1$; $b_2=3$; $b_2-c_2=2$; $(b/c)_2=3$;

Programme 3: $c_3=2$; $b_3=6$; $b_3-c_3=4$; $(b/c)_3=2$;

Programme 4: $c_4=2$; $b_4=2$; $b_4-c_4=0$; $(b/c)_4=1$.

Allocation of a fixed budget of seven dollars according to benefit-cost ratios would lead to the choice of programmes 1 and 2, with an aggregate net social benefit of 17, and one dollar of unallocated funds. An aggregate net social benefit of 19 can be obtained by choosing programmes 1 and 3, although programme 3 has a lower benefit-cost ratio than programme 2.

With a small number of competing safety programmes, the allocation can be done heuristically as in the above examples. However, if a large number of programmes are involved then a more sophisticated method of allocation, involving mathematical programming, may be required.

2.4.3 Cost-effectiveness analysis.

The social costs of farm (and other) accidents are extremely difficult to measure in practice. The cost of uncertainty and the cost of suffering are the most difficult, particularly when accidents are fatal or result in serious disability. Consequently, obtaining a measure of the social benefits of various safety programmes is likely to be a formidable and inexact task. By comparison, the social cost of a safety programme is a far more accessible figure. For these reasons, cost-effectiveness analysis may prove to be more tractable than cost-benefit analysis as a method of evaluating safety programmes.

To carry out a cost-effectiveness analysis of safety, a measure is needed of the "effectiveness" per dollar spent on each safety programme. Since, in principle, effectiveness is best measured by the social benefits of a programme, the proxy measure which is chosen should be highly correlated with social benefits. For safety programmes which aim to prevent accidents, the most obvious measure of effectiveness is the expected number of accidents avoided as a result of each safety programme. The effectiveness of safety programmes which aim to reduce the severity of accidents cannot be measured by the expected number of accidents avoided, since a safety programme may not succeed in avoiding any accidents yet still be quite successful if the consequences of each accident are made less serious as a result of the programme.

Safety projects can be compared only when their effectiveness is measured by the same criterion. For example, it would not be valid to compare a safety programme, the effectiveness of which is measured by the number of accidents prevented per dollar expended, with a public works programme, which is evaluated in terms of kilometres of asphalt per dollar of expenditure. In order to decide how the nation's budget should be allocated, Treasury would be required to compare safety programmes with projects as diverse as defense, public works, education, health etc. Such a comparison requires a cost-benefit analysis. However, if the ACC has its own predetermined budget to allocate among safety programmes then a cost-effectiveness analysis, based upon the expected number of accidents prevented per dollar spent, is a realistic proposition, at least for programmes which aim to reduce the number of accidents. This is the approach followed by Gross (1972, pp.89-99) and Staats (1969, pp.240-254).

There is, however, an important assumption which underlies the use of cost-effectiveness analysis in an evaluation of different safety programmes. It is the assumption that the accidents which are prevented by different safety programmes are equally serious. Obviously, a safety programme which is expected to avoid x fatal accidents is more effective than another programme which, for the same cost outlay, is expected to prevent x accidents, each of which results in a single person receiving mild lacerations and losing a few days work. Of course not all accidents are equally serious, so the technique has to be adapted to enable an evaluation to be made of safety programmes. The modified version of cost-effectiveness analysis suggested below allows both types of safety programmes to be evaluated; those which aim to reduce the number of accidents and those which aim to reduce their severity.

Suppose existing accidents can be classified into a number of categories according to the severity of injury involved. For example, (1) fatal, (2) permanent disability, (3) temporary disability, and (4) no disability.[8] In addition to personal injury an accident may involve property damage. Estimates of the change in the number of accidents of each type, resulting from the implementation of each safety programme should not be too difficult to prepare. Safety programmes which aim to reduce the severity of accidents, rather than reduce their number outright, will cause a fall in the expected number of accidents in another. In effect, this type of safety programme results in accidents being reclassified from those involving a more serious type of injury to those involving a less serious type of injury. Programmes which aim to reduce the number of accidents will cause only reductions in the expected number of accidents. It would probably be most informative to express these changes in percentage terms.

In addition to the expected changes in the numbers of accidents of various types, estimates could be prepared of the more easily measured accident costs such as the direct loss of output expected and the indirect loss of output expected. The estimated cost of the safety programme would also be required. If this set of information could be obtained for each safety programme, decision makers would have a valuable set of objective data with which to make allocation decisions.

2.5 The Social Costs of Farm Accidents

In Section 2.3 it was argued that the social costs of farm accidents could be classified into four categories:

(1) the cost of uncertainty,
(2) the cost of suffering,
(3) the direct loss of output, or "output cost", and
(4) the indirect loss of output, or "resource cost".

These costs, particularly the last two categories, should be examined with two related objectives in mind. The first is to use historical data to estimate the costs to New Zealand society of all farm accidents which occurred during some recent time period. The second is to predict the savings in the social costs of accidents which are likely to result from the implementation of a given safety programme. Predicted savings in the output and resource costs of accidents will be based upon averages, estimated from past data, of output plus resource costs of predicted changes in the numbers of accidents of various

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8. The Accident Compensation Corporation already employs the first three categories in its published statistics of accidents.

types, will give rise to estimates of the savings in the output and resource costs of accidents, attributable to a given safety programme.

2.5.1 Costs of Uncertainty and Suffering

Of the four categories of social costs, the cost of uncertainty and the cost of suffering are by far the most difficult to measure. The cost of uncertainty is given by people's willingness to pay to avoid the uncertainty associated with living in a world where farm accidents occur and where no-fault accident compensation is provided. Alternatively, it is given by the compensation required to offset the disutility generated by uncertainty. The extent of uncertainty in such a world is far smaller than it would be if there were no means of obtaining accident compensation. Nevertheless, uncertainty is not entirely eliminated and its cost is a social cost of farm accidents. In principle, a Von Neumann-Morganstern experiment could be conducted to estimate, in monetary terms, the values which individuals place on the reduced probabilities of accidents of various types. This procedure was suggested by Jones-Lee (1969). In practice, it is doubtful whether interviewers are available who have sufficient skill to carry out the experiment.

The loss of welfare due to the suffering caused by the outcome of farm accidents is given by the minimum sum required in compensation, or by the maximum amount which people would be willing to pay to avoid such suffering. In principle, it is possible to measure this cost by asking a sample of people to estimate the willingness to pay or compensation figures. In practice, however, people may find it very difficult to provide the information required, even if they have no incentive to conceal their true preferences. Hence, some other means of estimating the cost of suffering, and the cost of uncertainty, is required.

The cost of uncertainty, and the cost of suffering, are reflected in the frequencies, and the probabilities, with which various types of accident occur within a given time period. It was suggested in Section 2.4 that farm accidents be classified into at least four types according to the severity of injury involved: (1) fatal injury, (2) permanent disability, (3) temporary disability, and (4) no disability. The number, or the probability, of farm accidents of each type could be estimated from historical data. This set of figures gives an indication of the costs of suffering and uncertainty associated with farm accidents. Expected changes, resulting from the implementation of a given safety programme, in the number, or in the probability, of accidents of each type indicate the savings in the costs of suffering and uncertainty attributable to the safety programme.

2.5.2 Output Costs.

The output cost is the direct loss of output to society, attributable to all farm accidents occurring during a given period of time. It is the aggregate value of agriculture output lost, due to accidents, by all farms which had accidents during the specified time period. Therefore, a start can be made by examining the loss of output by an individual farm. The relevant concept of lost farm output is the difference between the value of output which would have been produced and sold had no accident occurred, and the value of output produced and sold given that an accident has occurred - the "with - without" principle in cost-benefit analysis.

Farm output lost should be valued at farm gate prices, net of the costs of any inputs which normally would have been used to produce the output, but were not used because the accident curtailed productive activity. This method of valuation is the same as valuing lost farm output at its value added, plus the cost of inputs which had been used in the production process prior to the accident occurring.

Consider an individual farm in terms of a production function of the form:

$$Q = f(N; L; K)$$

where Q = the quantity of farm output,
N = the quantity of natural resources,
L = the quantity of human resources, and
K = the quantity of man-made resources.

This approach reveals that an accident will result in a direct loss of the farm's output if one or more of the following occur as a result of an accident:

(1) There is a reduction in the quantity of one or more of the inputs into the production process, that is, a reduction in the quantity of natural, human or man-made resources;

(2) There is a reduction in the productivity of one or more of inputs into the production process, that is, a reduction in the productivity of natural, human or man-made resources; or

(3) Output is destroyed after it has been produced.

If either of the first two outcomes occur, then less output will be produced than would have been produced had the accident not occurred. In this sense the accident results in a loss of output. Under the third condition, output is produced but is destroyed prior to being sold. Certain activities, most notably fire fighting, are carried out to minimize accidental damage to the factors of production and consequently to minimize any reduction in their quantity or productivity. These activities also aim to minimize damage to finished farm output.

<u>Damage to natural and man-made resources</u>: An accident reduces the quantity of natural or man-made resources available to a farm when resources are damaged so badly that they cannot be used in the production process either permanently or temporarily. Serious accidents can completely destroy property resources. Less serious accidents may render resources such as land, water, machinery, buildings, etc., unusable until they are repaired.

An accident reduces the productivity of land or capital when resources are not rendered unusable, but are damaged so severely that their efficiency is impaired. In the case of capital, sometimes it is difficult to distinguish between a reduction in productivity and short term reductions in quantity. For example, machinery which receives minor damage in an accident may be subject to frequent breakdowns, each of which is repaired quickly but still interferes with the productive activity on the farm. Whether this is an example of reduced productivity or of a series of temporary reductions in the quantity of capital is a moot point, but its effect is the same: to reduce the quantity of agricultural output produced by the farm. In other cases the distinction is more clear cut. An example of reduced productivity is a fence which is damaged to the extent that determined stock can force their way through, although the bulk of the flock (or herd) are effectively enclosed. A fence which is burnt to the ground is an example of a reduction in the quantity of capital. So is a chemical spillage which damages crops or pasture on which animals graze, and is so toxic that the land needs to be taken out of production.

Many accidents lead to a reduction in both the quantity and the productivity of land and capital. For example, a fire may partially damage a farm building and completely destroy equipment stored within the building. Machinery which is damaged in an accident may operate at reduced efficiency for a period of time, then completely fail and have to be replaced. An accident may result in land or water being entirely removed from production for a year or so, followed by a period during which it is in use, but with its productivity reduced.

If a natural or man-made resource, which is damaged in a farm accident, is neither repaired nor replaced, the result will be a reduction in either the quantity or productivity of the resource. Normally, this will lead to a loss of farm output. Perhaps the most difficult resource to replace is farm land, for it is usually fixed in supply and has no chosen substitutes. Consequently, if an area of land is removed from production, or has its productivity reduced, and if the land is not repaired, there will be a loss of farm output, not only in the year in which the accident occurs but in future years as well.

In many cases, however, resources can be repaired or replaced. Even permanently damaged land can be replaced by developing previously unproductive land, or by purchasing additional land. Similarly, capital can be repaired, or substitute capital can be borrowed from a neighbour, hired or purchased from a commercial outlet. When the resource is repaired or replaced, the reduction in the quantity or productivity will be smaller than it otherwise would have been. Therefore, we would expect a smaller direct loss of farm output than would have occurred had the resource not been repaired or replaced.

At one extreme, the resource may be replaced or repaired perfectly and instantaneously, in which case there will be no direct loss of farm output. Towards the other extreme, repairs may be delayed or imperfect, the damaged resource may not be replaced for some time, or the replacement resource may be a poor substitute for the one which is damaged. In these circumstances, a considerable direct loss of farm output is expected. Thus the amount of farm output which is lost as a result of any particular accident will depend upon the specific types of repair and replacement activities which are undertaken in response to the accident. Responses will undoubtedly vary between farms (and farmers), even for identical accidents. Consequently, the amount of farm output lost will also vary between farms, even for identical accidents.

Sometimes a replacement resource may be available on the farm itself. If the replacement resource would have lain idle had the accident not occurred, then it can be said to augment the quantity of the input available, and reduce the amount of farm output which otherwise would have been lost. However, simply redirecting a resource from one farm activity to another does not increase the quantity of the resource. Any loss of farm output resulting from the transfer of an on-farm resource into the accident environment should be counted as a direct loss of the farm's output due to the accident.

A second set of factors also influenced the amount of farm output which is directly lost as a result of an accident. Factors include the type of farm on which the accident occurs, the original productivity of the resource which is damaged in the accident, the time of year at which the accident occurs, and the duration of time for which there is a reduction in the quantity or productivity of the resource. In fact, the duration of time for which the resource is impaired may itself be influenced by the time of year at which the accident occurs, for the availability of repair facilities and replacement resources may be subject to seasonal variation. For example, it may be difficult to obtain a replacement header at harvest time, although headers may be readily available at other times of the year.

Damage to human resources: An accident results in a reduction in the quantity of farm labour when one or more farm workers are so badly injured that they have to stop work, either permanently, as in the case of fatalities and permanent disabilities, or temporarily. A reduction in the quantity of farm labour also occurs when farm workers, who are not injured in the accident, stop work in order to assist the accident victim or otherwise ameliorate the effects of the accident.

An accident causes a reduction in the productivity of labour when farm workers are not so badly injured that they are forced to stop work entirely, but are injured severely enough to reduce the efficiency with which they perform their tasks. There is reason to believe that many farm accidents in New Zealand result in a substantial reduction in the productivity of labour, rather than a reduction in the quantity of labour available.[9] This is particularly likely on one-man farms. The operator of a one-man farm has a strong incentive not to take time off if an accident occurs because the routine of farm operations will be disrupted to the extent that he will suffer a substantial financial loss. Hence, he continues to work, at reduced efficiency, whereas his counterpart in industry probably would have stopped work altogether. By working longer hours at reduced efficiency, the operator may be able to avoid a loss of farm output, although he will experience a reduction in his leisure time. The extent to which it is possible to reduce the loss of output will depend upon the type of farm and the time of year at which the accident occurs. In general, some loss of farm output is expected if an accident reduces the productivity of farm labour.

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9. J.G. Pryde, pers. comm., 1983

Many accidents lead to a reduction in both the quantity and the productivity of labour. For example, a man may be forced to take a few days off work and, on his return, he may operate at less than his usual level of efficiency for some time. Alternatively, an accident may result in one farm worker being unable to work for a period of time, while another continues working, but with his efficiency impaired. When an employee injured in a farm accident does not recover for some time, and meanwhile is not replaced, the result will be either a reduction in the quantity of labour or a reduction in its productivity, or both. Consequently, there will be a direct loss of farm output.

There is a point of contention regarding the correct way to measure the direct loss of output in the case of a fatal accident. It has been argued that the valid measure is the output lost to the society which remains after the accident has occurred. Since the victim is no longer a member of that society the direct loss of output which the deceased would have produced, had he lived, minus the output which he would have consumed:

> "When a worker (paid or unpaid) is prevented from working as a result of an injury, then in a time of full employment the community loses his production for the period of his incapacity. In the case of death the position is more complicated, for whilst the community loses his future output it also saves his future consumption. The loss to the community is thus the difference between what would have been his future production and consumption, after both have been discounted to present day values. The resulting figure is usually referred to as the net loss of production." (Dawson, 1973, p.338; and Jones-Lee, 1976, pp.43-51)

The opposing view states that the victim of a fatal accident should be included as a member of the society whose social welfare function is being considered. This view is expressed by Schelling (1968, p.299), who asks: "who loses if a death occurs and answers: "First, the person who dies...second,...people close to the person who dies...Finally,...other people." Accordingly, the valid measure of the direct loss of output is the gross output which the deceased would have produced, had he lived.

In this study the direct loss of output resulting from a fatal accident will be measured by the gross output which the deceased would have produced had he lived. An ex ante study of farm safety programmes involves estimating the cost of tomorrow's farm accidents to tomorrow's society. This society certainly includes the unidentified victims of tomorrow's accidents. An historical analysis of yesterday's farm accidents employs past data but should be conducted as if it were from the point of view of the society which existed prior to the occurrence of the accidents. Again the society whose welfare function is being evaluated includes as members the victims of fatal accidents.

The speed with which injured labour recovers from a non-fatal accident depends upon the effectiveness and timeliness of any medical treatment which is dispensed following the accident. Alternatively, if replacement labour is available, there is the option of substituting replacement labour for that which has been injured in the accident. "Repairing" or replacing labour will reduce losses in the quantity of productivity of labour and so will reduce the amount of farm output which otherwise would have been lost as a result of the accident.

If the injured are treated so successfully that they recover immediately, or if they are replaced right away by labour which is a perfect substitute, the direct loss of farm output will be small. However, if the injured are slow to recover, if replacement labour is not available, or if it is available but is a poor substitute for that which is injured, a considerable amount of farm output is likely to be lost. Thus the amount of farm output which is lost will depend upon the specific decisions made by farmers concerning the repair and replacement of injured workers. Since decisions will vary between farmers, the amount of farm output lost will also vary between farms, even for identical accidents.

Replacement labour which is available on the farm itself will augment the existing stock of labour only if it would have been unemployed, had the accident not occurred. Indeed, there may be certain times of the year when farm labour is under-employed and so using a worker to replace another, who has been injured in an accident, does not result in a loss of output elsewhere on the farm. Any loss of farm output which does result from redirecting labour from other productive activities into the accident environment, should be counted as a direct loss of the farm's output resulting from the accident.

The amount of farm output which is directly lost as a result of injury to labour in an accident, will be influenced by factors such as the type of farming carried out, the type of labour injured (for example, managerial, skilled, unskilled, etc.), the time of the year at which the accident occurs, and the duration of time for which the farm labour force is affected by the accident. Seasonal influences are particularly important since certain types of labour are more readily available at certain times of the year.

Destruction of farm output: Finally, an accident may result in a direct loss of the farm's output by destroying output after the production process is complete. Examples include fires, spillage of chemicals, accidents involving motor vehicles, etc., which destroy livestock, crops and other farm produce which is being stored on the farm prior to sale, or which is being transported to market.

2.5.3 Resource Costs.

A farm accident results in an indirect loss of output if resources are diverted away from other productive activities into the accident environment, resulting in a loss of output elsewhere in the economy. In principle, this loss of output is measured by society's willingness to pay for it, or at least by its market value. However, if markets are working well, market values can be approximated by the payments made to the resources employed to deal with the consequences of farm accidents. If markets are not operating satisfactorily, then the resources so employed should be valued at their opportunity cost. This is equal to the value of each resource's marginal product in the employment from which it is diverted.

The types of activity which are undertaken in the accident environment can be classified into three groups:

(1) Repair Activities: These are activities which aim to repair damage to natural, man-made and human resources.

(2) Replacement Activities: These are activities which attempt to substitute natural, man-made or human resources for those which are damaged in an accident.

(3) Prevention Activities: These are activities which are undertaken in an effort to prevent damage to resources used in farm production, or to farm output itself.

The objects of repair, replacement and prevention activities can be divided into four groups:

(1) Natural resources, including land, water, air, etc.

(2) Man-made resources, such as building and structures, machinery and equipment, livestock, crops and other farm produce except for production which is in its final, marketable state.

(3) Human resources, which include both labour itself and the personal effects used by labour such as clothing and footwear, spectacles, contact lenses, hearing aids, false teeth, artificial limbs, etc.

(4) Finished agricultural output, such as livestock, crops, etc., which is in a marketable state.

Taking each of the three activities with each of their four objects the resource costs of farm accidents can be broken down into the categories displayed in Table 1.

TABLE 1

Resource Costs of Farm Accidents: A Typology

Type of Activity	Natural Resources	Man-Made Resources	Human Resources	Finished Output
		(Category of Resource Cost)		
Repair	1	2	3	4
Replacement	5	6	7	-
Prevention of Damage	8	9		11

(Object of the Activity: Natural Resources, Man-Made Resources, Human Resources, Finished Output)

In fact, there is no category of resource cost involving replacement of finished output, for output which is destroyed (and hence is in need of replacement) is classified as a direct loss of output and has already been discussed in the previous section.

A few words of elaboration are required in regard to the category covering repair of human resources. Included in this category of resource costs are:[10]

(1) The cost of medical, optical and dental services, used to treat accident victims.

(2) The cost of pharmaceuticals, X-rays etc., administered to accident victims, plus the costs of new aids, artificial limbs etc., with which the victim is fitted.

(3) Services such as nursing, home-help etc., which are required to assist the accident victim in the longer term.

(4) The cost of transportation necessary for medical, dental, optical etc., treatment to be administered.

(5) The cost of repairing personal effects which were damaged in the accident.

It was stated previously that resources employed to deal with the effects of farm accidents should be valued at their opportunity cost if markets are not working well. There are three main types of market imperfection which cause market values of resources to deviate from their opportunity costs.

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10. Many of these costs are covered by accident compensation. See sections 72, 73 and 75 through 78 of the Accident Compensation Act (as amended).

(1) The first is the case of goods and services which are subsidized, for example medical and ambulance services. Charges for subsidized goods and services will understate their opportunity costs; what is required is the charge without the subsidy deducted.

(2) The second case is that of resources which would be unemployed if they were not employed within the accident environment. The opportunity cost of these resources is close to zero, since little or no output is foregone from other sectors of the economy.

(3) The third case involves resources which are not marketed. For example, replacement labour or capital may be borrowed rather than hired or purchased, and so no market payment is made. The opportunity cost of borrowed resources depends upon whether or not the resources are being diverted away from productive activity. If not, then their opportunity cost is (close to) zero. If so, then their opportunity cost is measured by the cost of hiring or purchasing resources to undertake the productive activity from which the resources in question have been diverted.

