

Some Aspects of
Innovation
&
Technology Adoption
in New Zealand Agriculture

**Kellogg Rural Leadership Programme
Personal Project
Course XI 1992**

by

**Gilbert van Reenen
RD 2
Wanaka**

The Kellogg Rural Leadership Programme - What is it?

The Kellogg Rural Leadership programme arose in 1979 from a conviction that leadership would be a critical factor in the future performance of New Zealand agriculture. It was conceived and designed by agricultural economist, Dr John Pryde, as a one year programme with three distinct phases.

Phase 1 is the Lincoln University campus - based phase involving intensive group activity concentrating on the main ingredients of leadership. This combines personal development topics such as the psychology of leadership, critical thinking, decision making, goal setting, time management, communication, interpersonal and negotiating skills with current affairs and economic matters including privatisation, marketing boards, sector production systems, media training and pressure group tactics and an understanding of the political system. During this phase participants are addressed by a number of top leaders in agriculture and industry, chairmen of producer boards, senior politicians, outstanding business and financial leaders and public figures as well as government officials and academic staff.

Phase 2 consists of the participants researching a self chosen project throughout the year relevant to their vocation or involvement in the rural community. This is the context of this document.

Phase 3 involves presenting the findings of the project to the other participants which leads to further discussion and a critical review by peers who collectively have a wide range of perspectives. Following this ordeal participants travel to Wellington for a week to visit the "corridors of power". During this segment members are able to study at first hand the machinery of government and political processes. This is effectively achieved through direct interviews with top government and private sector officials.

The Kellogg Rural Leadership course is open to all rural women and men aged between 25 and 45 years. It receives strong financial support from producer boards and other organisations. Approximately 20 participants are selected biennially from throughout New Zealand.

The current Kellogg programme course director is Dr Alistair McArthur of the Agricultural Economics Department at Lincoln University.

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Summary

The transfer and adoption of scientific information in New Zealand agriculture is below optimal levels. This is particularly so in regard to genetic improvements in the sheep industry.

The New Zealand sheep industry has experienced declining revenue versus expenditure ratios for two decades. Drastic changes in attitudes, policies and strategies will be required in all New Zealand pastoral industries during the next decade to reverse trends in declining commodity prices in real terms.

Changing farm practices involves changes in perceptions and attitudes. Many techniques are available to change agents to bring this about. To be successful a change agent requires strong interpersonal relationship skills. In the author's opinion the most important of these are to do with developing empathy with the client, active listening, avoiding creating a defensive environment, and encouraging a supportive environment.

The most useful means of communication between change agent and farmer involves a dynamic convergent process whereby the plans, messages and information are continuously being modified by both parties. This is not a traditional method of communication.

A number of historical and cultural factors are impeding the uptake of genetic improvement by the New Zealand farming communities.

Low levels of public and private research and development expenditure are likely to impair the advancement of New Zealand pastoral farming in the next few decades.

Most of the current production, efficiency and quality limiting problems in New Zealand agriculture are very specific to New Zealand conditions. It is unlikely that overseas research results can be successfully applied to solve these problems. New Zealand agriculture is desperately short of "wordsmiths" to translate and interpret research findings and make them relevant and meaningful to typical farmers.

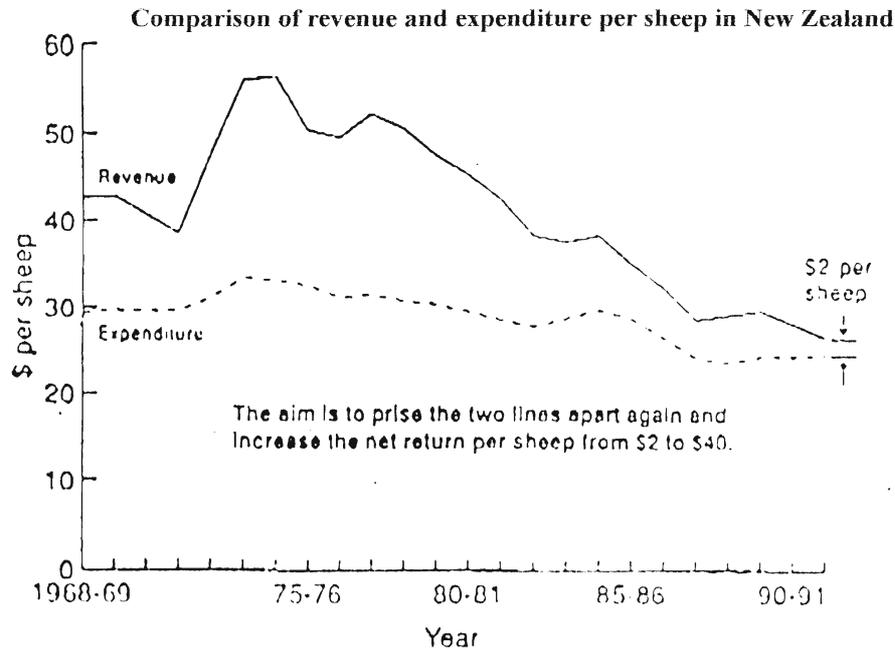
Introduction

New Zealand pastoral farming is in crisis. The crisis is not sudden. It has been developing insidiously for at least two decades. The essence of the crisis is economic.