2.6 Conclusion and Implications

It is clear from the foregoing discussion that in order to quantify safety benefits an extensive body of factual information is required. Indeed, from the practical point of view, it is unlikely that suitable data can be obtained from the present sources of available statistical data series. Even with primary data especially collected for safety programme evaluative purposes, the complexity of the measurement problem - and in particular, due to the inherent uncertainty of farming in general, the imprecision of estimating agricultural production benefits foregone - can be expected to result in large margins for error in estimation. Improving the confidence limits on safety benefit estimates will have to be balanced against the cost of acquiring more accurate information.

From the point of view of public welfare (i.e. adopting a national accounting stance or viewpoint), it is of primary importance that the overall magnitude of social costs are established in the first instance. In terms of safety measures to prevent accidents it matters first whether or not the social costs are very large or very small. The second objective of this study is essentially to establish a lower bound estimate on these costs to society. If it appears that the social costs of farm accidents are important enough to warrant publicly-financed safety programmes to prevent their occurrence, then the next step is to consider the cost-effectiveness of preventing accidents (their social costs) by various alternative means. "Cost-effectiveness" is emphasised since safety organisations face a budget constraint, and since policies and programmes aimed at certain types of accidents will require different budget levels and have differing impacts on the social costs avoided. While a cost-effectiveness criterion may not ensure an optimal national safety policy, it does provide a basis for rationing scarce public funds between competing safety programme options.

If individual farmers were fully aware of the private costs of accidents on their farms, in particular the costs which the ACC does not compensate them for, it is believed that this knowledge would provide an incentive for improved farm safety. Since uncompensated private costs are costs borne by society, if they are not recognised by the private individual as 'real costs' then the condition of 'moral hazard' operates to the detriment of the tax paying public. The cost-effectiveness of a safety campaign directed at the farmer is, therefore, contingent upon the magnitude (the actual monetary importance) of uncompensated losses, and the ability to communicate this information to both farmers and public administrators. For this reason the present study focuses on procedures for estimating the private uncompensated costs of farm accidents. Methods whereby such costs can be prevented, based on farmers' perceptions of risk and avoidance of risk through recognised safety measures, are also examined in this study. However, the scope of the present analysis does not provide a sound basis for the evaluation of present safety programmes. The empirical results examined only refer to the populations of farmers who reported accidents in a recent year and not to the total population of farmers at which present safety information is directed.

CHAPTER 3

THE SURVEY AND ANALYSIS OF RESULTS

3.1 Introduction

The approach adopted for the empirical analysis made use of both secondary and primary data sources. In the next section of this chapter the secondary sources of information on New Zealand farm accidents are reviewed. Since accident information is limited essentially to the routine data collected by the ACC as part of an individual's application for injury compensation, it is appropriate that the analysis builds upon this data base. Secondly, because the ACC presently relies on these data to make inferences with regard to safety measures, it is important that means are considered (when possible) for testing their reliability and usefulness. The survey conducted as part of this study provided such an opportunity.

While the discussion in Chapter 2 set out a detailed, complete and theoretically sound methodology for assessing accident costs and prevention benefits, the empirical analyses described in this chapter focus on certain aspects of the problem only. For example, of the four general classes of social cost - uncertainty, pain and suffering, loss of output, and loss of productive resources - only the latter two are addressed in the empirical analysis. Further, within the resource cost categories only those few which could be readily estimated using a simple mail questionnaire approach were attempted. As it happens however the particular categories of accident code examined are believed to make up the greater part of total private costs to farmers. Such losses, net of compensation payments, are hereafter referred to as the "uncompensated" costs of farm accidents.

The survey, which is described in Section 3.3, was designed as a follow-up to the information already in hand for individuals who submitted compensation claim forms in 1980. In addition to collecting the necessary information for estimating uncompensated private costs to farmers, information was also collected in an attempt to test the accuracy of the claim form data and to improve understanding about the accident, specifically its cause and effect and whether safety measures were used (or could have been used) in that particular case. The latter data are potentially important in assessing the efficacy of alternative approaches to farm safety. Section 3.4 presents the results of the survey, with the main conclusions and limitations of the analysis summarised in the last section of the chapter.

3.2 Review of Existing Information

There have been few previous studies of farm accidents in New Zealand, and apart from the annual reports published by the ACC and a number of sectoral studies (for example, Bruce-Smith, 1982), there have been no in-depth investigations at the industry level. By contrast, considerable work has been conducted on accident costing and safety programmes in the forestry and construction industries in New Zealand (see, for example, Benis, 1975; Havik and Benis, 1975; and Kaiser, 1972). These two industries in particular have high accident rates world-wide and have been the subject of intensive investigations for many years (Simonds and Grimaldi, 1963).

Incidental to a national survey to identify the health risks to the New Zealand farm population, Pryde (1981) collected data on injuries sustained by farmers during the 12 months prior to September, 1980. Although much of the data related to general health problems and to the provision of medical services in rural areas, analysis of this information was helpful in forming the approach to this study. Since a detailed review of Pryde's results have been reported by Greer (1981), only highlights are discussed here.

Of the 2,232 randomly selected farmers who returned valid responses to Pryde's questionnaire, 681 reported having experienced pains associated with lifting. A further 462 accidents were reported, which included chemical injuries, burns, eye injuries, injuries sustained during the use of farm bikes or other machinery and implements, and injuries caused by animals. The percentage contribution of each type of injury to the total is shown in Table 2.

TABLE 2

Injury Types as a Percentage of Total Injuries (excluding lifting pains) and as a Percentage of Total Farmers Surveyed

Injury Type	Percent of Total Injuries Oct '79-Sept '80 %	Percent of Total Farmers Surveyed in Experiencing Type of Injury in 12 Mths %
Chemical	8.4	4.4
Burns	10.0	5.2
Eye	19.0	9.9
Farm bike	8.9	4.7
Machinery	10.3	5.4
Animal	43.2	22.5

Source: Greer (1981)

Lifting pains affected 30.5 percent of all farmers surveyed while injuries caused by animals were the second most numerous.

A number of hypotheses were formulated concerning the relationships between accidents and age, the effectiveness of protective clothing, and the differences in accident rates between farm types. These hypotheses and the results of the statistical analyses used to test them provided a basis for examining population groups 'at risk'. It should be pointed out however, that only the 'farmer' (presumably the household head) was asked to respond, hence it is highly probable that these results understate the total 'on farm' accident rate.

In a preliminary report of farm accident statistics in Great Britain, the Royal Society for Prevention of Accidents found that "experienced, mature and knowledgable men are most subject to risk" (Butterworth, 1977). It also seems likely that the nature of injuries will change with age, in that fewer injuries might be caused by unfamiliarity with machines and chemicals but a greater number of strains and sprains may result from lack of appreciation of reduced physical strength. According to the results reported in Table 3, more farmers in the under 30 group had sustained at least one injury in the preceding 12 months than in either of the other age groups. When lifting pains were included in the sum of all injuries there was no significant difference. Younger farmers were shown to be more likely to sustain most types of injury than older farmers. The exception is that pains associated with lifting are most common in the middle age group and there is an approximately similar incidence in the older and younger groups.

Chemical related injuries are also highest amongst the middle group. Machinery injuries appear to be a declining function of farmer's age. More than twice as many farmers in the under 30 age group suffered burns than in either of the other categories, and there was an apparent decline in the incidence of both animal injuries and eye injuries with increasing age. However, no statistically significant trends in the nature of injuries emerged between age groups.

TABLE 3

<u>Percentage of Eligible Individuals Sustaining Injuries by Age Group</u>

	Age In Years		
Type of Injury	< 30	31-45	> 46
Chemical	5.3	5.9	2.9
Burn	13.6	4.7	3.2
Eye Injury	15.8	11.3	5.8
Lifting Pain	27.1	34.3	27.6
Animal Injuries	29.2	24.8	17.4
Machinery Injuries	15.9	11.1	6.5
Any Injury Excluding Lifting Pains	47.3	42.1	28.0
Any Injury Including Lifting Pains	60.8	59.0	46.7

Source: Greer (1981)

Questions were also asked concerning the use of protective clothing and safety devices. In general young farmers appear to wear protective clothing more frequently than the other age groups, although the statistical relationship was typically poor with respect to age, sex and marital status. Since Young Farmers Clubs throughout New Zealand have been running safety courses for their members (some 7,000) in recent years, it is possible that the more frequent use of protective clothing by this age group is a reflection of these education programmes.

Where the number of farmers experienced at least one accident, excluding those reporting lifting pains, there were significant differences in accident rates between groups who worked different hours per week. Accident rates rose steadily as average working hours increased. Although there was a marked increase in accidents between farmers who worked less than forty hours per week and those who worked more than 70 hours, considerable fluctuations were observed between these two extremes. Both farm type and hours worked per week affect the numbers of farmers experiencing at least one accident in the previous 12 months, and hours worked per week differs significantly between farm types. Dairy farmers reported the greatest number of accidents (excluding lifting pains) and also the highest number of hours worked per week, while 'other' farmers who work the fewest hours had the second highest accident rate. Cropping farmers had the fewest accidents despite working the second highest number of hours.

There were few significant relationships detected between farm types and the rates of particular types of injury sustained. Trends do exist, however, and further study is warranted if safety programmes are to be targeted at those sub groups within the farm population at greatest risk. An obvious area where differences in accident rates might occur is where farm operations are carried out on different types of terrain.

The only comprehensive set of data describing injury accidents in New Zealand is compiled by the Accident Compensation Corporation. These data are supplied by the injured person by completing the ACC's 'C-1 form'. An example of this form is included at the end of Appendix 2. Because ACC's insurance scheme is compulsory, this data set encompasses a very high proportion of all accidents involving significant personal injury. Other sources of accident data are either too dispersed to be efficiently collected (e.g. hospital records) or likely to be confidential and thus difficult to assess. With only about six percent of New Zealand farms reporting compensatible accidents each year, a random survey of farm households would be an expensive means of collecting such data.

The relative importance of agricultural accidents in New Zealand can be seen from the aggregated ACC data summarised in Table 4. In comparison with other industries, farm and related agricultural service industry accidents accounted for about ten percent of total compensated work accidents in 1981. On the basis of injury rate, 36 accidents occurred per 1,000 workers in agriculture and livestock production, much less than in forestry (135) or mining (62), but considerably more than in the trade and service sectors (14 to 23). According to the ACC classifications used, the incidence of compensated injury is more than

TABLE 4

Comparison of Compensated Work Accidents by Industrial Classification, New Zealand 1981[c]

NZSIC[a]	Industrial Group	Fatality	Permanent Disability	Temporary Disability	Total	Labour Force	Injury Rate[b]
	All Industries	212	1,319	45,439	46,970	1,272,333	37
111	Agriculture & Livestock Production	22	176	3,652	3,850	106,641	36
112	Agricultural Science	6	16	817	839	10,412	81
121–122	Forestry and Logging	8	18	1,036	1,062	7,834	135
2	Mining and Quarrying	4	8	301	313	5,059	62
3	Manufacturing	25	496	17,420	17,941	305,724	59
5	Construction	11	134	3,861	4,006	112,137	36
6	Wholesale and Retail Trade	5	90	3,014	3,109	216,122	14
9	Community and Social Services	21	122	5,872	6,015	263,249	23

Source: Accident Compensation Corporation (1982)

a New Zealand Standard Industrial Classification
b The injury rate is defined of the total number of compensated accidents per 1,000 workers
c Statistics as at 31 May 1982 (pers. comm., Heidenstrom, 1983)

twice as high on an injury rate basis in agricultural services than in primary farm production.

For the year ended March 31, 1981, the ACC paid out a total of $104.5 million in compensation and medical payments (Accident Compensation Corporation, 1982). Dividing total payments by total compensated accidents, including approximately 57,000 non-work related injuries, the 'statistical average' accident required about $1,000 of compensation. Of the total compensation paid, about half was earnings-related compensation (i.e., for time away from work). Statistics on compensation expenditure by industrial groups are not available to allow a comparison of cost per accident. An estimate developed by the authors, based on the results of the survey (which is discussed in a later section of this report), gives an average expenditure per accident in primary production agriculture of about $700, or a total of $2.7 million in fiscal 1980.

As discussed in the preceding chapter, the social costs are expected to be greater than the amount of compensation actually paid. In addition to the fact that the ACC does not compensate the wage earner for the 'full amount' of wages lost (compensation is 80 percent of actual wages), there are also the costs of uncertainty and suffering and loss of productivity (resource costs). An indication of the relative importance of these non-quantified social costs can be judged from the data reported in Table 5. Hired farm managers have the lowest injury rate, while hired workers have the highest injury rate in primary production agriculture. Farm workers apparently suffer more temporary disabilities as a result of injury in relation to farmers and farm managers. However, fatalities and permanent disabilities have a low probability of occurrence (i.e. one-fifth of one percent) with farm accidents. If these data can be accepted as basically correct (there is always some doubt about the accuracy of such data), then the social costs of suffering would appear to be largely a temporary phenomenon of a small magnitude (<u>except</u>, of course, to the particular individuals and the families who make up the fatality and permanent disability statistics).

The ACC data set includes information concerning the location of the accident geographically and by industrial classification, certain socio-demographic characteristics of the person injured, a description of incapacity and the amount of compensation paid. In order to ascertain the usefulness of this information for the purpose of developing farm safety programmes, the existing ACC data were carefully examined with the assistance of ACC Research Unit staff. The main findings are briefly reviewed below. Frequency tables summarising the complete C-1 form data for the 300 accident cases sampled are reported in Appendix 2.

TABLE 5

Compensated Work Accidents in Agriculture by Occupation - New Zealand 1980-81

Occupational Group	Fatality	Permanent disability	Temporary disability	Total	Labour force	Injury rate
Farm managers	2	8	112	122	5,604	22
percent (%)	(0)	(.1)	(2.0)	(2.2)	(100.0)	
Farmers	14	106	2,104	2,224	67,161	33
percent	(0)	(.2)	(3.1)	(3.3)	(100.0)	
Agricultural Workers	13	81	2,372	2,466	47,476	52
percent	(0)	(.2)	(5.0)	(5.2)	(100.0)	

Source: Accident Compensation Corporation (1982)

The analysis of the ACC data file was carried out jointly with ACC Research Unit staff as a critique of the overall usefulness of the C-1 form as a vehicle for safety evaluation. Initial inspection of the data revealed that more than 10 percent of the accident cases did not occur while the injured person was engaged in farm work. These leisure or domicile activities, if included with work accidents would over-state the incidence of accidents in farming if that was the intended objective of a farm safety evaluation. The 'type of farm' was also a problem, since the classification used did not distinguish very well between specialised enterprises.

The diversity of accidents makes their classification from a safety viewpoint very difficult. In an attempt to cope better with this problem, Heidenstrom (1982) developed a verb-noun technique for coding narrative statements concerning "how" the accident occurred and "what caused" it. This system provides a highly detailed 'cause and effect' understanding of the accident and is potentially ideal for a careful analysis of safety options. However, it does require highly skilled data coders for interpretation of responses to open ended questions. As it stands, the C-1 form does not collect attitudinal and behavioural data concerning safety precautions actually taken, and it does not directly address the cause of the accident. Accordingly, it is possible that an alternative line of questioning might generate different answers. Hence, a more direct questioning approach might be worth testing against the noun-verb classification method.

An inherent problem with this data base is that it only includes injury accidents that exceed five working days of incapacity. Whether or not incapacities of a shorter duration are important from the social cost viewpoint is not known. Assuming that the cost estimates obtained in this study are reasonable and conceptually sound, they should be regarded as a lower bound on the true social costs of total accidents in farming.

3.3 The Survey Design

The two basic aims of the primary data analysis were to estimate the extent of losses not compensated for, and to extend the ACC data base by collecting additional information about the causes and effects of farm accidents. The approach involved a random sample survey of individuals who received compensation for a farm accident in 1980-81 that exceeded five working days of incapacity. Three hundred accident cases were drawn from an estimated population exceeding 4,000. A carefully designed mail questionnaire was developed and pre-tested using a number of recognised experts in survey design, as well as colleagues at Lincoln College, ACC rural safety consultants and headquarters staff. The questionnaire and survey procedure followed closely the "total design method" (or TDM) suggested by Dillman (1979). The response rate, after the second reminder letter, was between 70 and 80 percent, depending on what assumptions are made in defining 'response'. If it is assumed that all non-work related accident cases were returned, the response rate is 173/230, or 75 percent (see Table 6). For normally distributed variables, a sample size of 173 should be sufficient to provide statistically significant inferences about the mean and variance of population parameters (Mendenhall and Reinmuth, 1971, pp.195-213).

The questionnaire, which is reproduced in Appendix 1, was addressed to the farm owner or manager on whose property the accident occurred. Since nearly half of these accidents involved farm employees, it was considered important that the owner or manager completed the questions calling for a judgement as to the impact of the accident on farming operations. It was believed hired employees and possibly family members would have difficulty in providing such information. As the survey was confidential, individual responses were not disclosed to anyone outside of the authors, not even to the ACC. There is every reason to believe that the answers obtained were conscientiously and honestly given.

TABLE 6

Summary of Response to the Postal Questionnaire

Questionnaire Forms	Number	Percent
Posted to respondents	300	100
Returned: before first reminder	109	36
before second reminder	198	66
total	243	81
Not returned	57	19
Non-work related	70	23.3
Usable for analysis	173	57.7

The questionnaire form was divided into several parts. The first set of questions sought to clarify certain facts about the accident victim, the extent of the injury, where on the farm the accident happened, etc., to verify the C-1 form data. Three of these questions (numbers 5, 6 and 7), which dealt with how the accident happened, were reproduced exactly as they were asked on the respondents' original C-1 form. The following set of questions (numbers 8 to 11) queried whether any safety measures were employed at the time of the accident and whether or not safety precautions might have prevented it in the first place. In the next part of the questionnaire the respondent was asked to estimate the extent of personal cost (or loss) sustained and any consequences the accident had on subsequent farm management decisions. The last part of the questionnaire attempted to collect data on the type and size of farm, size of the work force, experience and related factors which were unknown but possibly relevant to formulating safety policy (National Safety Council, 1975).

The forms, with return stamped envelopes, were sent out in May, 1982. Nearly all had been returned by late July. Follow-up letters (reminders), including replacement forms in the second follow-up, were mailed 15 days and five weeks after the first mailing. Completed questionnaires were interpreted and coded by one person as soon as they were returned. Much of the coding was pre-determined, either by the structured questioning in some cases or the conventions used for the original C-1 data. The data were analysed using the 'Statistical Package for the Social Sciences' (SPSS) on the College's VAX computer.

3.4 Summary of Results

The empirical findings are reported under the headings of three main themes in the analysis: the general nature of farm accidents, their uncompensated private costs, and the potentials of safety measures to reduce the social cost of farm accidents.

3.4.1 Farming Accidents: An Expanded Profile.

It was pointed out in Section 3.2 that the ACC's present system for gathering accident information was not specifically geared to safety needs. Consequently, some information about the accident and the injured person that could be meaningful to safety programme administrators is not routinely collected. Examples include a more precise understanding of 'who' was injured, the perceived consequences in terms of disability and loss of future productive capacity, the accident environment, and other background information about the farm and the farmer that may be useful in identifying 'at risk' individuals and situations. The following information, considered in conjunction with the C-1 data reported in Appendix 2, provides a more in-depth understanding of the accidents that occurred in fiscal 1980.

The employment status of the injured individual is reported in Table 7. This classification was thought to be more meaningful than the present method used by the ACC (refer to Appendix 2, Table 2.2) since it allows comparison of employment positions 'on the farm' rather than general occupational codes. The results are generally consistent with the data reported by the ACC (also refer to Table 5), but show the relative frequency of accidents by <u>source</u> of on-farm employment. In order of decreasing frequency, most accidents involved farm owner-operators (42 percent), hired employees (24 percent) and family members (17 percent). A test of the difference between this distribution and the distribution of employment categories as reported in the agricultural census yields a statistically significant difference at the 10 percent level (Chi-Square test). Unfortunately, because the two distributions are not definitionally consistent - in terms of the employment categories used - this test cannot be regarded as reliable. However, adding together the owner-operator and family member categories suggests that a greater proportion of accidents occur to the immediate farm family (60 percent) than indicated by the ACC's ratio of 'farmers: agricultural workers' in Table 5 (also see Appendix 2, Table 2.12).

TABLE 7

Farm Accidents by Employment Status of the Injured Person in Comparison to Agricultural Census Employment Categories

Employment classification of injured person	Survey Respondents Number	Survey Respondents Percent		Agricultural Census[a] Percent
Farm owner, part owner	73	42.2		55.9
Hired employee (full & part time)	41	23.7 }		
Family of owner or employee	30	17.3 }	54.3	39.6
Contractor, casual labourer	23	13.3 }		
Hired manager	5	2.9		4.7
Unknown	1	0.6		-
Total	173	100.0		100.0

a New Zealand Government (1980 p.791)

Q.1. "At the time of the accident the injured person was (Appendix 1)

The data reported in Table 8 indicate the farm owner-operator's perception of the permanent effects of the injury. Seventy-one percent indicated no permanent effects, and of those with some form of permanent disability (29 percent), the majority of cases were considered 'slight' to 'moderate'. It should be noted that the farmers' perception of permanent effects resulting from the injury are significantly greater (Table 8) than the ACC's accident file summary suggests (see Table 5).

TABLE 8

Degree of Permanent Effects from Injuries Caused by the Accident

Description	Respondents Number	Respondents Percent
No known permanent effects	123	71.1
Slight effects	15	8.7
Moderate effects	31	17.9
Serious effects	4	2.3
	173	100.0

Q.2. "Has the injured person suffered any permanent effects from the accident? If yes, please describe these." (Appendix 1)

Hours worked by injured persons during the week of the accident are summarised in Table 9. The results indicate that most of the accidents happen to people who were working a normal farm week, i.e. 40 to 60 hours. Unfortunately, sufficient secondary data on the relative frequency of farm work by employee status is not presently available to test hypotheses relating accident frequency to work rates. Such information is not routinely collected in the agricultural census, hence a special survey would be required to compare accident with non-accident farm types and workloads.

TABLE 9

Hours Worked on the Farm by the Injured Person at the Time of the Accident

Hours per week	Respondents Number	Percent
None	3	1.7
Less than 20 hours	15	8.7
20 to 40 hours	31	17.9
41 to 60 hours	83	48.0
More than 60 hours	33	19.1
Unknown	8	4.6
Total	173	100.0

Q.3. "How many hours a week was the injured person working on the farm at the time of the accident?" (Appendix 1)

Where on the farm the accident happened was also queried, and these results are reported in Table 10. The ACC's present system of recording the accident scene does not adequately describe the accident 'environment', or the underlying features of the 'scene' which may be contributory to accident event (refer to Appendix 2, Table 2.11). The results of the survey suggest that such information may be important in formulating safety strategies. About 45 percent of the accidents occurred in enclosures (i.e. farm yards, sheds and workshops). Terrain features such as hill country vs flat paddocks were equally distributed as places where accidents occur outside of enclosed work areas. While more useful than the ACC's 'work-nonwork' classification, additional information would be needed to utilise such findings in developing safety approaches centred on work 'environments'.

TABLE 10

Places on the Farm Where Accidents Occurred

Accident Scene	Respondents Number	Percent
Farm Yard or Shed	65	37.6
Flat Paddock	42	24.4
Hill Paddock	42	24.4
Workshop	14	8.1
Unknown	10	5.8
Total	173	100.3

Q.4. "Where on the farm was he/she when the accident happened?" (Appendix 1)

The underlying cause of the accident is determined (surmised) by the ACC using the verb-noun interpretive system developed by Heidenstrom (1982). As a check on this method, which relies on the careful interpretation by skilled analysis of open ended responses, the respondents were asked the identical question they answered on the original C-1 form. The problem with a direct comparison of these responses with the interpretation of the original responses (which the authors have not seen) is the time that has elapsed between the accident and the survey. It could be argued however that problems of recall might be balanced by the period of reflection (in this case less than two years), such that the accuracy of this information in depicting the accident causes may even be enhanced by "follow-up" questioning. The survey results are summarised in Tables 11 and 12.

TABLE 11

Farming Activities Engaged in at the Time of the Accident

General Activity	Respondents Number	Respondents Percent
Working with Animals	48	27.7
Tripping, Falling	36	20.8
Operating Machinery	33	19.1
Operating Vehicles	27	15.6
Handling, Lifting	19	11.0
Passive (Leptospirosis etc.)	8	4.6
Unknown	2	1.2
Total	173	100.0

Q.5. "What was he/she doing when the accident happened?" (Appendix 1)

TABLE 12

Location of Injuries Resulting from the Accident

Injury Location	Respondents Number	Respondents Percent
Lower limbs	70	40.5
Upper limbs	39	22.5
Back	26	15.0
Trunk	14	8.1
Head	11	6.4
Systemic	8	4.6
Unknown	5	2.9
Total	173	100.0

Q.7. "What were his/her injuries?" (from C-1 form, Appendix 2)

The order of relative importance of the farm activities engaged in when the accident occurred were handling livestock (28 percent), operating machinery (19 percent) and vehicles (16 percent), and general handling and lifting of objects (11 percent). A significant proportion of the respondents did not clearly specify the activity, but rather indicated the 'act' which was under initiation. For example, 21 percent of the accidents were attributed to the general category of "tripping or falling". The significance of such data for safety analysis purposes is obviously limited, since tripping and falling injuries can occur with almost any type of farm activity. The main point is that alerting farmers to the dangers of handling livestock may be more effective in avoiding injury than stressing the fact that many accidents occur through tripping over things and falling down. Passive injuries such as leptospirosis, which accounted for about five percent of total accidents, has been identified in a recent safety campaign as an 'actively-related' farm hazard.[11]

Since the types of injuries suffered most frequently are fairly clear, for example the lower limbs (Table 12), protective measures such as specialised work boots could be an appropriate safety campaign theme. However, an analysis of the types of injuries based on the ACC's detailed categories, as shown in Table 13, is not particularly useful as an insight into accident prevention.

TABLE 13

The Type of Injuries Caused by the Accident

Injury Type[a]	Respondents Number	Respondents Percent
Strain	48	27.7
Fracture	40	23.2
Crushing	28	16.2
Laceration	26	15.0
Viral	9	5.2
Dental	8	4.6
Burn	5	2.9
Infection	3	1.7
Unknown	6	3.5
Total	173	100.0

a As summarised from the ACC's 'verb-noun' (Heidenstrom) classification system.

11. This ACC safety campaign was a joint effort with animal health specialists (MAF) and Department of Health personnel (pers. comm., Bruce-Smith, 1983)

Furthermore, there is the danger that open ended responses to questions regarding the accident can be misinterpreted by the safety analyst. Apart from the fact that the C-1 form data file included a number of non-work related farm accident cases, comparing the survey responses with the ACC data on 'type of injury' (see Table 2.5, Appendix 2) indicated a significant difference in the ordering of injury types. While this specific result is not meaningful to safety planning, it does raise the question as to whether a sophisticated method of interpreting response (the Heidenstrom verb-noun system) is reliable or simply results in specious accuracy. The results obtained in this survey, however, are not thought to be an adequate test of this proposition.

The survey questionnaire included additional background information on the type of farm and socio-economic characteristics of the farm operator. Descriptive data about the farms are summarised in Tables 14 to 17. These data, unfortunately, are not particularly useful since no significant differences were found between the distribution of accidents under the classification used for farm size and type of farm (including terrain, see Table 16) and the distribution of these characteristics based on census data. In other words, the incidence of accidents appears to be randomly distributed with respect to farm type. The farm classification system used in the survey did however yield a different distribution than that obtained from the C-1 data (see Appendix 2, Table 2.1). The authors believe the farm-type groups used in the survey (refer to Table 15) give a more accurate depiction of New Zealand's primary production sector.

Another method of classifying farms is by the size of the labour force. The hypothesis under test would be that accident rates per work day do not vary with the size of the labour force under supervision. Studies in the forestry sector, for example, have shown that larger work forces tend to have fewer accidents per unit of working time than small ones ( ). This result has been attributed to the fact that as the supervisory function of management increases in importance, so does the awareness of accident hazard, and measures such as safety training to prevent accidents. Farming, however, is typically an owner-operator profession, with the greatest proportion of work accidents occurring to the farmer or members of the farm family. The results summarised in Table 17 compare the frequency of accidents for permanent, part-time, casual, family and 'other' services of farm labour. Such information is potentially useful to safety policy administrators, but again, sufficient data on the agricultural workforce is not presently available to enable accident rates to be statistically compared to identify the particular employment groups at risk.

TABLE 14

Size of Farm on Which the Accident Occurred

Farm Area in Hectares	Survey Respondents Number	Survey Respondents Percent	Agricultural Census Percent[a]
Less than 20	18	10.4	23.6
20-50	18	10.4	15.3
50-100	32	18.6	19.3
100-250	32	18.6	26.0
250-500	22	12.7	8.9
500-1000	16	9.2	3.1
1000-2000	8	4.6	2.0
2000-3000	5	2.9	
More than 3000	3	1.7	
Unknown	19	10.9	-
Total	173	100.0	99.9

a New Zealand Government (1980 p.360)

Q.17 "What is the area of your farm?"(Appendix 1)

TABLE 15

Farm Type and Accident Frequency

Type of Farm[a]	Survey Respondents Number	Survey Respondents Percent	Agricultural Census Percent[b]
Mixed Livestock	37	21.4	24.3
Dairy	37	21.4	21.8
Contractor[c]	37	21.4	-
Sheep	24	13.9	24.5
Miscellaneous (tree, cropping)	23	13.3	10.9
Orchard, Market garden	10	5.8	7.2
Beef	4	2.3	9.3
General	1	0.6	2.0
Total	173	100.0	100.0

Q.19 "What percentage of your farm's income is derived from each of the following: (Appendix 1)

a. These categories were based on percentage breakdowns of gross farm income following the assumptions used in the Agricultural Census.

b. New Zealand Government (1980 p.361).

c. Definition: farms where earned income from contracting services provided by the owner-operator exceeded 75 percent of total farm income.

TABLE 16

Topography of Farm on Which the Accident Occurred

General Topography[a]	Respondents Number	Percent
Very steep	1	0.6
Steep	25	14.5
Moderately steep	40	23.0
Rolling	43	24.9
Flat	47	27.2
Unknown	17	9.8
TOTAL	173	100.0

a Based on a weighted average scheme devised by the authors. Essentially, any farm with 50 percent or more of a particular terrain was classified as that type of general topography. As far as the authors are aware suitable national statistics are not available for purposes of comparing survey responses with statistical census data.

Q.18 "How much of your farm falls into each of the following classes?" (Appendix 1).

TABLE 17

Hours Worked by Various Classifications of Farm Employees

Classification of Farm Labour Inputs:	Respondents Number	Respondents Percent
A. Employees, permanent & part-time (Hours/year):		
None	138	79.8
Less than 500 hours	11	6.6
500 to 1,000 hours	5	3.0
1,000 to 2,000 hours	7	4.2
More than 2,000 hours	7	4.2
Unknown	5	2.9
Total	173	100.7
B. Casual labour (Hours/year):		
None	92	53.2
Less than 100 hours	25	14.7
100 to 200 hours	20	11.6
200 to 500 hours	23	13.4
500 to 1,000 hours	6	3.6
1,000 to 2,000 hours	2	1.2
Unknown	5	2.9
Total	173	100.0
C. Family labour (Hours/year):		
None	118	68.2
Less than 500 hours	24	13.3
500 to 1,000 hours	6	3.6
1,000 to 2,000 hours	11	6.6
More than 2,000 hours	10	6.0
Unknown	4	2.3
Total	173	100.0
D. Other labour (Hours/year):		
None	161	93.1
Less than 500 hours	3	1.8
More than 500 hours	5	3.0
Unknown	4	2.3
Total	173	100.2

Q.21 "Until the accident, how much work was done in a 'normal' year by other labour?"(Appendix 1)

Social and demographic characteristics of the farm operator were also collected in the follow-up survey. In contrast to similar data on the accident victim (refer to Appendix Tables 2.6, 2.7, 2.10 and 2.13), the age, sex, marital status and experience in farming were not significantly different (based on census data) from what would be expected in a random sample of New Zealand farm operators (Table 18). The accident victims, however, tend to be younger and less experienced (Appendix Table 2.7) in farm work. Apart from this, the other information tabulated from the C-1 form, for example the fact that accidents occur more frequently between 11a.m. and 7p.m. and on Mondays and Thursdays, is not easily translatable into any meaningful safety strategies for the farm sector.

TABLE 18

Age and Sex of the Injured Person Compared with National Farm Employment Data

Item	Injured Person Number	Injured Person Percent		Agricultural Workers Percent [a]
Age in years:				
0-14	2	1.2		
15-19	14	8.1)		
20-29	48	27.7)	-	33.4
30-39	44	25.4)		
40-49	34	19.7)	-	44.1
50-59	24	13.9		22.5
60+	7	4.0		
	173	100.0		100.0
Sex:				
male	147	85		82
female	26	15		18
	173	100		100

a New Zealand Government (1980, p.776 and 787)

Overall, the upshot of the follow-up survey is that the identification of farm employees (and employers) or the work activities which contribute to significant accident hazard, remain unclear. This finding implies, while recognising the need of additional data to test this proposition, that farm accidents occur more or less at random and that there are few, if any, special 'at risk' groups on which safety programmes can usefully be focussed. This latter point is examined in some detail in Section 3.4.3.

3.4.2 Empirical Estimates of Accident Costs

The survey was designed to provide selected estimates of the "uncompensated" costs that result from farm accidents. According to the cost accounting methodology presented in Chapter 2, these are direct costs to the farmer and hence social costs to the nation. Such costs are not presently accounted for in assessing accident costs, hence the potential benefits to national farm safety programmes will be underestimated if these costs prove to be significant. This survey attempted to generate empirical estimates of the following types of resource costs (refer to Table 1, Chapter 2):

1. Category 2, 'repair' of man-made resources;
2. Categories 6 and 7, 'replacement' of man-made and human resources, respectively; and
3. Categories 9 and 11, 'prevention' of damage to man-made resources and marketable produce, respectively.

As reported previously (Section 2.5.3), the ACC compensation payments are believed to provide a lower bound estimate on the social costs of "repair to human resources" (category 3). No attempt was made to estimate empirically the costs of "preventing damage" to human resources (category 10), which the others conceive as specific expenditure on farm safety measures (and devices) by farmers.[12] Measures of the uncertainty and suffering component of accident costs were not attempted in the survey as it was felt that these aspects could be better approached in a personal interview format.[13] Finally, no attempt has been made in this survey to establish the costs of accidents in terms of losses to natural resource productivity, categories 1, 5 and 8 (Table 1). While these losses are not believed to be significant, they should be remembered, and where sufficient data exists, highlighted in an overall assessment of the potential serial benefits of farm safety programmes.

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12. Publicly funded farm safety programmes, i.e. from ACC levies and tax-payer contribution, are taken up in Chapter 4.

13. In fact, the results of many previous studies suggest that a carefully developed interview format is essential to generate objective responses (data) for reliable policy analyses, and even then such empirical relationships have limited use in assessing the implications of a range of practical policy options (Dillman, 1978; Jones-Lee, 1976).

It is important to stress that the estimates of resource cost and production loss rely to a large degree on the farmer's own interpretation of the accident's consequences. It is possible that some farmers were unwilling to take the time necessary to think carefully through the accident event and its full consequences before answering the survey questions. On the other hand, the authors did not receive any survey responses that suggested that respondents were purposely attempting to introduce bias in the results through strategic

behaviour. The responses are summarised, basically, in the order that the questions were put to the respondents.

The first question focussed on the cost of replacing the injured person for the duration of his or her incapacity. The results reported in Table 19 indicate that in 30 percent of the cases family members were called upon to fill the void. Additional labour was employed in only 21 percent of the cases. In the majority of these accidents it would appear that family, friends and other regular employees were able to cope with the lost time created by the accident. Only in four percent of the cases was the accident considered to have caused delays or uncompleted tasks.

TABLE 19

Resources Used to 'Cope With' the Injured Person's Work Load While Incapacitated

How work was done	Respondents Number	Respondents Percent
Family helped out	70	30.0
Employed extra labour	49	21.3
Usual staff worked longer	47	20.4
Friends helped out	22	9.6
Work was not affected	12	5.2
Work was not done, or was delayed	10	4.4
Employed contractors	7	3.0
Hired additional machinery	1	0.4
Unknown	12	5.2
Total	230 [a]	100.0

a Numbers do not sum to 173 due to multiple responses.

Q.12a "How was the accident victim's work done while he/she was unable to work?" (Appendix 1) (circle a number, or numbers, as appropriate).

The farmer's perceptions of the increase in operating costs as a result of employing extra resources to replace the injured person are summarised in Table 20. Fifty-three percent indicated no increase in the costs of operation. A further 30 percent indicated that additional costs ranged between $100 and $2,000. About five percent indicated higher added costs, with about eight percent of the respondents unable to provide an estimate.

TABLE 20

The Increase in Farm Operating Costs Resulting from the Utilization of Extra Labour Resources

Increased Costs	Respondents Number	Respondents Percent
No increase	92	53.2
Less than $100 increase	6	3.5
$100-$499 increase	29	16.8
$500-$999 increase	14	8.1
$1,000-$1,999 increase	9	5.2
$2,000-$2,999 increase	5	2.9
More than $3,000 increase	4	2.3
Unknown	14	8.1
Total	173	100.0

Q.12b "Did this increase the farm's operating costs?"(Appendix 1)

The next question asked of the respondent was to estimate the repair and/or replacement costs of resources physically damaged in the accident. The categories of damaged resources included buildings, plant and machinery, livestock losses, losses of stored produce or production inputs, and damage to standing crops (refer to Q.13 of the questionnaire, Appendix 1). The respondent was also asked to report the percentage of the loss covered by insurance in each case. These results are summarised in Table 21.

Only 28 respondents (16 percent) reported any damage to resources. Almost half of the reported damage costs involved machinery, and to a lesser extent, livestock and farm structures. It was interesting to note that, with few exceptions these resource losses were not covered by insurance. In nearly all cases the amount of these costs was small, typically less than $100. No cost estimates were reported for standing crops and stored produce and supplies.

TABLE 21

Nature of Damage and Estimated Monetary Losses Attributed to the Accident

Nature of Loss and Estimated Value:	Respondents Number	Respondents Percent
A. Type of damage or loss sustained:		
Damage to machinery	13	46.4
Livestock losses	7	25.0
Damage to buildings, fences, etc.	5	17.9
Stored produce losses	2	7.1
Damage to standing crops	1	3.6
Total	28	100.0
B. Repair or replacement cost of damaged machinery:		
$0 or unknown	164	94.8
$10	1	.6
$20	1	.6
$30	1	.6
$35	1	.6
$50	1	.6
$100	2	1.2
$1,500	1	.6
$3,750	1	.6
Total	173	100.0
C. Repair or replacement cost of damaged buildings and structures:		
$0 or unknown	168	97.1
$10	1	.6
$20	1	.6
$50	2	1.2
$150	1	.6
Total	173	100.0
D. Replacement cost of livestock lost:		
$0 or unknown	169	97.7
$300	2	1.2
$450	1	.6
$700	1	.6
Total	173	100.0

Source: Q.13, Appendix 1

Production losses were addressed in several questions which were meant to orient the farmer into thinking about delays to the completion times of farm operations. It has been hypothesised by ACC safety staff that failure to accomplish critical farm tasks such as drenching, planting, harvesting, spraying, etc., is perhaps the largest 'hidden' cost in farm accidents. Unfortunately, accurate estimates of the costs of delays resulting from accidents are exceedingly difficult to obtain. The only reliable method of obtaining such data may be through detailed case studies of selected accidents which can be generalised and then aggregated for a given study population.

The approach adopted in this survey was to ask the farmer to evaluate such consequences for him or herself. Leading up to the question requiring a judgment as to the probable production loss were a number of introductory questions designed to focus the respondent's attention on some potential consequences of not being able to perform operations on schedule. These results are reported in Table 22.

The types of operations delayed by the accident were categorised from opened responses into four types: livestock management, crop sowing and harvesting, farm improvement, and all other operations (Part A, Table 22). Sixty-four respondents (about one third of the total) indicated delays resulting from the accident, with the majority of these being livestock management operations. The accident typically happened before or just after the operation started (Part B), and caused delay in completing the task generally exceeding several days (Part C). In more than 60 percent of the cases the accident resulted in delays exceeding five days and/or the abandonment of the operation altogether.

Reasons why output was reduced were generally not clear (Part D, Table 22). Respondents did not provide specific reasons in most cases, preferring to generalise the consequence as "less product" or "lower yield". The farmers' estimated production loss resulting from delays is reported in Table 22, Part E. It is important to note that only 16 (or one fourth) of the 64 farmers reporting delays thought that the accident reduced farm revenue. Of those who believed revenue was reduced, over one third were not able to provide an estimate of the amount of reduction.

Respondents were also asked if, because of the accident, they had changed their farming practices. These results (Table 23) suggest that less than 10 percent initiated changes in operating methods, with less than one percent leaving farming as a profession. This is consistent with the generally low incidence of permanent disabilities in farm accidents during the period of study (refer to Table 5).

TABLE 22

Farming Operations Delayed Due to the Accident and Their Estimated Costs in Foregone Revenue in Fiscal 1980

Nature of Delay and Cost:	Respondents Number	Respondents Percent
A. Types of operations delayed:		
Livestock management	35	54.7
Crop sowing and harvesting	15	23.4
Farm improvements	11	17.2
Other	3	4.7
Total	64	100.0
B. Stage of operation at the time of accident:		
Not started	22	33.8
Just begun	19	29.2
One quarter done	4	6.2
Half done	11	16.9
Three quarters done	5	7.7
Almost done	4	6.2
Total	65	100.0
C. Length of time the operation was delayed:		
A few hours	12	20.0
1 to 5 days	10	16.7
5 to 10 days	12	20.0
More than 10 days	23	38.3
Abandoned the job	3	5.0
Total	60	100.0
D. Causes of reduction in output due to the delay in completing the operation:		
Lower livestock production	7	50.0
Lower crop production	4	28.6
Improvements not done	2	14.3
Other	1	7.1
Total	14	100.0

E. The farmer's estimate of the amount of loss in farm output:

$500	1	6.3
$600	1	6.3
$1000	2	12.5
$1500	1	6.3
$1800	2	12.5
$2000	2	12.5
$3000	1	6.3
Unknown	6	37.5
Total	16	100.0

Source: Q.14a, b, c Appendix 1.