It involves:-

- declining commodity (output) returns
- increasing input costs
- declining productivity.

Probably the most dramatic example of this is evident in the sheep industry.



The trends indicate a non-sustainable situation - unless there are dramatic changes.

"If New Zealand is to be a prosperous nation in the next century, broad-based, systemic change is required in:

- attitudes
- institutions
- policies
- strategies"

--- Porter Project Report.

The drastic changes that are required to retain the viability and regain the vitality of the New Zealand sheep industry (and other pastoral industries) will involve innovation and technology adoption on a huge scale.

As a veterinary scientist with a strong interest in genetic improvement and modern breeding methods, I consider that one of the most fruitful areas that can be altered is the innate productivity of the "average" animal within the national flocks. We have had the tools and knowledge of quantitative genetics for at least four decades now, but in that time the average carcass weight of lambs at slaughter has declined by 2.3kg. The national lambing percentage has increased by only two per cent. The average fleece weight for all breeds has increased by only 0.1kg. This pathetic record is despite huge advances in animal health and disease control, pasture management, new cultivar development, objective recording systems, breeding technology and massive expansion of agricultural scientific knowledge.

"We are sending messages to the planets, but are unable to send them to our farmers despite all the technology we have"

--- Dr Clive Dalton

As a recently appointed member of the Biological Sciences committee of the Foundation for Research Science and Technology - the body which administers the New Zealand Public Good Science Fund, I am acutely aware of the huge accumulating body of scientific information which could be used to advance agriculture in New Zealand. But currently there is an apparent void in the uptake and application of appropriate technology.

Consequently my main objective in this study has been to identify some of the features of innovation and technology adoption in New Zealand agriculture. With a better understanding of the "anatomy" of the process, hopefully we will be better able to devise ways of improving the technology transfer process in an extremely dynamic environment. Hopefully, too, it will help to facilitate the broad-based systemic change needed to restore New Zealand to prosperity.

This essay cum review is generally written from the perspective of the person hoping to promote the adoption of some new or more appropriate technology. I shall refer to this person as "the change agent".

The Information Gap

At the heart of any discussion on technology transfer in agriculture is the phenomenon known as the Information Gap.

This is the difference between the available information farmers need to be more profitable, productive, efficient or satisfied and the knowledge and information farmers actually have and use to those ends.

This gap has a number of components, the more important of which are shown in Figure.1

Fig 1 The Information Gap

Information Farmers Need

Research Gap

Synthesis / Interpretation Gap

Dissemination Gap

Reception Gap

Knowledge and information farmers have

I like to visualise the information gap as a braided Canterbury river bed with each of the components in the diagram representing a single stream. The relative importance and size of each will vary with time and situation. The main point of the analogy

though is that if one of the streams or gaps cannot be traversed then the total gap cannot be bridged and the information remains unexploited.

The Research Gap

This is often the easiest gap to define though filling it may be a different matter depending on the problem. It is simply the gap in fundamental knowledge about a process or phenomenon. The solution is to first define the problem then to expand the effort by establishing and conducting research programmes to answer the questions.

Synthesis/Interpretation gap

This arises when the necessary information is actually available but not integrated, analysed and interpreted in the context of the problem it is required to address.

Dissemination Gap

This is created by the situation where the relevant information is available, synthesised and integrated and is appropriate, but is not available to, or is not reaching the farmer. Potential solutions may involve altering the form in which the information is presented or the technique used for presenting or disseminating the material.

Reception Gap

This represents the barrier which arises when the relevant information is presented or made available to the farmer but he does not comprehend it fully.

An instinctive response of scientists when confronted with the reality that the message is not getting through is to carry out some more research on the subject.

Last year I came across this poem printed in **Farming Systems Support Project** Newsletter, vol 2, No.1. 1984. which provides a wry but very apt comment on this reflex.

Why Do Farmers Do What They Do?

Economists, agronomists, and planners of late
 Have discovered a new way to pontificate
 Beyond mere jargon, like "success enhancement",
 "Integrated development", "rural advancement"
 Working in all their infinite wisdom
 They're trying to define a "farming system"
 To answer the question for all of you
 "Why do farmers do what they do?"

At universities and experiment stations 'round the globe'
 In offices, labs, and on farms they probe,
 Through consultancy surveys in developing nations
 Upstream and downstream experimentations
 With yield rates, inputs and multiple regressions,
 Attempting to explain that profoundest of questions
 With the diverse hypotheses they each eschew
 On why farmers do what they do.