TABLE 23

Changes in Farming Methods Since the Accident

Description of changes	Respondents Number	Percent
No changes	142	82.1
Changed enterprises or operating methods	14	8.1
Changed farms	4	2.3
Left farming	1	0.6
Unknown	12	7.0
Total	173	100.0

Source: Q.15, Appendix 1

It is clear from the relative magnitude of resources and production losses that labour-related expenditures are considered by farmers to be the most important source of accident-related private costs. Over 53 percent of the farm operators reported no change in operating costs as a result of the accident, and of the remainder 60 percent reported increased operating costs less than $500. About five percent of all respondents estimated their increased operating costs in excess of $2,000, with eight percent unable to provide an estimate. Only a few operators reported any significant loss in output: less than two percent of the sample claimed a loss in gross farm revenue exceeding $1,000, these losses largely due to delays in performing farm operations.

A final set of calculations was required to obtain an imputed value for 'lost time'. Where the operator or hired manager was injured, an average weekly wage less compensation received was used to estimate the cost of time lost. For a hired employee, the average wage for five working days plus the employer's share of wages thereafter, calculated at 25 percent of the total compensation paid by the ACC, provided an estimate of employee lost time. The average weekly wage rates used were $153 for owner-operators and hired managers, and $106 for hired employees and family members. To these costs were added the respondents' estimates of damaged resources and production foregone, less insurance payments when this information was known. It is difficult to judge whether the resulting estimate for uncompensated direct costs understates or overstates the actual case, but it is in some instances significantly higher than the estimates offered by many farmers participating in the survey (refer to Table 20). The results are summarised in Table 24.

TABLE 24

Frequency Distribution for Uncompensated Direct Costs of Farm Accidents in New Zealand, 1980-81 (in March 1981 Dollars)

Uncompensated direct cost per accident	Number	Relative frequency	Cumulative frequency
		%	%
$106	64	37	47
$107-200	23	13	50
$201-300	15	8	58
$301-400	15	8	66
$401-500	8	5	71
$501-1,000	20	12	83
$1,001-2,000	13	8	92
$2,001-3,000	7	4	96
$3,001-4,000	6	3	99
$4,001-4,857	2	1	100
	173	100	

Total uncompensated direct costs for sampled farms = $96,851
Sample mean = $563.09
Inferred direct costs for total NZ farm accidents = $1,211,000[a]

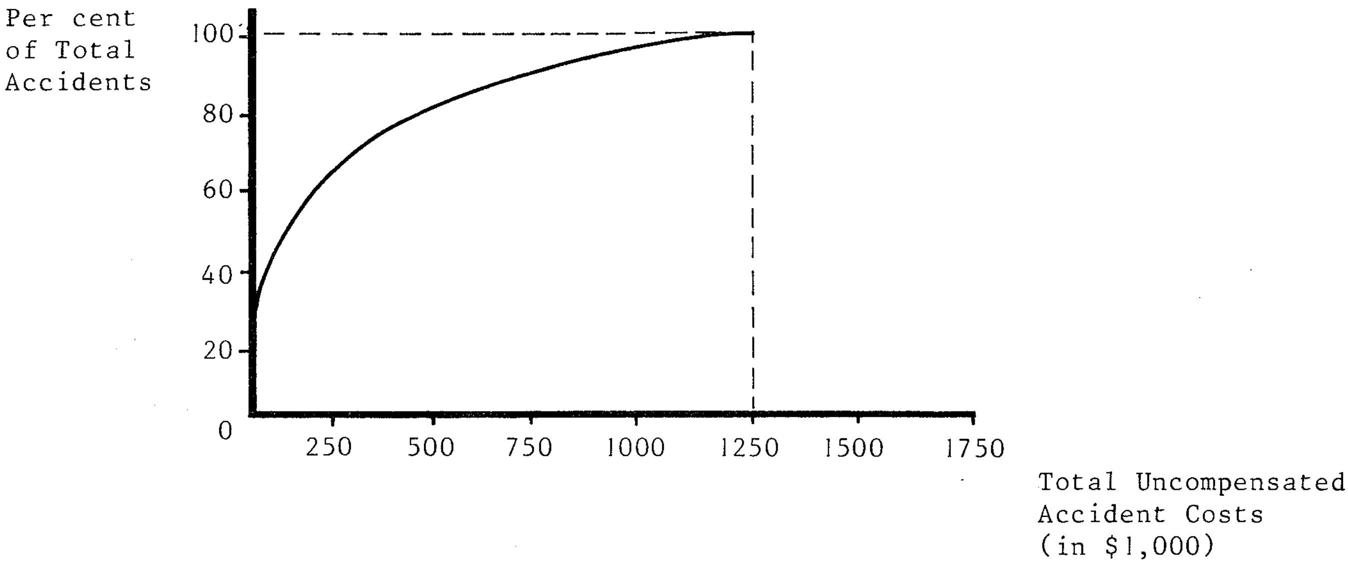
a Based on a 95 percent confidence interval this estimate could range between $0.8m and $1.6m.

Half of the on-farm work-related accidents resulted in direct costs to farmers of between $100 and $200 per accident (in March 1981 dollars). Accordingly it is not surprising that many farmers pay little attention to (or at least express little concern over) the impact of accidents on farm incomes. For a few, however, the uncompensated loss can be considerable; the data show almost ten percent of the personal injury accidents resulted in direct costs exceeding $1,000. Several respondents indicated that they had sold their farms as a result of the accident, and a number of others were still receiving compensation when the survey was undertaken. It is therefore possible that these estimates could understate the actual costs when viewed over the longer term. To put these results in a national perspective, dividing the estimated total cost by the sampling rate (about eight percent), yields a total of $1.2 million. This is about one half of the amount paid thus far in compensation by the ACC (pers. comm. Bruce-Smith, 1984).

The cumulative frequency distribution of uncompensated direct (private) accident costs to New Zealand farmers, based on an extrapolation of the sampled cases, is illustrated in Figure 6. The shape of the curve clearly indicates a need to carefully explore concentration safety resources on the evidence of severe accidents vs less costly but more frequent accident cases. How this trade off might be evaluated is explored in the following analyses of accident cause and effect.

FIGURE 6

Cumulative Frequency of Uncompensated Direct Costs of Farm Accidents in New Zealand 1980-81



3.4.3 Opportunities for Improving Farm Safety

This part of the analysis explored some possible cause-effect relationships between the individual, the work activity and the accident. Cross tabulations of the data and Chi-Square statistical tests were used to see if certain relationships could be established that would help to explain why the accident happened and how it could be avoided in the future. To assist with this assessment, the respondents were asked to supply their own interpretation of the accident cause and the kind of safety measures that may avoid or lessen its effect. These responses are summarised in Table 25 to 28.

Major and minor contributing factors to the cause of the accident (Table 25) were elicited with a structured, rather than open-ended question. This was to encourage the respondent to think about the underlying reason (or excuse) as opposed to the event itself, such as "I tripped and fell". The results indicate that the major reason was something that could not be controlled (an 'Act of God'). Carelessness was frequently cited, but only as a minor factor. While it could be argued that almost any accident should be avoidable with due foresight and caution, clearly most farm operators significantly discounted this possibility with regard to the particular accident.

TABLE 25

Summary of Reasons Given for the Cause of Farm Accidents

Cause or explanation	Percent of respondents citing as Major	Minor
	%	%
'Act of God'	43	15
Carelessness	20	46
Inexperience	11	14
Weather	11	10
Faulty equipment	9	9
Fatigue, ill-health	6	6
Total	100	100

Source: Q.8., Appendix 1

TABLE 26

Safety Measures Taken at the Time of the Accident

Description	Respondents Number	Respondents Percent
No safety precautions taken	136	78.6
Protective clothing and/or safety devices in use	21	12.1
Training in safety measures	7	4.0
Protective clothing/safety devices and training	5	2.9
Unknown	4	2.3
Total	173	100.0

TABLE 27

Possible Measures to Prevent the Accident

Description	Respondents Number	Respondents Percent
Accident not preventable	89	51.4
Change technique and/or equipment	35	20.2
Taking more care	29	16.8
Avoiding the farming operation	11	6.4
Change technique and/or equipment and take more care	2	1.2
Avoid the operation and take more care	1	0.6
Unknown	6	3.5
Total	173	100.0

Source: Q.10, Appendix 1

TABLE 28

New Safety Measures Adopted to Prevent the Accident from Occurring in the Future

Description	Respondents Number	Respondents Percent
No precautions taken	119	68.8
Change equipment and technique	37	21.4
Avoid the operation	11	6.3
More care taken	5	2.9
Unknown	1	0.6
Total	173	100.0

Source: Q.11, Appendix 1

Seventy-nine percent of the respondents reported that no special safety precautions had been taken at the time of the accident (Table 26), and less than 50 percent could think of any measures which would have prevented it (Table 27). When asked if any safety measures had been adopted since the accident (to prevent it from happening again), two-thirds of the farm operators indicated that no special precautions had been taken (Table 28). However, 21 percent suggested that they had changed equipment or methods of performing that type of activity.

Overall, these results indicate that many farmers do not perceive significant private benefits to on-farm safety. This is consistent with the level of estimated costs (reported in Section 3.4.2) for most accident cases, and the low expected probability of serious statistical accidents (Table 4). However, it does not necessarily support the apparently widely-held belief that accidents are random events. They occur precisely because safety precautions are not taken. The final task of this analysis was to identify unique individuals, farming activities and work situations which might assist safety analysts and programme administrators in deciding how to improve the allocation of funds and effort devoted to on-farm safety.

Discrete data analysis techniques, principally Chi-Square, were applied to the survey and ACC data sets to test the degree of association between selected variable distributions. It was necessary in many instances to transform the survey responses into fewer groups to meet the required number of observations per cell. In some cases this reduced the distinctive nature of the survey response distributions. The original (untransformed) responses are reported in Appendix 3. The results of the statistical analysis of the transformed data are summarised in Table 29.

TABLE 29

Summary of tests of Relationships Between Farm Accident Characteristics, Costs and Safety Data

Statistical associations between variables[a]	Question No.	Farm type	Accident scene	Safety precautions	Preventability	Future precautions	Delays in operations	Operating cost increase
	Question No.	19	4	9	10	11	14	12
Accident type	5	S	S	N	S	N	N	
Accident cause	6						N	
Person injured:	1	S	N		S		N	N
Age (C—1 form)			N	N	N			
Injury type			N	N	N	N		
Permanent effects	2			N	S	N		N
Farm experience (C—1 form)				N				
Farm manager:								
Experience	23			N	N	N	S	N
Education	24			N	N	N	N	N
Hours worked/week	22					N	S	N
Type of farm	19			N			N	N
Size of workforce	21			N	N	N	N	N
Accident delays	14				N	N		N
Operating cost increase	12				N	N		

a Interpretation: N = no significant association
S = significant association based on χ^2 at .10 level of significance or better
Blank spaces denote hypothetical co—relationships not tested

Among the significant associations found were:

(1) If the injured person was a hired employee, the accident was considered more preventable, and accidents involving the farmer or a family member, less preventable.

(2) The type of farm (based on percent of income by enterprise) indicated that accidents occur more frequently to hired employees on farms which do a high proportion of contract work, to family members on mixed livestock farms, and to owner-operators on dairy farms. It was also indicated that animal-related accidents occurred more frequently in enclosures (pens, yards, sheds) and vehicle accidents more frequently on hill paddocks.

(3) Where the injury resulted in permanent effects, farmers more frequently could identify ways in which the accident might have been avoided.

(4) The activity most frequently associated with types of safety measures was handling machinery (exercise more care), and least frequently was handling animals (generally not preventable).

(5) Farmers who identified delays in operations were most frequently those with 10 years or more of farm experience, or those who were working long hours (60 + hours per week) at the time of the accident.

(6) No significant associations were found for variables such as increased operating cost, age, type of injury, level of education, and size of the workforce.

3.5 Conclusions and Limitations

The main conclusions to be drawn from the empirical analysis can be summarised by answering four questions:

(1) Did the supplemental information, obtained from a follow-up postal survey, substantially improve understanding about farm accidents?

(2) Are the estimated social costs reliable and 'significant' for safety planning purposes?

(3) What major insights were gained in the analysis of accident causes and safety practices?

(4) What are the chief limitations of the approach and analysis?

The follow-up mail questionnaire proved to be a successful method of collecting supplemental (and more detailed) information. Provided that the survey is carefully designed and focusses on specific data needs, it is a very cost-effective method of generating accident information for safety analysis. In conjunction with the ACC's present information base, the survey data did help to provide a more comprehensive understanding of the compensated work accidents on farms in 1980-81. The data helped to better characterise the farm, the farmer and the nature of the accident event, and shed new light on the effects of the accident in terms of its private and social costs and the farm operator's attitude towards safety. These additional insights should form a productive ground for pursuing some concrete ideas on farm safety enhancement.

Following on from the social cost-benefit framework, the survey provided an opportunity to estimate the so-called hidden or compensated costs of accidents - the potential total benefits to safety. While the estimation procedure used is theoretically sound, only the 'resource cost' and 'production loss' components of social cost were estimated. Estimates of the more subjective costs relating to uncertainty and human suffering were not attempted in this study. Hence, the cost estimates reported should be regarded with caution as they are likely to under-state the true costs to society. None-the-less, the magnitude and variance of the estimates are important information for safety planning. In most farm accident cases the uncompensated costs are apparently small, probably less than five percent of after-tax net farm income. Because the incidence of serious accidents is so low for the farm population at a given point in time, it would appear quite difficult to use such information in a convincing way to address the average farmer's safety needs.

The results of the analysis of cause and effect and safety practices were generally disappointing in that more definitive relationships could not be established. If such information is thought essential to the design of safety policies and programmes, then perhaps a different approach, for example, in-depth interviews, may be more appropriate for gaining an understanding of how and why the accident happened. It is fairly clear from the opinions expressed by this sample of farms that many (if not most) accidents are 'unpreventable'. The apparent lack of interest in prevention (this is the authors' inference) stems from this fundamental belief.

The above conclusions, however, must be considered in light of the study's limitations. Time and financial resource constraints did not allow a comprehensive analysis of costs and benefits to the degree suggested for a full assessment of safety policy alternatives (Chapter 2). First, and perhaps most important, the results only apply to that portion of the farm population that received compensation for accidents in 1980-81. It is possible that general farmer attitudes towards safety are significantly different from this sampled group. Second, while the survey was conducted on the basis of a well-thought-out plan and objective, there remains considerable scope for biased responses due to the survey method used. For example, there is no way of knowing whether or not some of the data were purposely manufactured by respondents participating in the survey. Third, the sample size of 300 proved too small in a number of cases so that appropriate statistical tests could not be applied. Consequently, aggregating the range of responses to certain questions resulted in the loss of potentially important information.

Given a conceptual framework for evaluating farm safety programmes which should provide a sound guide for future research and policy (Chapter 2), and given a limited (but likely relevant) attempt at estimating the "uncompensated" costs of accidents to farmers, the concluding chapter provides a synthesis of the study results and recommendations for future safety planning and policy analysis.

CHAPTER 4

IMPLICATIONS FOR SAFETY PLANNING

The implications of the study results on present and future safety policy and research are outlined in the discussion which follows. In the first section the purpose, approach and the main findings of the study are reviewed. The discussion of implications is centred on three main issues: information system needs for safety evaluation, safety cost-effectiveness analyses and future research needs.

4.1 Summary of the Study and Results

The analysis of the public worth of safety, meaning the benefit to society of preventing accidents, is both a conceptual and empirical problem. The primary aim of this study was to elucidate the conceptual and theoretical issues from the social (or public sector) viewpoint, leading to a general methodology which could be used in appraising the social costs and benefits of accident prevention. While there remains some important questions regarding the methods of valuing accident costs, the concepts and logical structure of the assessment methodology (reported in Chapter 2) provide a sound basis for safety policy analysis. The secondary aim of the study, that of applying the assessment framework in an empirical analysis of actual farm accident cases, addressed the second problem area in evaluating safety: the quantity and quality of available data. As made clear in the elaboration of the methodology, a large body of empirical data is required to obtain reliable estimates of costs and benefits. In an attempt to overcome some of these data limitations, a carefully designed survey was conducted as part of this study. The results of the empirical analysis (reported in Chapter 3) point out some further difficulties for the safety policy analyst.

First, the approach followed was to survey (via a mail questionnaire) a random sample of farm accident cases reported in a recent year. Since this was in effect a 'follow-up' survey, that is based in part on information the respondent previously reported to the ACC, this approach afforded the opportunity not only to check the accuracy of the information on file for each accident but also to fill gaps in accident related details and to collect some attitudinal data. The results of the survey revealed some discrepancies between the two data sets but the differences (possibly due to coding errors) were relatively minor. The supplemental information collected, for example data on the farm operator, the farm labour force, type and size of farm, etc., did provide a better characterisation of the accident situation and background. However, details with respect to the nature and effects of the accident, particularly those effects that result in private costs to the farmer which are not compensated for by accident insurance, are difficult to obtain in a mail questionnaire format. While more expensive, a personal interview approach would likely result in more reliable information and in a more complete description of accident effects. Judging from the response rate (81 percent) and from the high proportion of completed forms, the survey method used was shown to be efficient and generally reliable in obtaining useful responses.

Second, the analysis and interpretation of the survey results is unique to the sampled farm operators. The size of the sample (300 accident cases in 1980) is sufficiently large to allow extrapolation to the farm accident population from which the sample was drawn. Hence the interpretation of responses regarding attitudes to safety or the preventability of accidents do not necessarily hold for the farm population in general. Since the number of farmers who submit claims for accident compensation is proportionately quite small (36 cases per 1,000 farm workers in 1980-81), the results of the empirical analysis have limited application outside the actual (or historical) accident cases examined. Accordingly, for some safety analysis purposes, for example an ex-post evaluation of safety programmes in use, a survey of farmer attitudes and safety behaviour of the general farm population would be necessary. Secondary sources of information such as the annual census of agriculture often do not provide suitable data for evaluation of sample representativeness. While the survey provided a much better understanding of accident-farm-owner/operator associations, this level of detail could not be used to advantage since it could not be easily compared with an appropriate set of 'non-accident' population statistics.

Finally, limited research budgets and staff time may preclude some types of studies that the policy analyst may believe are essential. The use of existing accident information, supplemented with postal survey data as in the present study, cannot be expected to satisfy all of the empirical data requirements for sound safety policy formulation. In fact, perhaps the main conclusion to be drawn from this study (refer to section 3.5) is that descriptive accident information, and for that matter attitudinal data, does not readily translate into useful safety policy information. The present data base is insufficient for identifying specific groups of individuals, types of farm work situations, etc., which form the "at risk" groups for focusing safety effort. Further, the full social costs of farm accidents are difficult to measure and accurate estimates may only be obtainable through detailed case studies of several years duration. Consequently only partial analyses of safety cost-effectiveness and safety programme efficiency are possible at the present time.

4.2 Information System Needs

While it is true that the present ACC claims form (C-1) does not provide sufficient data for safety analysis purposes, it is not clear at this stage what specific new data would be most useful and whether a modified claims form or a supplemental 'safety analysis' form would be an appropriate vehicle to obtain it. Further, it would seem that with a growing data base there is an improved scope for time series and cross-section analyses, using the verb-noun methodology, to examine in detail the relative frequency of accident types and causes. From such results it should be possible to establish 'groups', 'types', and 'environments' frequencies for statistical (historical) accidents.

However, in order to establish "at risk" individuals and accident situations, it will be necessary to generate benchmark data from the general farm population and distribution of farm work. As the agricultural census data falls short in this, comparable frequency distributions of accident and non-accident data (needed to establish the at-risk type information) will probably necessitate a national farm survey of some form or another. It seems essential that general farm profile data is used in safety analysis since the incidence of compensated (farm) work accidents is relatively low. Hence, the cost-effectiveness of safety measures would probably be improved if 'targeted' specifically at these groups which have the higher probabilities of accidents.

It should be noted that the ACC could make use of already established general farmer surveys, for example the AERU's annual farmer opinion survey (refer to section 3.2). Farm profile data might also be collected through a co-operative survey as part of the annual agricultural census. In any case such benchmark data need only be collected periodically, perhaps every five years. With the use of selected farm population parameters the overall value of the ACC's current accident frequency data would be markedly enhanced for safety analysis and programme development.

4.3 Safety Cost-Effectiveness

It is not known from the present analysis how effective the ACC's current safety campaigns are (or have been) in reducing the incidence of farm accidents or in reducing their social costs. While it is clear that in the absence of safety policies significant social costs would accrue, additional information is needed before farm safety can be evaluated in the social cost-benefit sense as proposed in this study. Basically this requires accounting for the social costs avoided per dollar of safety expenditure. The relative efficiency of safety expenditure can begin with an assessment of the comparative costs of alternative programmes or approaches. Armed with these data, safety planners and administrators will be in a better position to identify the "orders of magnitude total safety benefits (social costs) would have to be" to obtain 'net' safety programme benefits. While the authors did not examine the 'costs of safety', such data should be relatively easy to estimate for most safety programmes aimed at the rural sector.

The next level of analysis would involve a carefully developed case study or set of comparable accident case histories to examine the influence of safety information in reducing accidents. This would probably (but not necessarily) require a number of experiments which would allow the comparison of accident frequency and resulting social costs "with and without" the safety input. It is possible that such information might also be obtained from a careful "before and after" analysis, which would be less expensive but more difficult due to the identity problem in sorting out cause and effect. Much new insight would be in terms of an improved rationalisation of safety programme expenditure, since in this step the "net" benefits (or costs) can be compared.

4.4 Future Research Directions

In addition to the ideas already covered in the above comments, there appears considerable scope for further analysis of existing ACC data. For example, safety administration expenditures could be compared on a common basis (e.g., costs per dollar of gross farm income or foreign exchange earned, costs per hour worked by activity, etc.) to appraise the relative importance of accidents on sectoral output, employment and efficiency. Extended to other industrial groups, such information would be helpful in appraising the relative importance of safety policies aimed at different target groups in the New Zealand economy. The wide discrepancy in accident rates between sectors has long been used as a rationale by safety agencies to allocate safety effort, but in no studies that the authors′ are aware of are estimates of foregone production per unit of labour compared across sectors of the economy.

Rural safety personnel represent an important resource for future safety research. Currently they provide the primary link in information flows between programme administrators and farm families. It is possible that in the future the rural safety staff could become more involved in research work, particularly where detailed case histories based on personal interviews may play an increasing role in farm safety data generation. The case study approach which examines the effects of accidents over time is perhaps the best method for accurately estimating the full social costs of farm accident. The rural safety officers are also perhaps the best qualified people to carry out the interview work and assist with data analysis and interpretation. The disadvantages however, such as less time for other functions, would have to be balanced against the benefits of higher quality information for safety purposes.

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APPENDICES

Appendix 1

The Survey Questionnaire

AGRICULTURAL ECONOMICS RESEARCH UNIT
LINCOLN COLLEGE, CANTERBURY

14 May, 1982

Dear Sir or Madam,

The AERU is conducting a study of accidents on New Zealand farms and we seek your co-operation. Our aim is to find out how much accidents are costing farmers.

The Accident Compensation Commission have provided us with a list of farmers who reported work-related accidents during the period 1980-81. Approximately 300 farmers, selected at random, will be participating in this survey.

According to the information we have, (name) had an accident while working on your farm on (date). This is a survey about that accident. If possible, we would like the PERSON who was IN CHARGE OF THE FARM at the TIME OF THE ACCIDENT to complete the survey form and return it to us in the stamped, addressed envelope enclosed.

All answers will be handled in strict confidence. There will be no way of identifying individual farms or farmers from any results made available to the public or to organisations outside the AERU.

It would be helpful to us if you could return the completed form at your earliest convenience. Thank you very much for your co-operation with this study.

Yours faithfully,

P.D. Chudleigh
Director

Postal and telegraphic address: AERU, Lincoln College, Canterbury, New Zealand

AGRICULTURAL ECONOMICS RESEARCH UNIT
LINCOLN COLLEGE, CANTERBURY

14 May, 1982

Dear (Name),

The AERU is conducting a study of accidents on New Zealand farms and we seek your co-operation. Our aim is to find out how much accidents are costing farmers.

The Accident Compensataion Commission have provided us with a list of on-farm accidents during the period 1980-81. Approximately 300 accidents, selected at random, will be included in this survey.

According to the information we have, you had an accident while on a farm on (date). This is a survey about that accident. If the accident was related to the operation of the farm, we would like the PERSON who was IN CHARGE OF THE FARM at the TIME OF THE ACCIDENT to complete the survey form and return it to us in the stamped, addressed envelope enclosed. If this is not pssible, please complete the form yourself.

If the accident did NOT occur during farming operations, please place the uncompleted form in the stamped, addressed envelope and return it to us.

All answers will be handled in strict confidence. There will be no way of identifying individuals, farms or farmers from any results made available to the public or to organisations outside the AERU.

It would be helpful to us if you could return the completed form at your earliest convenience. Thank you very much for your co-operation with this study.

Yours faithfully,

P.D. Chudleigh
Director

Postal and telegraphic address AERU, Lincoln College, Canterbury, New Zealand

AGRICULTURAL ECONOMICS RESEARCH UNIT
LINCOLN COLLEGE, CANTERBURY

3 June, 1982

Dear Sir or Madam,

A few weeks ago I wrote to you seeking information about a farm accident. As of today we have not received your completed questionnaire. I am writing to you again because of the significance each questionnaire has to the usefulness of our study results.

As I mentioned in my first letter, the questionnaire should be filled out by the person who was in charge of the farm at the time of the accident. If that is not possible, please complete it yourself and return it to me at your earliest convenience. If the accident was not work related, please return the questionnaire uncompleted.

My sincere thanks for your co-operation.

Yours faithfully,

P.D. Chudleigh
Director

Postal and telegraphic address: AERU, Lincoln College, Canterbury, New Zealand
Telephone Christchurch 252 811

AGRICULTURAL ECONOMICS RESEARCH UNIT
LINCOLN COLLEGE, CANTERBURY

30 June 1982

Dear Sir/Madam,

This is a final reminder about our survey of farm accidents as we have not yet received your completed questionnaire.

The large number of returns we have received to date is very encouraging. However, our ability to accurately describe the effects of farm accidents depends upon you and the others who have not yet responded. Past experience shows that those of you who have not yet responded may provide quite different answers from those who already have. We would be very grateful if you would share your knowledge of this accident with us.

Another questionnaire form and return envelope have been included for your convenience.

If the accident did not occur during farming operations please place the uncompleted form in the stamped addressed envelope and return it to us.

Yours faithfully,

P.D. Chudleigh,
Director.

Encl.

Postal and telegraphic address: AERU, Lincoln College, Canterbury, New Zealand
Telephone Christchurch 252 811

AGRICULTURAL ECONOMICS RESEARCH UNIT
LINCOLN COLLEGE, CANTERBURY

FARM ACCIDENTS

A SURVEY OF NEW ZEALAND FARMERS ABOUT THE EFFECTS OF FARM ACCIDENTS.

This survey will provide important information about the kinds of accidents which happen on farms, how much they cost the farmer and the nation, and how they might be prevented.

The study is being carried out by the Agricultural Economics Research Unit of Lincoln College, and is supported by the Accident Compensation Corporation.

Most of the questions concern the accident which happened on your farm in 1980 or 1981.

Please answer all questions. If you wish to qualify your answers, or add any comments, please do so in the margins or on a separate sheet of paper.

All answers are completely confidential to the AERU, and no information which could identify individuals will be released.

CONFIDENTIAL

FORM No.

This document is the property of the Agricultural Economics Research Unit, Lincoln College. If found, please return to:

The Director, AERU, Lincoln College, Canterbury, New Zealand.

First we would like to ask some questions about the accident and about the injured person.

1. At the time of the accident the **injured** person was? (circle a number)

1. OWNER,PART-OWNER,LESSEE OR SHAREFARMER
2. HIRED MANAGER
3. HIRED EMPLOYEE
4. CONTRACTOR OR SEASONAL WORKER
5. FAMILY OF OWNER OR EMPLOYEE
6. OTHER (please describe)

____

____

2a. Has the injured person suffered any permanent effects from the accident? (circle a number)

1. NO → If NO or DON'T KNOW SKIP TO Q.3
2. YES
3. DON'T KNOW → If NO or DON'T KNOW SKIP TO Q.3

If YES

b. Please describe these effects.

____

____

____

3. How many hours a week was the injured person working on the farm at the time of the accident? (circle a number)

1. NONE
2. LESS THAN 20 HOURS A WEEK
3. BETWEEN 20 AND 40 HOURS A WEEK
4. BETWEEN 40 AND 60 HOURS A WEEK
5. MORE THAN 60 HOURS A WEEK
6. DON'T KNOW

4. Where on the farm was he/she when the accident happened? (circle a number)

1. HILL PADDOCK
2. FLAT PADDOCK
3. LIVESTOCK YARD OR SHED
4. WORKSHOP
5. OTHER(please describe)

____

____

5. What was he/she doing when the accident happened?

____

____

____

6. How did the accident happen?

____

____

____

7. What were his/her injuries?

____

____

____

8. Accidents sometimes have more than one cause. How much did **each** of the following help cause the accident?

	Importance in causing the accident (Circle your answer)		
1. Carelessness	NONE	MINOR	MAJOR
2. Lack of experience	NONE	MINOR	MAJOR
3. Fatigue,Ill-health	NONE	MINOR	MAJOR
4. Poor weather	NONE	MINOR	MAJOR
5. Faulty equipment	NONE	MINOR	MAJOR
6. 'Act of God'	NONE	MINOR	MAJOR
7. Other (describe)	NONE	MINOR	MAJOR

____

____

____

9a. Were any safety precautions taken against this kind of accident? (circle a number)

1. NO → If NO, skip to Q.10
2. YES

b. What were they? (circle a number)

1. PROTECTIVE CLOTHING
2. SAFETY DEVICES
3. BOTH 1 AND 2
4. TRAINING, SAFETY INSTRUCTION
5. TRAINING, PLUS 1 OR 2
6. OTHER(please describe)

____

____

____

10a. Do you think that this accident could have been prevented? (Circle a number)

1. NO
2. YES

b. Please explain how, **or** why not.

____

____

____

11a. Have any further safety precautions been taken since the accident? (circle a number)

1. NO → If NO skip to Q. 12
2. YES

b. What are they? (circle a number)

1. PROTECTIVE CLOTHING
2. SAFETY DEVICES
3. BOTH 1 AND 2
4. TRAINING, SAFETY INSTRUCTION
5. TRAINING, PLUS 1 OR 2
6. OTHER(describe)

____

____

____

An accident may have complex effects upon farm costs and production. To help us to understand these, we would like to ask some questions about the way the accident affected your costs, production and farming routine.

12a. How was the accident victim's **work** done while he/she was unable to work? (circle a number, or numbers, as appropriate)

1. USUAL STAFF WORKED LONGER HOURS
2. EMPLOYED EXTRA LABOUR
3. EMPLOYED CONTRACTORS
4. FAMILY HELPED OUT
5. FRIENDS HELPED OUT
6. HIRED ADDITIONAL MACHINERY
7. OTHER (describe)

____

____

____

b. Did this increase the farm's **operating** costs?(circle a number)

1. NO
2. YES - less than $100
3. YES - between $ 100 and $ 499
4. YES - between $ 500 and $1000
5. YES - between $1000 and $1999
6. YES - between $2000 and $2999
7. YES - over $3000
8. DON'T KNOW

13. Did the accident cause:

a. Damage to buildings etc.(e.g. fences)? (Circle a number)

1. NO
2. YES

If YES: Type of building ________________________

Approximate repair/replacement cost ....$_____
How much of this was covered by insurance ..... _____%

b. Damage to plant or machinery? (Circle a number)

1. NO
2. YES

If YES: Type of machinery ________________________

Approximate repair/replacement cost ....$_____
How much of this was covered by insurance ..... _____%

c. Livestock losses? (Circle a number)

1. NO
2. YES

If YES: Type(s) of livestock ________________________

Approximate value of loss ....$_____
How much of this was covered by insurance ..... _____%

d. Damage to standing crops? (Circle a number)

1. NO
2. YES

If YES: Type of crops ________________________

Approximate value of loss ....$_____
How much of this was covered by insurance ..... _____%

e. Damage to stored produce or supplies?(e.g. hay, seed, fertilizer) (Circle a number)

1. NO
2. YES

If YES: Type(s) of produce or supplies ________________________

____

Approximate value of loss ....$_____
How much of this was covered by insurance ..... _____%

14. Did the accident lead to delays in any important farming operations? (e.g. drenching 2000 breeding ewes)

1. NO → If NO skip to Q.15
2. YES

If YES

a. Please describe the operation(s).

OPERATION	At the time of the accident the operation was (circle your answer)					
1. ______	NOT STARTED	JUST BEGUN	1/4 DONE	1/2 DONE	3/4 DONE	ALMOST DONE
2. ______	NOT STARTED	JUST BEGUN	1/4 DONE	1/2 DONE	3/4 DONE	ALMOST DONE
3. ______	NOT STARTED	JUST BEGUN	1/4 DONE	1/2 DONE	3/4 DONE	ALMOST DONE

b. How many days did the accident delay these operations?

OPERATION (from above)	The operation was delayed by (Circle your answer)				
1.	A FEW HOURS	1-5 DAYS	5-10 DAYS	MORE THAN 10 DAYS	ABANDONED THE JOB
2.	A FEW HOURS	1-5 DAYS	5-10 DAYS	MORE THAN 10 DAYS	ABANDONED THE JOB
3.	A FEW HOURS	1-5 DAYS	5-10 DAYS	MORE THAN 10 DAYS	ABANDONED THE JOB

c. Please describe the reduction in farm output caused by these delays.

OPERATION (from above)	REASON FOR OUTPUT REDUCTION	VALUE OF LOSS
1.	______	$______
2.	______	$______
3.	______	$______

15. Have there been any changes in the **way** you farm since the accident? (Circle a number)

1. NO
2. YES - LEFT FARMING
3. YES - CHANGED FARMS
4. YES - NOW LEASE ALL OR PART OF THE FARM TO ANOTHER
5. YES- STILL ON THE SAME FARM, BUT CHANGED ENTERPRISES OR OPERATING METHODS (Explain or describe changes)

___

___

___

16. If there are any other details of the accident or any changes it has made to your farming operations which you think might be useful to our study, will you please note them here.

___

___

___

___

___

___

___

___

___

___

___

___

Finally, we would like to ask some questions about yourself, and the farm in general, to help us interpret results.

17. What is the area of your farm?

______ HA. (______ACRES)

18. How much of your farm falls into **each** of the following classes?

1. VERY STEEP(WALKING ONLY) ...... ____%
2. STEEP (HORSE,FARMBIKE) ...... ____%
3. MOD. STEEP (4-WHEEL DRIVE) ..... ____%
4. ROLLING (2-WHEEL DRIVE) .... ____%
5. FLAT .... ____%

19. What percentage of your farm's income is derived from each of the following activities?

1. SHEEP............. ______%
2. BEEF.............. ______%
3. DAIRYING.......... ______%
4. CROPPING.......... ______%
5. HORTICULTURE ..... ______%
6. OTHER (describe)

_______________ ..... ______%

20. Until the accident, how many people were employed on the farm on a permanent, full-time basis?

1. OWNER(S).......... ______ number
2. HIRED MANAGER(S).. ______ number
3. EMPLOYEE(S)....... ______ number

21. Until the accident, how much work was done in a 'normal' year by other labour?

1. PERMANENT PART-TIME EMPLOYEES .... ____ weeks a year ____ hours a week
2. SEASONAL WORKERS AND CONTRACTORS .... ____ weeks a year ____ hours a week
3. FAMILY OF OWNER OR EMPLOYEE .... ____ weeks a year ____ hours a week
4. OTHER(describe) ________________ .. ____ weeks a year ____ hours a week

22. About how many hours per week were **you** working at the time of the accident?

________ hours

23. At the time of the accident **you** were? (Circle a number)

1. OWNER, PART-OWNER, LESSEE OR SHAREFARMER
2. HIRED MANAGER
3. OTHER (describe)

____

____

24a. What is your date of birth?

_____ day _____ month _____ year

b. What is your marital status? (Circle a number)
1. SINGLE
2. MARRIED
3. DE FACTO MARRIED
4. WIDOWED
5. SEPARATED
6. DIVORCED

c. What was the highest level you reached at school? (Circle a number)

1. PRIMARY, INTERMEDIATE
2. SECONDARY
3. SCHOOL CERTIFICATE
4. 6th. FORM CERTIFICATE
7. U.E.
8. 7th. FORM

d. How many years have you worked on farms since you left school?

_______ years

e. Have you had any formal training since you left school? (e.g. Short courses, Lincoln College, University, Technical Institute.)

COURSE	PLACE	LENGTH

Is there anything else you would like to tell us about the accident, or about its effects? If so please use this space for that purpose.

Thank you for your contribution to this study. If you would like a summary of the results, please PRINT your name and address on the back of the return envelope (NOT on this questionnaire). We will see that you get it. Please place your completed questionnaire in the stamped, addressed envelope provided and return it to:

The Director,
AERU,
Lincoln College,
Canterbury.

Please rest assured that the information gathered in this survey is completely confidential to the AERU, and that no results will contain information that would identify individual farmers.

APPENDIX 2

Summary of Farm Accident Data Obtained from Present ACC Files

The following summary tables report the types of information currently collected by the Accident Compensation Corporation. This information was obtained from the 'C-1 form' which is filled in by any individual seeking compenstion for a personal injury accident. These data were used to assist in the identification of data gaps that could be partially filled by a follow-up survey aimed at the development of a data base for safety policy analysis. The data reported are for the 1980 fiscal year.

TABLE 2.1

Type of Farm on Which the Accident Occurred

Farm Type	Number	Percent
Mixed livestock	83	27.5
Dairy	49	16.2
Sheep	27	8.9
Contractor	27	8.9
Miscellaneous	23	7.6
General	16	5.3
Orchard, market garden	14	4.6
Beef	4	1.3
Unknown	59	19.5
Total	302[a]	100.0

a Two of the 300 accident cases were duplicated in the ACC data listing.

TABLE 2.2

Occupation Type of the Injured Person

Occupation	Number	Percent
Farmer, manager	115	38.1
Farm hand	66	21.9
Contractor	34	11.3
Sharemilker	11	3.6
Orchardist, market gardener	9	3.0
School student	6	2.0
Housewife	2	0.7
Other	10	3.3
Unknown	49	16.2
Total	302	100.0

TABLE 2.3

Hour of the Day When the Accident Occurred

Accident Times	Number	Percent
5-7 a.m.	5	1.6
8-10a.m.	34	11.3
11a.m.-1p.m.	83	27.5
1-4p.m.	76	25.2
5-7p.m.	69	22.9
8-10p.m.	9	3.0
Midnight-1a.m.	12	4.0
Unknown	14	4.6
Total	302	100.0

TABLE 2.4

Days of the Week Accidents Occurred

Day of the Week	Number	Percent
Monday	58	19.2
Tuesday	35	11.6
Wednesday	47	15.6
Thursday	61	20.2
Friday	43	14.2
Saturday	29	8.3
Sunday	30	9.9
Unknown	3	1.0
Total	302	100.0

TABLE 2.5

Types of Injuries Sustained in the Accident

Injury Types	Number	Percent
Strain	101	33.4
Fracture	70	23.2
Laceration	45	14.9
Lost tooth	29	9.6
Crushing	27	8.9
Viral	17	5.6
Burn	6	2.0
Other	5	1.7
Unknown	2	0.7
Total	302	100.0

TABLE 2.6

Marital Status of the Injured Person

Status	Number	Percent
Married	192	63.6
Single	108	35.8
Widowed	1	0.3
Unknown	1	0.3
Total	302	100.0

TABLE 2.7

Previous Farming Experience of the Injured Person

Experience (years)	Number	Percent
Less than 1 year	110	36.4
1 to 3 years	47	15.5
4 to 10 years	58	19.2
11 to 20 years	32	10.6
21 to 30 years	23	7.7
More than 30 years	18	5.8
Unknown	14	4.6
Total	302	100.0

TABLE 2.8

Extent of Incapacity Resulting from the Injury

No. of Weeks Incapacitated	Number	Percent
No incapacity	50	16.6
1 week or less	52	17.1
2 weeks	78	25.8
3 weeks	38	12.6
4 weeks	43	14.2
5-7 weeks	19	6.2
8-10 weeks	10	3.3
11-13 weeks	3	1.0
14-35 weeks	3	0.9
Over 35 weeks	6	2.0
Total	302	100.0

TABLE 2.9

Compensation Received as a Result of the Injury

Amount received (as of March 31, 1982)	Number	Percent
$		
Less than 100	56	18.5
100-299	104	34.4
300-599	64	21.2
600-999	38	12.5
1,000-1,999	24	7.8
2,000-2,999	7	2.2
3,000-3,999	4	1.4
4,000-6,000	5	1.5
Total	302	100.0

TABLE 2.10

Age of the Injured Person

Age (in years)	Number	Percent
0-14	6	1.9
15-19	27	8.9
20-29	84	27.8
30-39	71	23.6
40-49	58	19.3
50-59	37	12.3
More than 59	19	6.3
Total	302	100.0

TABLE 2.11

Environment in Which Accident Occurred

Environment	Number	Percent
Work	253	83.8
Home	24	7.9
Sport	8	2.6
Travel to work	1	0.3
Other	13	4.3
Unknown	3	1.0
Total	302	100.0

TABLE 2.12

Employment Status of the Injured Person

Status	Number	Percent
Employee	163	54.0
Self-employed	124	41.1
Unemployed	1	0.3
Unknown	14	4.6
Total	302	100.0

TABLE 2.13

Sex of the Injured Person

Sex	Number	Percent
Male	253	83.8
Female	49	16.2
Total	302	100.0

APPENDIX 3

TABLE 3.1

Hours Worked Per Week By the Injured Person at the Time of the Accident

Injured Person	Work Hours per Week						Percent	Number
	None	<20	20–40	40–60	>60	Unknown		
Farm Owner		0.6	5.8	19.1	15.0	1.8	42.2	73
Hired Employee		1.7	2.3	18.5	1.2		23.7	41
Family or Owner/Employee		4.6	5.2	4.0	2.3	1.2	17.3	30
Contractor, Casual Labourer	1.7	1.7	4.0	4.0	0.6	1.2	13.3	23
Hired Manager			0.6	2.3			2.9	5
Unknown						0.6	0.6	1
Percent	1.7	8.7	17.9	48.0	19.1	4.6	100.0	
Number	3	15	31	83	33	8		173