Variability and generalisation,
 Indigenous knowledge and maximisation,
 The issues discussed, the factors controlled,
 Computers click, theories unfold.
 Papers get published, conferences convened
 Projects are funded; it becomes obscene
 When predictably they conclude in the Final Review
 That a more generous grant might give them a clue
 As to why farmers do what they do.

Somewhere farmers plough and plant,
 Milk their cows, work and chant.
 After the interviews, trials and calculations,
 The experts retire to their research stations
 And the farmers continue to grow their corn,
 While old women die and children are born.
 The men swap stories and drink their brew,
 And they scratch their heads and wonder anew,
 "Why do scientists do what they do?"

Characteristics of change

Change is :

- *Inevitable*
- *Creates Problems*
- *Creates Opportunities*

Most of us are surrounded every day by a huge backlog of useful information that we have not yet put to profitable use in our lives. The most frequent reason for this delay is merely attitudinal. Instituting change is therefore mostly to do with changing attitudes and perceptions.

Six distinct steps are usually involved in the execution of change.

1. Perception

Change normally relies on a prior decision. This decision process begins with perception about an innovation. Both the innovation and the need must be perceived by the individual for eventual adoption to occur.

Perceptions of an innovation by an individual adopter change as he or she moves through the various stages of adoption. What is perceived as new in the early stages may be perceived as commonplace in the later stages and vv. These have important effects on individual behaviour.

2. Motivation

Motivation is an essential step to overcoming natural resistance to change. Behaviours and practices that are comfortable (habits) are normally resistant to change, as are those which represent the first successful attempt at solving a particular problem (primacy).

Individual perceptions of the existing need and the innovation must be such as to provide the impetus for further action, thus overcoming these and further resistances. The greater the sense of deprivation inherent in a felt, unmet need, the greater the propensity to seek a solution. For sustained motivation throughout the decision making process, there must also exist a belief that suitable solutions exist in the environment or that a particular innovation is a good candidate for solving a problem. The degree to which individuals feel they have control over those things that affect them appears to influence their motivation to search for or be open to ideas for change.

3. Attitude

This stage contains three components, cognitive, affective and behavioural. As the individual moves through this stage, he or she develops beliefs about the innovation based on information they have developed in social interactions, in reading advertisements, articles, published reports, etc. These are called peripheral beliefs and are based on information supplied by authorities considered trustworthy. These beliefs are subject to change if the authorities from which they are derived change position, or they may be replaced if more basic beliefs contradict the peripheral beliefs.

4. Legitimation

This occurs when the individual seeks reinforcement for an action being conceded. The appropriateness of the action is of prime importance.

5. Trial

In this stage the farmer will put the innovation to a personal test prior to complete acceptance. Occasionally the nature of the innovation or the situation may make personal testing impossible and the farmer will "try" the innovation through vicarious experience, with results similar to those of personal testing.

6. Evaluation

This is a necessary formal step between the trial and adoption stages.

Factors involved in the climate for change

Perceived Need for change	The extent to which an individual or group experiences a problem
Openness to change	The readiness to accept change
Potential for change	The capacity to accept and implement change
Perceived control over change	The extent to which the individual or group believes they have control over the process
Perceived need for change	The extent to which an individual or group accepts the need to implement of change
Commitment to change	The recognition of the importance of undertaking remedial action (social change) in response to a problem

Resistance and Barriers to Change

By definition any change involves an alteration in the status quo. So whenever change is attempted, resistance is likely to appear.

Resistance is often a healthy phenomenon particularly when the advocated change is harmful to the individual or to society. Resistance will often modify any change proposed. Resistance can be used very constructively by change agents. Especially it can provide an opportunity for insight into the various conditions that should be considered in selecting and shaping intervention strategies. Resistance can be defined as any conduct that serves to maintain the status quo in the face of pressure to alter the status quo. In many cases the same dimensions are involved in both hindering and facilitating change. An innovation which is incompatible with a particular norm may be adopted by one person as a symbol of defiance and rejected by the majority for fear of social disapproval. Similarly, the uniqueness of an innovation may be a cause of attraction for an innovative person and a cause of resistance for more conservative people.

Cultural Barriers to change

Cultural values and beliefs

This includes phenomenon such as achievement motivation, Religious ideologies and fatalism.

Cultural ethnocentrism

This relates to the change agent conveying a feeling of cultural superiority. It is also to do with different perceptions of the problem and hence different expectations of what the agreed change can achieve. It can be summed up as the "not invented here syndrome"

Saving Face

Social Barriers to change

Group solidarity.

Rejection of outsiders

Conformity to norms

Conflict

Group insight

Organisational barriers to change

Threat to power and influence.