TABLE 3.2

Injured Person and Scene of the Accident

Injured Person	Scene of the Accident: Yard or Shed	Hill Paddock	Flat Paddock	Workshop	Unknown	Percent	Number
	Total Percent						
Farm Owner	18.5	9.2	10.4	2.3	1.7	42.2	73
Hired Employee	6.4	4.0	8.1	3.5	1.7	23.7	41
Family of Owner/Employee	6.4	5.8	2.3	1.7	1.2	17.3	30
Contractor, Casual Labourer	5.2	5.2	2.3	0.6		13.3	23
Hired Manager	1.2		1.2		0.6	2.9	5
Unknown					0.6	0.6	1
Percent	37.6	24.3	24.3	8.1	5.8	100.0	
Number	65	42	42	14	10		173

TABLE 3.3

Farming Activities Injured Person was Engaged in at Time of Accident

Person Injured	Farming Activity: Animals	Tripping, Falling	Operating Machinery	Operating Vehicle	Handling, Lifting	Passive	Unknown	Percent	Number
	Total Percent								
Farm Owner	13.9	7.5	8.1	6.9	3.5	2.3		42.2	73
Hired Employee	5.2	5.8	4.0	4.6	2.3	1.2	0.6	23.7	41
Family of Owner/Employee	4.0	4.6	4.0	1.7	2.3	0.6		17.3	30
Contractor, Casual Labourer	2.9	2.9	2.9	1.7	2.9			13.3	23
Hired Manager	1.7					0.6	0.6	2.9	5
Unknown				0.6				0.6	1
Percent	27.7	20.8	19.1	15.6	11.0	4.9	1.2	100.0	
Number	48	36	33	27	19	8	2		173

Table 3.4

Injured Person and Preventability of Accident

Injured Person	Accident Preventable: Yes	No	Unknown	Percent	Number
	Total Percent				
Farm Owner	23.1	15.6	3.5	42.2	73
Hired Employee	10.4	11.6	1.8	23.7	41
Family of Owner/Employee	11.0	5.8	0.6	17.3	30
Contractor, Casual Labourer	3.5	7.5	2.3	13.3	23
Hired Manager	0.6	1.7	0.6	2.9	5
Unknown	0.6			0.6	1
Percent	49.1	42.2	8.6	100.0	
Number	85	73	15		173

TABLE 3.5

Injured Person and Increases in Operating Costs

Person Injured	Operating Cost Increase: No Increase	<$100	$100–$499	$500–$999	$1000–$1999	$2000–$2999	>$3000	Unknown	Percent	Number
	Total Percent									
Farm Owner	15.6	0.6	8.7	5.8	5.2	1.7	2.3	2.3	42.2	73
Hired Employee	13.3	1.2	5.2	1.2		1.2		1.8	23.7	41
Family of Owner/Employee	11.0	1.7	2.3	1.2				1.2	17.3	30
Contractor, Casual Labourer	10.4		0.6					2.3	13.3	23
Hired Manager	2.3							0.6	2.9	5
Unknown	0.6								0.6	1
Percent	53.2	3.5	16.8	8.1	5.2	2.9	2.3	5.2	100.0	
Number	92	6	29	14	9	5	4	9		173

TABLE 3.6

Injured Person and Delays in Important Farming Operations

Injured Person	Delays in Operations: No	Yes	Unknown	Percent	Number
	Total Percent				
Farm Owner	27.7	12.7	1.7	42.2	73
Hired Employee	20.2	2.3	1.2	23.7	41
Family of Owner/Employee	11.0	5.2	1.2	17.3	30
Contractor, Casual Labourer	12.1	1.2		13.3	23
Hired Manager	2.9			2.9	5
Unknown	0.6			0.6	1
Percent	74.6	21.4	4.1	100.0	
Number	129	37	7		173

TABLE 3.7

Injured Person and Change in Way of Farming

Injured Person	Changes in Farming						
	No Changes	Changed Methods	Changed Farm	Left Farming	Unknown	Percent	Number
			Total Percent				
Farm Owner	34.1	5.8	1.2		1.2	42.2	73
Hired Employee	22.0		0.6		1.2	23.7	41
Family of Owner/Employee	12.7	2.3	0.6		1.8	17.3	30
Contractor, Casual Labourer	9.8			0.6	2.9	13.3	23
Hired Manager	2.9					2.9	5
Unknown	0.6					0.6	1
Percent	82.1	8.1	2.3	0.6	7.0	100.0	
Number	142	14	4	1	12		173

TABLE 3.8

Injured Person and Farmtype

Injured Person	Farmtype: Mixed Livestock	Dairy	Contractor	Sheep	Orchard, Market Garden	Beef	General	Miscellaneous	Percent	Number
	Total Percent									
Farm Owner	9.2	15.6		7.5	3.5	1.2	0.6	4.6	42.2	73
Hired Employee	1.7		21.4			0.6			23.7	41
Family of Owner/Employee	5.2	3.5		4.6	1.7	0.6		1.7	17.3	30
Contractor, Casual Labourer	3.5	1.2		1.7	0.6			6.4	13.3	23
Hired Manager	1.2	1.2						0.6	2.9	5
Unknown	0.6								0.6	1
Percent	21.4	21.4	21.4	13.9	5.8	2.3	0.6	13.3	100.0	
Number	37	37	37	24	10	4	1	23		173

TABLE 3.9

Injured Person and Position of Questionnaire Respondent

Injured Person	Form-filler's Position: Farm Owner	Hired Employee	Family of Owner/ Employee	Contractor, Casual Labourer	Hired Manager	Unknown	Percent	Number
	Total Percent							
Farm Owner	39.3	0.6	1.2			1.2	42.2	73
Hired Employee	12.1	4.6			4.0	2.9	23.7	41
Family of Owner/Employee	7.5	1.7	6.4		0.6	1.2	17.3	30
Contractor, Casual Labourer	6.4	1.2		2.3	0.6	2.9	13.3	23
Hired Manager	1.7				1.2		2.9	5
Unknown	0.6						0.6	1
Percent	67.6	8.1	7.5	2.3	6.4	8.1	100.0	
Number	117	14	13	4	11	14		173

TABLE 3.10

Degree of Permanent Effects Suffered by Injured Person

Permanent Effects	Injured Person: Farm Owner	Hired Employee	Family of Owner/ Employee	Contractor, Casual Labourer	Hired Manager	Unknown	Percent	Number
	Total Percent							
No Permanent Effects	26.0	20.8	12.1	8.7	2.9	0.6	71.1	123
Serious	1.2		0.6	0.6			2.3	4
Moderate	10.4	2.3	2.3	2.9			17.9	31
Slight	4.6	0.6	2.3	1.2			8.7	15
Percent	42.2	23.7	17.3	13.3	2.9	0.6	100.0	
Number	73	41	30	23	5	1		173

TABLE 3.11

Degree of Permanent Effects and Farming Activity Engaged in at Time of Accident

Permanent Effects	Farming Activity: Animals	Tripping, Falling	Operating Machinery	Operating Vehicle	Handling, Lifting	Passive	Unknown	Percent	Number
	Total Percent								
No Permanent Effects	20.8	11.0	13.3	11.0	9.2	4.6	1.2	71.1	123
Serious		1.2	1.2					2.3	4
Moderate	4.6	6.9	2.3	2.9	1.2			17.9	31
Slight	2.3	1.7	2.3	1.7	0.6			8.7	15
Percent	27.7	20.8	19.1	15.6	11.0	4.6	1.2	100	
Number	48	36	33	27	19	8	2		173

TABLE 3.12

Degree of Permanent Effects and Location of Injuries Sustained

Permanent Effects	Injury Location: Lower Limbs	Upper Limbs	Back	Trunk	Head	Systemic	Unknown	Percent	Number
	Total Percent								
No Permanent Effects	29.5	15.6	7.5	6.4	4.6	4.6	2.9	71.1	123
Serious	0.6	1.2	0.6					2.3	4
Moderate	8.1	1.7	6.4	1.7				17.9	31
Slight	2.3	4.0	0.6		1.7			8.7	15
Percent	40.5	22.5	15.0	8.1	6.4	4.6	2.9	100.0	
Number	70	39	26	14	11	8	5		173

TABLE 3.13

Degree of Permanent Effects and Type of Injury Sustained

Permanent Effects	Injury Type										
	Strain	Fracture	Crushing	Laceration	Viral	Dental	Burn	Infection	Unknown	Percent	Number
	Total Percent										
No Permanent Effects	19.1	15.0	11.6	10.4	5.2	2.9	2.3	1.2	3.5	71.1	123
Serious	0.6		1.2	0.6						2.3	4
Moderate	8.1	6.4	2.3	1.2						17.9	31
Slight		1.7	1.2	2.9		1.7	0.6	0.6		8.7	15
Percent	27.7	23.1	16.2	15.0	5.2	4.6	2.9	1.7	3.5	100.0	
Number	48	40	28	26	9	8	5	3	6		173

TABLE 3.14

Degree of Permanent Effects and Safety Precautions Taken

Permanent Effects	Precautions Taken: No	Yes	Unknown	Percent	Number
	Total Percent				
No Permanent Effects	41.0	15.6	14.4	71.1	123
Serious	2.3			2.3	4
Moderate	12.1	3.5	2.3	17.9	31
Slight	5.8	1.7	1.2	8.7	15
Percent	61.3	20.8	17.9	100.0	
Number	106	36	31		173

TABLE 3.15

Degree of Permanent Effects and Preventability of Accident

Permanent Effects	Accident Preventability				
	No	Yes	Unknown	Percent	Number
	Total Percent				
No Permanent Effects	35.8	28.9	6.3	71.1	123
Serious		2.3		2.3	4
Moderate	6.4	10.4	1.2	17.9	31
Slight		7.5	1.2	8.7	15
Percent	42.2	49.1	4.6	100.0	
Number	73	85	8		173

TABLE 3.16

Degree of Permanent Effects and New Safety Precautions Taken

Permanent Effects	Precautions Taken: No	Yes	Unknown	Percent	Number
Total Percent					
No Permanent Effects	39.3	22.0	9.8	71.1	123
Serious	1.7	0.6		2.3	4
Moderate	11.0	5.2	1.7	17.9	31
Slight	4.0	2.9	1.8	8.7	15
Percent	56.1	30.6	13.3	100.0	
Number	97	53	23		173

TABLE 3.17

Degree of Permanent Effects and Increases in Operating Costs

	Operating Cost Increase									
Person Injured	No Increase	<$100	$100–$499	$500–$999	$1000–$1999	$2000–$2999	>$3000	Unknown	Percent	Number
					Total Percent					
No Permanent Effects	40.5	1.7	13.3	5.8	2.3	1.2	1.2	5.2	71.1	123
Serious	1.2						0.6	0.6	2.3	4
Moderate	8.1	0.6	2.9	1.7	2.3	1.2	0.6	0.6	17.9	31
Slight	3.5	1.2	0.6	0.6	0.6	0.6		1.8	8.7	15
Percent	53.2	3.5	16.8	8.1	5.2	2.9	2.3	8.1	100.0	
Number	92	6	29	14	9	5	4	14		173

TABLE 3.18

Degree of Permanent Effects and Delays in Important Farming Operations

Permanent Effects	Delays in Operations: No	Yes	Unknown	Percent	Number
	Total Percent				
No Permanent Effects	54.9	13.3	2.9	71.1	123
Serious	1.7	0.6		2.3	4
Moderate	11.6	5.2	1.2	17.9	31
Slight	6.4	2.3		8.7	15
Percent	74.6	21.4	4.1	100.0	
Number	129	37	7		173

TABLE 3.19

Degree of Permanent Effects and Changes in Farming

	Changes in Farming						
Permanent Effects	No Changes	Changed Methods	Changed Farm	Left Farming	Unknown	Percent	Number
			Total Percent				
No Permanent Effects	63.6	3.5		0.6	1.2	71.1	123
Serious		1.2			0.6	2.3	4
Moderate	12.7	1.2	2.3		1.7	17.9	31
Slight	5.8	2.3			0.6	8.7	15
Percent	82.1	8.1	2.3	0.6	7.0	100.0	
Number	142	14	4	1	12		173

TABLE 3.20

Work Hours per Week of Injured Person and Delays in Important Farming Operations

	Delays in Operations				
Work Hours per Week	Yes	No	Unknown	Percent	Number
	Total Percent				
None	1.2	0.6		1.7	3
<20 Hours	7.5	0.6	0.6	8.7	15
20–40	15.0	2.9		17.9	31
40–60	37.0	8.7	2.3	48.0	83
>60 Hours	11.0	7.5	0.6	19.1	33
Unknown	2.9	1.2	0.6	4.6	8
Percent	74.6	21.4	4.1	100.0	
Number	129	37	7		173

TABLE 3.21

Scene of Accident and Farming Activity Engaged in

Accident Scene	Farming Activity: Animals	Tripping, Falling	Operating Machinery	Operating Vehicle	Handling, Lifting	Passive	Unknown	Percent	Number
				Total Percent					
Farm Yard or Shed	17.9	6.4	6.4	1.2	3.5	2.3		37.6	65
Flat Paddock	5.2	5.8	5.2	5.2	2.9			24.3	42
Hill Paddock	3.5	4.6	4.0	8.7	2.9		0.6	24.3	42
Workshop		2.9	3.5		1.7			8.1	14
Unknown	1.2	1.2		0.6		2.3	0.6	5.8	10
Percent	27.7	20.8	19.1	15.6	11.0	4.6	1.2	100.0	
Number	48	36	33	27	19	8	2		173

TABLE 3.22

Scene of Accident and Location of Injury Sustained

Accident Scene	Lower Limbs	Upper Limbs	Back	Trunk	Head	Systemic	Unknown	Percent	Number
	Injury Location								
	Total Percent								
Farm Yard or Shed	12.7	9.8	5.8	1.7	4.6	2.3	0.6	37.6	65
Flat Paddock	10.4	4.6	4.6	3.5	0.6		0.6	24.3	42
Hill Paddock	12.7	4.0	2.9	2.3	0.6		1.8	24.3	42
Workshop	2.3	3.5	1.7	0.6				8.1	14
Unknown	2.3	0.6			0.6	2.3		5.8	10
Percent	40.5	22.5	15.0	8.1	6.4	4.6	2.9	100.0	
Number	70	39	26	14	11	8	5		173

TABLE 3.23

Scene of Accident and Farmtype

Accident Scene	Farmtype								Percent	Number
	Mixed Livestock	Dairy	Contractor	Sheep	Orchard, Market Garden	Beef	General	Miscellaneous		
	Total Percent									
Farm Yard or Shed	8.7	9.2	5.8	6.9	0.6	1.2	0.6	4.6	37.6	65
Flat Paddock	2.3	5.8	7.5	1.7	2.3	0.6		4.0	24.3	42
Hill Paddock	9.2	2.3	3.5	4.0	1.2	0.6		3.5	24.3	42
Workshop	0.6	1.2	2.9	1.2				0.6	8.1	14
Unknown	0.6	2.9	1.7					0.6	5.8	10
Percent	21.4	21.4	21.4	13.9	5.8	2.3	0.6	13.3	100.0	
Number	37	37	37	24	10	4	1	23		173

TABLE 3.24

Farming Activity Engaged in and Location of Injury Sustained

Farming Activity	Injury Location: Lower Limbs	Upper Limbs	Back	Trunk	Head	Systemic	Unknown	Percent	Number
	Total Percent								
Animals	9.2	7.5	1.7	4.6	4.0		0.6	27.7	48
Tripping, Falling	13.9	0.6	5.2	0.6			0.6	20.8	36
Operating Machinery	5.8	11.0	0.6		1.7			19.1	33
Operating Vehicle	8.7	2.9	1.2	2.3			0.6	15.6	27
Handling, Lifting	2.3	0.6	6.4	0.6	0.6		0.6	11.0	19
Passive						4.6		4.6	8
Unknown	0.6						0.6	1.2	2
Percent	40.5	22.5	15.0	8.1	6.4	4.6	2.9	100.0	
Number	70	39	26	14	11	8	5		173

TABLE 3.25

Farming Activity Engaged in at Time of Accident and Type of Injury Sustained

Farming Activity	Injury Type										
	Strain	Fracture	Crushing	Laceration	Viral	Dental	Burn	Infection	Unknown	Percent	Number
	Total Percent										
Animals	4.6	10.4	4.6	1.7	0.6	3.5		1.2	1.2	27.7	48
Tripping, Falling	11.6	2.9	2.3	2.9			1.2			20.8	36
Operating Machinery	1.7	0.6	4.6	9.8		0.6	1.2	0.6		19.1	33
Operating Vehicle	1.7	8.1	4.0	0.6			0.6		0.6	15.6	27
Handling, Lifting	8.1	1.2	0.6			0.6			0.6	11.0	19
Passive					4.6					4.6	8
Unknown									1.2	1.2	2
Percent	27.7	23.1	16.2	15.0	5.2	4.6	2.9	1.7	3.5	100.0	
Number	48	40	28	26	9	8	5	3	6		173

TABLE 3.26

Farming Activity Engaged in and Description of Safety Precautions Taken

Farming Activity	No Precautions	Protective Clothing	Safety Devices	Clothing & Devices	Training	Training & Clothing &/or Devices	Unknown	Percent	Number
	Description of Safety Measures								
				Total Percent					
Animals	22.0	0.6	1.7		2.3	0.6	0.6	27.7	48
Tripping, Falling	16.8	1.7	0.6	1.2	0.6			20.8	36
Operating Machinery	15.0	1.2		1.2		1.2	0.6	19.1	33
Operating Vehicle	0.6		1.2			1.2	0.6	15.6	27
Handling, Lifting	9.2	1.2			0.6			11.0	19
Passive	2.3		1.7		0.6			4.6	8
Unknown	0.6						0.6	1.2	2
Percent	78.6	4.6	5.2	2.3	4.0	2.9	2.3	100.0	
Number	136	8	9	4	7	5	4		173

TABLE 3.27

Farming Activity Engaged in and Description of Possible Preventative Measures

Farming Activity	Not Preventable	More Care	Care, Equip.	Care, Avoid Operation	Change Tech.	Change Tech., Equip.	Change Equip.	Avoid Operation	Other	Unknown	Percent	Number
	Possible Precautions											
	Total Percent											
Animals	16.2	2.9		0.6	2.3		2.3	1.7		1.7	27.7	48
Tripping, Falling	9.8	2.3	0.6		1.2		4.0	0.6		2.3	20.8	36
Operating Machinery	5.8	6.9			3.5		0.6	0.6	0.6	1.2	19.1	33
Operating Vehicle	5.8	3.5	0.6		2.9			1.2		1.7	15.6	27
Handling, Lifting	4.6	1.2			1.7			2.3		1.2	11.0	19
Passive	2.3					0.6	0.6		0.6	0.6	4.6	18
Unknown					0.6					0.6	1.2	2
Percent	44.5	16.8	1.2	0.6	12.1	0.6	7.5	6.4	1.2	9.3	100.0	
Number	77	29	2	1	21	1	13	11	2	16		173

TABLE 3.28

Farming Activity Engaged in and Description of New Safety Measures Taken

Farming Activity	New Precautions Taken									
	Not Preventable	More Care	Change Tech.	Change Tech., Equip.	Change Equip.	Avoid Operation	Other	Unknown	Percent	Number
	Total Percent									
Animals	19.1		1.2		2.3	0.6	1.2	3.5	27.7	48
Tripping, Falling	12.7	1.7	1.2		3.5	0.6	0.6	0.6	20.8	36
Operating Machinery	11.6	1.2	1.7	0.6	1.7	0.6		1.7	19.1	33
Operating Vehicle	4.6		1.2		2.3	1.2	1.2	5.2	15.6	27
Handling, Lifting	5.8		1.2		1.2	0.6		2.3	11.0	19
Passive	1.2			0.6	1.2		1.7		4.6	18
Unknown	1.2								1.2	2
Percent	56.1	2.9	6.4	1.2	12.1	3.5	4.6	13.0	100.0	
Number	97	5	11	2	21	6	8	23		173

TABLE 3.29

Farming Activity Engaged in and Delays in Important Farming Operations

Farming Activity	Delays in Operations				
	No	Yes	Unknown	Percent	Number
	Total Percent				
Animals	22.0	4.0	1.8	27.7	48
Tripping, Falling	15.0	5.2	0.6	20.8	36
Operating Machinery	14.5	4.0	0.6	19.1	33
Operating Vehicle	10.4	4.6	0.6	15.6	27
Handling, Lifting	8.1	2.3	0.6	11.0	19
Passive	4.0	0.6		4.6	18
Unknown	0.6	0.6		1.2	2
Percent	74.6	21.4	4.1	100.0	
Number	129	37	7		173

TABLE 3.30

Farming Activity Engaged in and Farmtype

Farming Activity	Farmtype: Mixed Livestock	Dairy	Contractor	Sheep	Orchard, Market Garden	Beef	General	Miscellaneous	Percent	Number
	Total Percent									
Animals	6.4	5.2	5.2	4.0		1.2		5.8	27.7	48
Tripping, Falling	3.5	4.0	5.2	3.5	1.2	0.6	0.6	2.3	20.8	36
Operating Machinery	4.6	4.6	3.5	2.9	1.2			2.3	19.1	33
Operating Vehicle	4.0	1.7	4.0	1.2	2.3	0.6		1.7	15.6	27
Handling, Lifting	2.9	1.7	1.7	2.3	1.2			1.2	11.0	19
Passive		3.5	1.2						4.6	8
Unknown		0.6							1.2	2
Percent	21.4	21.4	21.4	13.9	5.8	2.3	0.6	13.3	100.0	
Number	37	37	37	24	10	4	1	23		173

TABLE 3.31

Location of Injuries and Safety Measures Taken at Time of Accident

Injury Location	No Precautions	Protective Clothing	Safety Devices	Clothing & Devices	Training	Training & Clothing &/or Devices	Unknown	Percent	Number
	Description of Safety Measures								
	Total Percent								
Lower Limbs	31.8	2.9	1.7	1.7	1.7		0.6	40.5	70
Upper Limbs	19.1	0.6		0.6		1.7	0.6	22.5	39
Back	13.9	0.6					0.6	15.0	26
Trunk	3.5		0.6		1.7	1.2	0.6	8.1	14
Head	4.6	0.6	1.2					6.4	11
Systemic	2.3		1.7		0.6			4.6	8
Unknown	2.9							2.9	5
Percent	78.6	4.6	5.2	2.3	4.0	2.9	2.3	100.0	
Number	136	8	9	4	7	5	4		173

TABLE 3.32

Location of Injuries and Possible Preventative Measures

Injury Location	Not Preventable	More Care	Care, Equip.	Care, Avoid Operation	Change Tech.	Change Tech., Equip.	Change Equip.	Avoid Operation	Other	Unknown	Percent	Number
	Possible Precautions											
	Total Percent											
Lower Limbs	17.3	8.1			3.5		2.9	3.5		5.2	40.5	70
Upper Limbs	8.1	4.6	0.6	0.6	3.5		2.3	1.2	0.6	1.2	22.5	39
Back	6.9	1.2	0.6		1.7		1.2	1.7		1.8	15.0	26
Trunk	5.2	1.2			1.2		0.6				8.1	14
Head	3.5	1.7			1.2						6.4	11
Systemic	2.3					0.6	0.6		0.6	0.6	4.6	8
Unknown	1.2				1.2					0.6	2.9	5
Percent	44.5	16.8	1.2	0.6	12.1	0.6	7.5	6.4	1.2	9.3	100.0	
Number	77	29	2	1	21	1	13	11	2	16		173

TABLE 3.33

Location of Injuries and New Safety Precautions Taken

Injury Location	Not Preventable	More Care	Change Tech.	Change Tech., Equip.	Change Equip.	Avoid Operation	Other	Unknown	Percent	Number
	New Precautions Taken									
	Total Percent									
Lower Limbs	22.5	1.7	1.2		6.9	1.2	1.7	5.2	40.5	70
Upper Limbs	11.6	0.6	2.9	0.6	1.7	1.2	0.6	3.5	22.5	39
Back	8.7	0.6	1.2		1.7	1.2		1.7	15.0	26
Trunk	5.2		1.2					1.7	8.1	14
Head	5.8						0.6		6.4	11
Systemic	1.2			0.6	1.2		1.7		4.6	8
Unknown	1.2				0.6			1.2	2.9	5
Percent	56.1	2.9	6.4	1.2	12.1	3.5	4.6	13.3	100.0	
Number	97	5	11	2	21	6	8	23		173

TABLE 3.34

Type of Injury Sustained and Safety Precautions Taken at Time of Accident

Injury Type	Description of Safety Measures								
	No Precautions	Protective Clothing	Safety Devices	Clothing & Devices	Training	Training & Clothing &/or Devices	Unknown	Percent	Number
	Total Percent								
Strain	23.1	1.7	0.6	0.6	1.7			27.7	48
Fracture	0.6	0.6	1.7		0.6	1.7		23.1	40
Crushing	12.7			1.2	1.2		1.2	16.2	28
Laceration	13.3	1.2				0.6		15.0	26
Viral	2.9		1.7		0.6			5.2	9
Dental	4.0		0.6					4.6	8
Burn	1.2		0.6	0.6		0.6		2.9	5
Infection	1.2	0.6						1.7	3
Unknown	1.8	0.6					1.2	3.5	6
Percent	78.6	4.6	5.2	2.3	4.0	2.9	2.3	100.0	
Number	136	8	9	4	7	5	4		173

TABLE 3.35

Safety Precautions Taken at Time of Accident and Possible Preventative Measures

Safety Measures Taken	Possible Precautions											
	Not Preventable	More Care	Care, Equip.	Care, Avoid Operation	Change Tech.	Change Tech., Equip.	Change Equip.	Avoid Operation	Other	Unknown	Percent	Number
	Total Percent											
No Precautions	27.2	11.6	0.6	0.6	8.1	0.6	5.8	3.5	1.2	3.5	78.6	136
Protective Clothing	2.3	0.6						1.2		0.6	4.6	8
Safety Devices	2.3	0.6			0.6		0.6	0.6		0.6	5.2	9
Clothing and Devices	1.2						0.6			0.6	2.3	4
Training	2.3	1.2			0.6						4.0	7
Training & Clothing &/or Devices	0.6	1.2	0.6		0.6						2.9	5
Unknown	8.7	1.7			2.3		0.6	1.2		4.0	2.3	4
Percent	44.5	16.8	1.2	0.6	12.1	0.6	7.5	6.4	1.2	9.3	100.0	
Number	77	29	2	1	21	1	13	11	2	16		173

TABLE 3.36

Description of Safety Precautions Taken and Delays in Important Farming Operations

Safety Measures Taken	Delays in Operations: Yes	No	Unknown	Percent	Number
	Total Percent				
Protective Clothing	2.9	1.7		4.6	8
Safety Devices	3.5	1.7		5.2	9
Clothing & Devices	1.7	0.6		2.3	4
Training	3.5		0.6	4.0	7
Training & Clohting &/or Devices	2.3	0.6		2.9	5
No Precautions	58.4	16.8	3.5	78.6	136
Unknown	2.3			2.3	4
Percent	74.6	21.4	4.1	100.0	
Number	129	37	7		173

TABLE 3.37

Description of Safety Precautions Taken and Farmtype

Safety Measures Taken	Farmtype: Mixed Livestock	Dairy	Contractor	Sheep	Orchard, Market Garden	Beef	General	Miscellaneous	Percent	Number
	Total Percent									
Protective Clothing	1.7	0.6	0.6	0.6			0.6	0.6	4.6	8
Safety Devices		2.3	1.2	0.6				1.2	5.2	9
Clothing and Devices	0.6		0.6	0.6				0.6	2.3	4
Training		0.6	1.7	0.6				1.2	4.0	7
Training & Clothing &/or Devices	0.6	0.6	1.2					0.6	2.9	5
No Precautions	18.5	16.2	15.0	11.6	5.8	2.3		9.2	78.6	136
Unknown		1.2	1.2						2.3	4
Percent	21.4	21.4	21.4	13.9	5.8	2.3	0.6	13.3	100.0	
Number	37	37	37	24	10	4	1	23		173

TABLE 3.38

Safety Measures Taken at Time of Accident and Number of Permanent, Full–Time Employees

Safety Measures Taken	Full–time Employees: None	1–3 Employees	More than 3 Employees	Percent	Number
	Total Percent				
None Taken	31.8	24.9	5.8	62.4	108
Protective Clothing	1.7	2.3	0.6	4.6	8
Safety Devices	2.9	2.3		5.2	9
Clothing and Devices	1.7	0.6		2.3	4
Training	1.2	2.3	0.6	4.0	7
Training and Clothing &/or Devices	1.7	1.2		2.9	5
Unknown	8.7	8.1	1.7	18.5	32
Percent	49.7	41.6	8.7	100.0	
Number	86	72	15		173

TABLE 3.39

Safety Measures Taken at Time of Accident and Hours Per Year Worked by Permanent Part–Time Employees

	Part–timers Hours								
Safety Measures Taken	None	1–200 Hours	201–400 Hours	401–800 Hours	801–2,000 Hours	2,000+ Hours	Unknown	Percent	Number
	Total Percent								
None Taken	52.0	0.6	2.3	1.7	2.3	1.7	1.7	62.4	108
Protective Clothing	2.9	1.2			0.6			4.6	8
Safety Devices	4.6					0.6		5.2	9
Clothing and Devices	2.3							2.3	4
Training	2.3			0.6		0.6	0.6	4.0	7
Training & Clothing &/or Devices	2.3				0.6			2.9	5
Unknown	13.3	0.6	1.2		1.7	1.2	0.6	18.5	32
Percent	79.8	2.3	3.5	2.3	5.2	4.0	2.9	100.0	
Number	138	4	6	4	9	7	5		173

TABLE 3.40

Safety Measures Taken at Time of Accident and Hours Per Year Worked by Family of Owner or Employee

	Family: Hours Worked								
Safety Measures Taken	None	1–200 Hours	201–400 Hours	401–800 Hours	801–2,000 Hours	2,000+ Hours	Unknown	Percent	Number
				Total Percent					
None Taken	46.2	5.2	2.3	1.2	4.0	1.7	1.8	62.4	108
Protective Clothing	1.7	0.6	1.2	0.6		0.6		4.6	8
Safety Devices	2.9	1.2			1.2			5.2	9
Clothing and Devices	1.2					1.2		2.3	4
Training	1.2	0.6		0.6	0.6	0.6	0.6	4.0	7
Training & Clohting &/or Devices	2.3	0.6						2.9	5
Unknown	12.7	1.7		0.6	1.7	1.2	0.6	18.5	32
Percent	68.2	9.8	3.5	2.9	7.5	5.2	2.9	100.0	
Number	118	17	6	5	13	9	5		173

TABLE 3.41

Safety Measures taken at Time of Accident and Formfiller's Education

Safety Measures Taken	Education								
	Primary, Intermediate	Secondary	School Certificate	6th Form Certificate	U.E.	7th Form	Unknown	Percent	Number
				Total Percent					
None Taken	4.6	26.0	13.9	5.2	4.0	4.0	4.6	62.4	108
Protective Clothing	0.6	1.2	2.3				0.6	4.6	8
Safety Devices		1.7	1.2	0.6		1.2	0.6	5.2	9
Clothing & Devices		1.2	0.6				0.6	2.3	4
Training		1.2	1.2		0.6	0.6	0.6	4.0	7
Training & Clothing &/or Devices		1.7	0.6				0.6	2.9	5
Unknown	1.2	9.2	2.3	0.6		1.7	3.5	18.5	32
Percent	6.4	42.2	22.0	6.4	4.6	7.5	11.0	100.0	
Number	11	73	38	11	8	13	19		173

TABLE 3.42

Safety Measures Taken at Time of Accident and Farming Experience of Formfiller

Safety Measures Taken	1—3 Years	4—10 Years	11—20 Years	21—30 Years	More than 30 years	Unknown	Percent	Number
	Farming Experience							
	Total Percent							
None Taken	3.5	10.4	18.5	10.4	12.1	7.5	62.4	108
Protective Clothing		1.2	1.2		1.7	0.6	4.6	8
Safety Devices			0.6	3.5		0.6	5.2	9
Clothing & Devices			0.6	0.6	0.6	0.6	2.3	4
Training			0.6	0.6	2.3	0.6	4.0	7
Training & Clothing &/or Devices		2.3				0.6	2.9	5
Unknown	1.2	1.2	3.5	4.6	5.2	2.9	18.5	32
Percent	4.6	15.0	24.9	19.7	22.0	13.8	100.0	
Number	8	26	43	34	38	24		173

TABLE 3.43

Safety Measures Taken at Time of Accident and Formfiller's Tertiary Training

Safety Measures Taken	None	Farming Diploma	Farming Short Course	Non-Farming Degree	Farming Degree	Unknown	Percent	Number
	Tertiary Training							
	Total Percent							
None Taken	40.5	9.2	5.8	5.2	1.7		62.4	108
Protective Clothing	3.5		0.6	0.6			4.6	8
Safety Devices	2.9	1.2	0.6	0.6			5.2	9
Clothing & Devices	2.3						2.3	4
Training	1.2	1.7	0.6			0.6	4.0	7
Training & Clothing &/or Devices	1.7	0.6	0.6				2.9	5
Unknown	12.7	0.6	2.3	2.3		0.6	18.5	32
Percent	64.7	13.3	10.4	8.7	1.7	1.2	100.0	
Number	112	23	18	15	3	2		173

TABLE 3.44

Possible Preventative Measures and New Safety Measures Taken Since the Accident

	New Precautions Taken									
Possible Precautions	Not Preventable	More Care	Change Tech.	Change Tech., Equip.	Change Equip.	Avoid Operation	Other	Unknown	Percent	Number
				Total Percent						
Not Preventable	30.1	0.6	0.6		4.6	1.2	2.3	5.2	44.5	77
More Care	8.7	1.7	1.2		2.3	0.6	0.6	1.7	16.8	29
Care & Equipment	0.6					0.6			1.2	2
Care & Avoid Operation			0.6						0.6	1
Change Technique	5.2	0.6	2.9	0.6	1.2		0.6	1.2	12.1	21
Change Technique & Equipment				0.6					0.6	1
Change Equipment	3.5				3.5	0.6			7.5	13
Avoid Operation	3.5				0.6	0.6		1.7	6.4	11
Other			0.6				0.6		1.2	2
Unknown	4.6		0.6				0.6	3.5	9.3	16
Percent	56.1	2.9	6.4	1.2	12.1	3.5	4.6	13.3	100.0	
Number	97	5	11	2	21	6	8	23		173

TABLE 3.45

Possible Preventative Measures and Increase in Operating Cost

Possible Precautions	Operating Cost Increase									
	No Increase	<$100	$100–$499	$500–$999	$1000–$1999	$2000–$2999	>$3000	Unknown	Percent	Number
					Total Percent					
Not Preventable	27.2	2.3	5.8	4.0	2.3	0.6		2.3	44.5	77
More Care	6.4		3.5	1.7		1.2	1.2	2.9	16.8	29
Care & Equipment	0.6	0.6							1.2	2
Care & Avoid Operation					0.6				0.6	1
Change Technique	5.8		4.6	0.6	1.2				12.1	21
Change Technique & Equipment							0.6		0.6	1
Change Equipment	2.9	0.6	0.6	1.2	0.6	1.2		0.6	7.5	13
Avoid Operation	4.0		1.2	0.6			0.6		6.4	11
Other	1.2								1.2	2
Unknown	5.2		1.2		0.6			2.3	9.3	16
Percent	53.2	3.5	16.8	8.1	5.2	2.9	2.3	9.1	100.0	
Number	92	6	29	14	9	5	4	14		173

TABLE 3.46

Possible Preventative Measures and Delays in Important Farming Operations

Possible Precautions	Delays in Operations: No	Yes	Unknown	Percent	Number
	Total Percent				
Not Preventable	32.9	10.4	1.2	44.5	77
More Care	13.3	1.7	1.8	16.8	29
Care & Equipment	1.2			1.2	2
Care & Avoid Operation		0.6		0.6	1
Change Technique	8.7	3.5		12.1	21
Change Tech & Equipment	0.6			0.6	1
Change Equipment	5.2	2.3		7.5	13
Avoid Operation	3.5	2.3	0.6	6.4	11
Other	1.2			1.2	2
Unknown	8.1	0.6	0.6	9.3	16
Percent	74.6	21.4	4.1	100.0	
Number	129	37	7		173

TABLE 3.47

Description of New Precautions Taken and Increase in Operating Cost

New Precautions	Operating Cost Increase									
	No Increase	<$100	$100–$499	$500–$999	$1000–$1999	$2000–$2999	>$3000	Unknown	Percent	Number
	Total Percent									
Not Preventable	35.8	1.7	6.4	4.0	1.2	2.3	1.2	3.4	56.1	97
More Care	1.2			0.6	0.6		0.6		2.9	5
Change Technique	2.3		2.9		1.2				6.4	11
Change Technique, Equipment	0.6						0.6		1.2	2
Change Equipment	4.6	0.6	3.5	0.6	1.2	0.6		1.2	12.1	21
Avoid Operation	1.7	1.2						0.6	3.5	6
Other	0.6		1.7	1.7				0.6	4.6	8
Unknown	6.4		2.3	1.2	1.2			2.3	13.3	23
Percent	53.2	3.5	16.8	8.1	5.2	2.9	2.3	8.1	100.0	
Number	92	6	29	14	9	5	4	14		173

TABLE 3.48

Description of New Precautions Taken and Delays in Important Farming Operations

	Delays in Operations				
New Precautions Taken	No	Yes	Unknown	Percent	Number
	Total Percent				
Not Preventable	44.5	10.4	1.2	56.1	97
More Care	2.3	0.6		2.9	5
Change Technique	4.6	1.7		6.4	11
Change Tech, Equipment	1.2			1.2	2
Change Equipment	7.5	4.0	0.6	12.1	21
Avoid Operation	2.9	0.6		3.5	6
Other	3.5	1.2		4.6	8
Unknown	8.1	2.9	2.3	13.3	23
Percent	74.6	21.4	4.1	100.0	
Number	129	37	7		173

TABLE 3.49

Description of New Precautions Taken and Change in Way of Farming

	Changes in Farming						
New Precautions Taken	No Changes	Changed Methods	Changed Farm	Left Farming	Unknown	Percent	Number
	Total Percent						
Not Preventable	45.7	4.0	1.2		5.2	56.1	97
More Care	2.9					2.9	5
Change Technique	5.8	0.6				6.4	11
Change Technique, Equipment	0.6	0.6				1.2	2
Change Equipment	10.4	1.2			0.6	12.1	21
Avoid Operation	1.7		1.2	0.6		3.5	6
Other	4.0	0.6				4.6	8
Unknown	11.0	1.2			1.2	13.3	23
Percent	82.1	8.1	2.4	0.6	7.0	100.0	
Number	142	14	4	1	12		173

TABLE 3.50

Description of New Precautions Taken and Number of Permanent, Full—Time Employees

New Precautions Taken	Full—time Employees: None	1—3 Employees	More than 3 Employees	Percent	Number
		Total Percent			
Not Preventable	27.2	24.9	4.0	56.1	97
More Care	1.7	1.2		2.9	5
Change Technique	2.9	2.9	0.6	6.4	11
Change Technique, Equipment	0.6	0.6		1.2	2
Change Equipment	7.5	3.5	1.2	12.1	21
Avoid Operation	2.3	0.6	0.6	3.5	6
Other	1.7	2.3	0.6	4.6	8
Unknown	5.8	5.8	1.7	13.3	23
Percent	49.7	41.6	8.7	100.0	
Number	86	72	15		173

TABLE 3.51

Description of New Precautions Taken and Hours Per Year Worked by Family of Owner or Employee

New Precautions Taken	Family: Hours Worked								
	None	1–200 Hours	201–400 Hours	401–800 Hours	801–2,000 Hours	2,000+ Hours	Unknown	Percent	Number
				Total Percent					
Not Preventable	36.4	5.8	2.9	1.7	4.6	2.3	2.3	56.1	97
More Care	2.3					0.6		2.9	5
Change Technique	5.2				0.6	0.6		6.4	11
Change Technique, Equipment	1.2							1.2	2
Change Equipment	8.1	2.3		0.6	1.2			12.1	21
Avoid Operation	2.3	0.6				0.6		3.5	6
Other	3.5		0.6		0.6			4.6	8
Unknown	9.2	1.2		0.6	0.6	1.2	0.6	13.3	23
Percent	68.2	9.8	3.5	2.9	7.5	5.2	2.9	100.0	
Number	118	17	6	5	13	9	5		173

TABLE 3.52

Description of New Precautions Taken and Education of Formfiller

New Precautions Taken	Education: Primary, Intermediate	Secondary	School Certificate	6th Form Certificate	U.E.	7th Form	Unknown	Percent	Number
	Total Percent								
Not Preventable	5.2	20.2	14.5	3.5	2.9	4.0	5.7	56.1	97
More Care	0.6	1.2	1.2					2.9	5
Change Technique		1.2	2.9		1.2	0.6		6.4	11
Change Technique, Equipment		0.6					0.6	1.2	2
Change Equipment		5.8	1.7	2.3	0.6	1.2	0.6	12.1	21
Avoid Operation	0.6	2.3					0.6	3.5	6
Other		3.5	0.6			0.6		4.6	8
Unknown		7.5	1.2	0.6		1.2	2.9	13.3	23
Percent	6.4	42.2	22.0	6.4	4.6	7.5	11.0	100.0	
Number	11	73	38	11	8	13	19		173

TABLE 3.53

Description of New Precautions Taken and Formfiller's Years of Farming Experience

New Precautions Taken	Farming Experience: 1–3 Years	4–10 Years	11–20 Years	21–30 Years	More than 30 years	Unknown	Percent	Number
				Total Percent				
Not Preventable	2.9	6.4	16.8	11.0	9.8	9.3	56.1	97
More Care	0.6	0.6	0.6		1.2		2.9	5
Change Technique		1.7	1.2		2.3	1.2	6.4	11
Change Technique, Equipment		0.6			0.6		1.2	2
Change Equipment	0.6	2.3	2.3	3.5	2.9	0.6	12.1	21
Avoid Operation		2.3	0.6			0.6	3.5	6
Other			0.6	2.3	1.7		4.6	8
Unknown	0.6	1.2	2.9	2.9	3.5	2.3	13.3	23
Percent	4.6	15.0	24.9	19.7	22.0	13.8	100.0	
Number	8	26	43	34	38	24		173

TABLE 3.54

Description of New Precautions Taken and Formfiller's Tertiary Training

New Precautions Taken	Tertiary Training: None	Farming Diploma	Farming short Course	Non-Farming Degree	Farming Degree	Unknown	Percent	Number
	Total Percent							
Not Preventable	38.2	6.4	5.2	4.6	1.2	0.6	56.1	97
More Care	1.7	0.6		0.6			2.9	5
Change Technique	3.5	1.2	0.6	1.2			6.4	11
Change Technique, Equipment	0.6	0.6					1.2	2
Change Equipment	6.4	3.5	1.7		0.6		12.1	21
Avoid Operation	2.3	0.6	0.6				3.5	6
Other	2.9		1.2	0.6			4.6	8
Unknown	9.2	0.6	1.2	1.7		0.6	13.3	23
Percent	64.7	13.3	10.4	8.7	1.7	1.2	100.0	
Number	112	23	18	15	3	2		173

TABLE 3.55

Increase in Operating Cost and Delays in Important Farming Operations

Operating Cost Increase	Delays in Operations				
	No	Yes	Unknown	Percent	Number
	Total Percent				
No Increase	46.2	5.2	1.8	53.2	92
<$100	2.9	0.6		3.5	6
$100–$499	11.0	5.2	0.6	16.8	29
$500–$999	4.0	4.0		8.1	14
$1000–$1999	1.7	2.9	0.6	5.2	9
$2000–$2999	1.2	1.7		2.9	5
>$3000	1.2	1.2		2.3	4
Unknown	3.5	0.6	1.2	8.1	14
Percent	74.6	21.4	4.1	100.0	
Number	129	37	7		173

TABLE 3.56

Increase in Operating Cost and Farmtype

Operating Cost Increase	Farmtype: Mixed Livestock	Dairy	Contractor	Sheep	Orchard, Market Garden	Beef	General	Miscellaneous	Percent	Number
	Total Percent									
No Increase	13.3	8.7	11.0	7.5	2.9	1.7	0.6	7.5	53.2	92
<$500	4.6	4.1	6.4	1.8	1.8	0.6		1.2	20.3	35
$500–$1,000	1.2	2.9	1.2	1.7	0.6			0.6	8.1	14
>$1,000	1.7	2.9	1.2	2.3	0.6			1.8	10.4	18
Unknown	0.6	2.9	1.8					2.3	8.1	14
Percent	21.4	21.4	21.4	13.9	5.8	2.3	0.6	13.3	100.0	
Number	37	37	37	24	10	4	1	23		173

TABLE 3.57

Increase in Operating Cost and Number of Permanent, Full–Time Employees

	Full–time Employees				
Operating Cost Increase	None	1–3 Employees	More than 3 Employees	Percent	Number
		Total Percent			
No Increase	26.6	20.8	5.8	53.2	92
<$500	9.3	9.8	1.2	20.3	35
$500–$1,000	4.0	4.0		8.1	14
>$1,000	5.8	4.0	0.6	10.4	18
Unknown	4.1	2.9	1.2	8.1	14
Percent	49.7	41.6	8.7	100.0	
Number	86	72	15		173

TABLE 3.58

Increase in Operating Cost and Hours Per Year Worked by Permanent Part—Time Employees

Operating Cost Increase	Part—Timer's Hours								
	None	1—200 Hours	201—400 Hours	401—800 Hours	801—2,000 Hours	2,000+ Hours	Unknown	Percent	Number
				Total Percent					
No Increase	44.5		2.3	0.6	1.2	2.9	1.7	53.2	92
<$500	16.2	1.2		1.2	1.2	0.6		20.3	35
$500—$1,000	6.4				1.2	0.6	0.6	8.1	14
>$1,000	5.1	1.2	1.2	0.6	1.8		0.6	10.4	18
Unknown	7.5							8.1	14
Percent	79.8	2.3	3.5	2.3	5.2	4.0	2.9	100.0	
Number	138	4	6	4	9	7	5		173

TABLE 3.59

Increase in Operating Cost and Hours Per Year Worked by Contractors & Seasonal Workers

	Contractor's Hours							
Operating Cost Increase	None	1–200 Hours	201–400 Hours	401–800 Hours	800+ Hours	Unknown	Percent	Number
				Total Percent				
No Increase	27.7	15.0	2.9	3.5	2.3	1.7	53.2	92
<$500	9.3	5.2	4.1	1.8			20.3	35
$500–$1,000	3.5	3.5	0.6	0.6			8.1	14
>$1,000	7.5	0.6	1.8			0.6	10.4	18
Unknown	5.2	1.7	0.6			0.6	8.1	14
Percent	53.2	26.0	9.8	5.8	2.3	2.9	100.0	
Number	92	45	17	10	4	5		173

TABLE 3.60

Increase in Operating Cost and Hours Per Year Worked by Family of Owner or Employee

	Family: Hours Worked								
Operating Cost Increase	None	1–200 Hours	201–400 Hours	401–800 Hours	801–2,000 Hours	2,000+ Hours	Unknown	Percent	Number
				Total Percent					
No Increase	37.6	4.6	1.2	1.7	3.5	2.9	1.7	53.2	92
<$500	12.1	3.5	0.6	0.6	2.3	1.2		20.3	35
$500–$1,000	3.5	1.2	1.2		1.2	1.2		8.1	14
>$1,000	8.0	0.6	0.6	0.6			0.6	10.4	18
Unknown	6.9				0.6		0.6	8.1	14
Percent	68.2	9.8	3.5	2.9	7.5	5.2	2.9	100.0	
Number	118	17	6	5	13	9	5		173

TABLE 3.61

Increase in Operating Cost and Hours Per Week Worked by Formfiller

Operating Cost Increase	1–20 Hours	21–40 Hours	41–60 Hours	More than 60 Hours	Unknown	Percent	Number
	Formfiller's Hours						
			Total Percent				
No Increase	4.0	8.7	27.2	4.6	8.7	53.2	92
<$500	1.2	4.1	11.6	2.9	0.6	20.3	35
$500–$1,000	0.6	1.2	4.0	2.3		8.1	14
>$1,000	0.6		5.8	3.5	0.6	10.4	18
Unknown		0.6	4.1	1.2	1.2	8.1	14
Percent	6.4	14.5	52.6	14.5	12.1	100.0	
Number	11	25	91	25	21		173

TABLE 3.62

Increase in Operating Cost and Education of Formfiller

Operating Cost Increase	Education: Primary, Intermediate	Secondary	School Certificate	6th Form Certificate	U.E.	7th Form	Unknown	Percent	Number
	Total Percent								
No Increase	6.4	20.8	12.7	2.3	2.3	1.7	6.9	53.2	92
<$500		9.8	4.6	0.6	1.7	2.3	1.2	20.3	35
$500–$1,000		3.5	2.9	0.6		1.2		8.1	14
>$1,000		5.9	1.2	0.6	0.6	1.2	1.2	10.4	18
Unknown		2.4	0.6	2.3		1.2	1.8	8.1	14
Percent	6.4	42.2	22.0	6.4	4.6	7.5	11.0	100.0	
Number	11	73	38	11	8	13	19		173

TABLE 3.63

Increase in Operating Cost and Formfiller's Farming Experience

Operating Cost Increase	Farming Experience: 1–3 Years	4–10 Years	11–20 Years	21–30 Years	More than 30 years	Unknown	Percent	Number
				Total Percent				
No Increase	3.5	8.1	11.6	8.1	12.7	9.3	53.2	92
<$500	0.6	2.9	6.9	4.6	4.1	1.2	20.3	35
$500–$1,000			2.9	2.3	2.3	0.6	8.1	14
>$1,000		2.9	2.3	2.9	1.8	0.6	10.4	18
Unknown	0.6	0.6	0.6	1.2	1.2	2.4	8.1	14
Percent	4.6	15.0	24.9	19.7	22.0	13.8	100.0	
Number	8	26	43	34	38	24		173

TABLE 3.64

Increase in Operating Cost and Formfiller's Tertiary Training

Operating Cost Increase	Tertiary Training: None	Farming Diploma	Farming short Course	Non-Farming Degree	Farming Degree	Unknown	Percent	Number
	Total Percent							
No Increase	36.4	4.0	5.8	4.6	1.2	1.2	53.2	92
<$500	11.5	3.5	2.3	2.9			20.3	35
$500—$1,000	5.2	1.7	1.2				8.1	14
>$1,000	7.0	1.8		1.2	0.6		10.4	18
Unknown	4.6	2.3	1.2				8.1	14
Percent	64.7	13.3	10.4	8.7	1.7	1.2	100.0	
Number	112	23	18	15	3	2		173

TABLE 3.65

Delays in Important Farming Operations and Change in Way of Farming

Delays in Operations	Changes in Farming						
	No Changes	Changed Methods	Changed Farm	Left Farming	Unknown	Percent	Number
	Total Percent						
No	61.3	5.8	1.2	0.6	5.8	74.6	129
Yes	17.3	2.3	1.2		0.6	21.4	37
Unknown	3.5				0.6	4.1	7
Percent	82.1	8.1	2.4	0.6	7.0	100.0	
Number	142	14	4	1	12		173

TABLE 3.66

Delays in Important Farming Operations and Farmtype

Delays in Operations	Farmtype: Mixed Livestock	Dairy	Contractor	Sheep	Orchard, Market Garden	Beef	General	Miscellaneous	Percent	Number
	Total Percent									
No	15.6	15.0	17.9	8.7	5.2	1.7	0.6	9.8	74.6	129
Yes	5.2	5.2	2.3	5.2	0.6	0.6		2.3	21.4	37
Unknown	0.6	1.2	1.2					1.2	4.1	7
Percent	21.4	21.4	21.4	13.9	5.8	2.3	0.6	13.3	100.0	
Number	37	37	37	24	10	4	1	23		173

TABLE 3.67

Delays in Important Farming Operations and Number of Permanent, Full-Time Employees

Delays in Operations	Full-time Employees: None	1-3 Employees	More than 3 Employees	Percent	Number
	Total Percent				
No	34.7	34.1	5.8	74.6	129
Yes	13.3	6.4	1.7	21.4	37
Unknown	1.8	1.2	1.2	4.1	7
Percent	49.7	41.6	8.7	100.0	
Number	86	72	15		173

TABLE 3.68

Delays in Important Farming Operations and Hours Per Year Worked by Permanent Part-Time Employees

Delays in Operations	None	1-200 Hours	201-400 Hours	401-800 Hours	801-2,000 Hours	2,000+ Hours	Unknown	Percent	Number
	Part-Timers Hours								
	Total Percent								
No	60.7	1.7	1.7	1.7	3.5	3.5	1.7	74.6	129
Yes	17.3	0.6	1.2	0.6	1.2	0.6		21.4	37
Unknown	1.8		0.6		0.6		1.2	4.1	7
Percent	79.8	2.3	3.5	2.3	5.2	4.0	2.9	100.0	
Number	138	4	6	4	9	7	5		173

TABLE 3.69

Delays in Important Farming Operations and Hours Per Year Worked by Contractors & Seasonal Workers

Delays in Operations	None	1–200 Hours	201–400 Hours	401–800 Hours	800+ Hours	Unknown	Percent	Number
	Contractor's Hours							
	Total Percent							
No	42.2	19.1	4.6	4.6	2.3	1.7	74.6	129
Yes	9.2	6.4	4.6	1.2			21.4	37
Unknown	1.7	0.6	0.6			1.2	4.1	7
Percent	53.2	26.0	9.8	5.8	2.3	2.9	100.0	
Number	92	45	17	10	4	5		173

TABLE 3.70

Delays in Important Farming Operations and Hours Per Year Worked by Family of Owner or Employee

Delays in Operations	Hours Worked								
	None	1–200 Hours	201–400 Hours	401–800 Hours	801–2,000 Hours	2,000+ Hours	Unknown	Percent	Number
				Total Percent					
No	54.3	5.8	1.7	1.7	6.4	2.9	1.7	74.6	129
Yes	11.6	4.0	1.7	0.6	1.2	2.3		21.4	37
Unknown	2.3			0.6			1.2	4.1	7
Percent	68.2	9.8	3.5	2.9	7.5	5.2	2.9	100.0	
Number	118	17	6	5	13	9	5		173

TABLE 3.71

Delays in Important Farming Operations and Hours Per Week Worked by Formfiller

Delays in Operations	Formfiller's Hours: 1–20 Hours	21–40 Hours	41–60 Hours	More than 60 Hours	Unknown	Percent	Number
			Total Percent				
No	5.2	9.8	41.6	6.9	11.0	74.6	129
Yes	1.2	3.5	8.7	7.5	0.6	21.4	37
Unknown		1.2	2.3		0.6	4.1	7
Percent	6.4	14.5	52.6	14.5	12.1	100.0	
Number	11	25	91	25	21		173

TABLE 3.72

Delays in Important Farming Operations and Education of Formfiller

Delays in Operations	Education: Primary, Intermediate	Secondary	School Certificate	6th Form Certificate	U.E.	7th Form	Unknown	Percent	Number
	Total Percent								
No	5.2	30.1	16.8	3.5	4.0	5.8	9.2	74.6	129
Yes	1.2	9.8	4.6	2.9	0.6	1.7	0.6	21.4	37
Unknown		2.3	0.6				1.2	4.1	7
Percent	6.4	42.2	22.0	6.4	4.6	7.5	11.0	100.0	
Number	11	73	38	11	8	13	19		173

TABLE 3.73

Delays in Important Farming Operations and Farming Experience of Formfiller

Delays in Operations	Farming Experience							
	1–3 Years	4–10 Years	11–20 Years	21–30 Years	More than 30 years	Unknown	Percent	Number
	Total Percent							
No	2.9	9.8	19.1	13.3	17.3	12.1	74.6	129
Yes	1.2	5.2	5.2	5.8	2.9	0.6	21.4	37
Unknown	0.6		0.6	0.6	1.8	0.6	4.1	7
Percent	4.6	15.0	24.9	19.7	22.0	13.8	100.0	
Number	8	26	43	34	38	24		173

TABLE 3.74

Delays in Important Farming Operations and Formfiller's Tertiary Training

Delays in Operations	Tertiary Training							
	None	Farming Diploma	Farming Short Course	Non-Farming Degree	Farming Degree	Unknown	Percent	Number
	Total Percent							
No	49.1	8.1	7.5	6.9	1.7	1.2	74.6	129
Yes	12.7	4.0	2.9	1.7			21.4	37
Unknown	2.9	1.2					4.1	7
Percent	64.7	13.3	10.4	8.7	1.7	1.2	100.0	
Number	112	23	18	15	3	2		173

TABLE 3.75

Injured Person and Age (CI DATA)

Injured Person	Age of Victim: 0–14 Years	15–19 Years	20–29 Years	30–39 Years	40–49 Years	50–59 Years	60+ Years	Percent	Number
	Total Percent								
Farm Owner		0.6	5.8	12.7	13.3	6.9	2.9	42.2	73
Hired Employee	0.6	3.5	9.2	4.6	2.3	2.9	0.6	23.7	41
Family of Owner/Employee	0.6	2.9	5.8	3.5	2.3	2.3		17.3	30
Contractor, Casual Labourer		1.2	5.8	2.9	1.7	1.2	0.6	13.3	23
Hired Manager			0.6	1.7		0.6		2.9	5
Unknown			0.6					0.6	1
Percent	1.2	8.1	27.7	25.4	19.7	13.9	4.0	100.0	
Number	2	14	48	44	34	24	7		173

TABLE 3.76

Injured Person and Sex (C1 DATA)

Injured Person	Sex of Victim: Male	Female	Percent	Number
Farm Owner	37.0	5.2	42.2	73
Hired Employee	21.4	2.3	23.7	41
Family of Owner/Employee	11.0	6.4	17.3	30
Contractor, Casual Labourer	21.1	1.2	13.3	23
Hired Manager	2.9		2.9	5
Unknown	0.6		0.6	1
Percent	85.0	15.0	100.0	
Number	147	26		173

TABLE 3.77

Injured Person and Marital Status (CI DATA)

Injured Person	Marital Status: Single	Marrried	Percent	Number
Farm Owner	6.9	35.3	42.2	73
Hired Employee	11.6	12.1	23.7	41
Family of Owner/Employee	8.7	8.7	17.3	30
Contractor, Casual Labourer	6.9	6.4	13.3	23
Hired Manager	0.6	2.3	2.9	5
Unknown	0.6		0.6	1
Percent	35.3	64.7	100.0	
Number	61	112		173

TABLE 3.78

Injured Person and Previous Claims (CI DATA)

Injured Person	Claims: Yes	Claims: No	Percent	Number
Farm Owner	13.9	28.3	42.2	73
Hired Employee	9.8	13.9	23.7	41
Family of Owner/Employee	4.6	12.7	17.3	30
Contractor, Casual Labourer	2.9	10.4	13.3	23
Hired Manager	2.3	0.6	2.9	5
Unknown	0.6		0.6	1
Percent	34.1	65.9	100.0	
Number	59	114		173

TABLE 3.79

Injured Person and Previous Farming Experience (CI DATA)

Injured Person	Experience (in years): Less than 1 or None	1–3 Years	4–10 Years	11–20 Years	21–30 Years	30+ Years	Unknown	Percent	Number
Farm Owner	11.6	2.9	5.8	9.8	5.2	3.5	3.5	42.2	73
Hired Employee	5.2	6.9	5.8	2.9	1.7	0.6	0.6	23.7	41
Family of Owner/Employee	8.7	2.3	4.0	0.6	0.6	0.6	0.6	17.3	30
Contractor, Casual Labourer	4.6	3.5	2.9	0.6	0.6	0.6	0.6	13.3	23
Hired Manager	0.6		1.2	0.6		0.6		2.9	5
Unknown		0.6						0.6	1
Percent	30.6	16.2	19.7	14.5	8.1	5.8	5.2	100.0	
Number	53	28	34	25	14	10	9		173

TABLE 3.80

Injured Person and Environment of Accident (C1 DATA)

Injured Person	Environment: Work	Non–Work	Other	Percent	Number
	Total Percent				
Farm Owner	39.9	1.7	0.6	42.2	73
Hired Employee	23.7			23.7	41
Family of Owner/Employee	11.6	4.6	1.2	17.3	30
Contractor, Casual Labourer	13.3			13.3	23
Hired Manager	2.9			2.9	5
Unknown	0.6			0.6	1
Percent	91.9	6.4	1.7	100.0	
Number	159	11	3		173

TABLE 3.81

Scene of Accident and Activity Involved in at Time of Accident (C1 DATA)

Accident Scene	Farming Activity: Animals	Operating Machinery	Handling, Lifting	Operating Vehicle	Tripping, Falling	General & Passive	Unknown	Percent	Number
	Total Percent								
Farm Yard or Shed	16.8	5.2	5.2	1.2	4.6	4.6		37.6	65
Flat Paddock	4.6	4.6	3.5	5.8	4.6	0.6	0.6	24.3	42
Hill Paddock	5.2	5.8	2.9	5.8	2.9	1.7		24.3	42
Workshop	0.6	3.5	2.3		0.6	1.2		8.1	14
Unknown	1.2		1.2	0.6	0.6	2.3		5.8	10
Percent	28.3	19.1	15.0	13.3	13.3	10.4	0.6	100.0	
Number	49	33	26	23	23	18	1		173

TABLE 3.82

Activity Involved in at Time of Accident and Sex of Injured Person (C1 DATA)

Farming Activity	Sex of Injured Person: Male	Female	Percent	Number
	Total Percent			
Animals	22.0	5.8	27.7	48
Tripping, Falling	17.9	2.9	20.8	36
Operating Machinery	16.2	2.9	19.1	33
Operating Vehicle	15.0	0.6	15.6	27
Handling, Lifting	8.7	2.3	11.0	19
General & Passive	4.0	0.6	4.6	8
Unknown	1.2		1.2	2
Percent	85.0	15.0	100.0	
Number	147	26		173

TABLE 3.83

Activity Involved in at Time of Accident

Accident Activity (Survey)	Accident Type (Cl Data)								
	Animals	Operating Machinery	Handling, Lifting	Operating Vehicle	Tripping, Falling	General & Passive	Unknown	Percent	Number
	Total Percent								
Animals	23.7	1.2	0.6	0.6	0.6	0.6	0.6	27.7	48
Operating Machinery	1.2	12.1	2.3	0.6		2.9		19.1	33
Handling, Lifting	0.6	0.6	8.7			1.2		11.0	19
Operating Vehicle	1.2	1.7		11.6	0.6	0.6		15.6	27
Tripping, Falling	1.2	3.5	3.5	0.6	11.6	0.6		20.8	36
General & Passive						4.6		4.6	8
Unknown	0.6				0.6			1.2	2
Percent	28.3	19.1	15.0	13.3	13.3	10.4	0.6	100.0	
Number	49	33	26	23	23	18	1		173

TABLE 3.84

Farmtype (from Survey) and Farmtype (CI DATA)

Farmtype (Survey)	Mixed Livestock	Dairy	Contractor	Sheep	Orchard, Market Garden	General	Miscellaneous	Unknown	Percent	Number
	Farmtype									
	Total Percent									
Mixed Livestock	7.5	2.9	1.7	4.0			1.2	4.1	21.4	37
Dairy	6.4	10.4				2.3	0.6	1.7	21.4	37
Contractor	6.4	2.9	1.7	2.9	1.7	1.7	2.3	1.7	21.4	37
Sheep	5.8	1.7	1.2	2.3				2.9	13.9	24
Orchard, Market Garden	1.7		0.6	0.6	2.3			0.6	5.9	10
Beef	1.2							1.2	2.3	4
General						0.6			0.6	1
Miscellaneous	2.3	1.2	2.9	1.2	1.2		2.9	1.7	13.3	23
Percent	31.2	19.1	8.1	11.0	5.2	4.6	6.9	13.9	100.0	
Number	54	33	14	19	9	8	12	24		173

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