This is important where change is proposed within an organisation which has a hierarchical structure.

Organisational structure

For change and innovation to succeed within an organisation, it is important that the structure of the organisation in terms of authority patterns, channels of communication, division of labour, rules and procedures, etc be compatible or supportive of the change.

Climate for change

The kind of climate for change that exists in an organisation has important implications for change and resistance to change.

Technological barriers

One very real source of resistance to change is the absence of the necessary technical human skills to implement the change adequately.

Psychological Barriers to change

Perception

Selective perception and retention may prevent a person from seeing that the status quo is inadequate. For various reasons a farmer may not "see" problems requiring significant change or not "see" solutions even if a problem is recognised. Often when data suggesting problems and indicating solutions are thrust on the farmer, the data may become distorted or even forgotten.

An important cause of resistance to change occurs when a change agent and a client agree on a problem but do not share common perceptions about its nature and causes and hence have different perceptions of how to remedy the problem.

Incomplete or inadequate information can initially result in adoption and, because of unexpected negative experiences, serve as a barrier to further change. In general the greater the unanticipated negative consequence relating to the innovation, the greater the resistance to subsequent similar changes.

Another source of resistance to change may occur when assistance is provided freely. Cost always has an impact on perceived quality. Something given freely is often perceived as valueless.

Homeostasis

All living organisms seek a balance between arousal and stimulation and then try to maintain that state. The point of balance varies considerably between different individuals. Many programmes or suggested changes involve levels of arousal and stimulation well above what is comfortable to the individual. In this situation it is natural to resist the change. Many factors account for homeostasis eg. reluctance to acknowledge having weaknesses or inadequacies, awkwardness and fear of failure associated with something new, bad experiences with past change efforts, and concern about possible loss of present satisfaction are some of these.

Conformity and commitment

Conformity is a major force working against change. People inherently need to be liked, feel correct and have a natural desire to participate in the results of achieving collective goals. Similarly, commitment is a powerful force working against change. Financial and social psychological investment in programs and practices help root people in the status quo, and very special efforts, often in the form of incentives, must be used to create alternative investments in the advocated change.

Professional training and the associated professional socialisation process and its attendant pressures for conformity and commitment is frequently a source of resistance to change.

Personality factors

Low empathetic ability, high dogmatism, inability to deal with abstractions, fatalism, and low achievement motivation are all personality factors which have been identified as significant barriers to innovation adoption. Lack of conceptual and enquiring skills may limit motivation and the ability to evaluate and alter behaviour. Related to this is the lack of creativity as a barrier to innovation. It is thought that the inability to tolerate ambiguity is a major cause of resistance to change. However personality variables tend to be very innovation specific.

Propensity to assume risk is a particularly important personal trait as well as a social system trait.

Other sources of resistance are: rejection through ignorance or default (knowledge of an innovation but no interest in it) erroneous logic (rational but unfounded reasons) and unsuccessful experience with change.

The Process of Technology Transfer

The process by which the information is used in decision-making is made up of a series of information gathering steps. It begins with knowledge or general awareness of the new idea, followed by steps when additional information is gathered and interest is developed to a point of the person persuading her or himself and others about the relative value of the idea. This is followed by a decision to try to see how it works on a small scale, then by an implementation stage if the decision is in favour of the new idea, then by a confirmation stage.

Information transfer usually begins where farmers are at in their own knowledge. The key is in communication via conversation. Useful knowledge is created by the joint action of both parties and encompasses both scientific and aesthetic judgements.

There are two models used to describe the communication process. For simplicity the first model is likened to the movement of signals along a wire. See Fig 1. over.

This traditional model of communication is linear in nature; a person with a new idea creates a message about it, and then chooses a channel, some sort of communication linkage, by which the message can be sent to a receiver, who is as yet unaware of the new idea. The linear notion of communication is based on the idea that information is a "thing" that can be carried or sent from one point to another. The receiver of information is characterised as an isolated person. There is feedback from the person who received the message to the person who sent it; new messages may be sent to correct or clarify the perception the receiver has of the original message. However, little or no reference is made to the context or situation within which the person receives the information and intends to use it. And there is no expectation that the person sending the message will alter his or her understanding of its contents. This model assumes one-way, largely authoritarian, persuasive or manipulative communication "down" through a system. It overlooks the assertion that a technology cannot be understood outside of the environment where it is to be used. The model indirectly suggests that the user of the information is alone responsible for adapting the technology to its new context.

Recently a new different approach has been suggested to interpret flow and use of information. See Figure 2. over.

This "convergence model" approach emphasises information exchange and relationships rather than individuals as the units of analysis. Information is shared by participants in order to reach a mutual understanding of the meaning of the information in the context of its use. From this perspective, communication is based on a collaborative relationship between the person with the information and the person

Fig. 1 — A Traditional Model of Communication (developed from Schramm, 1963)

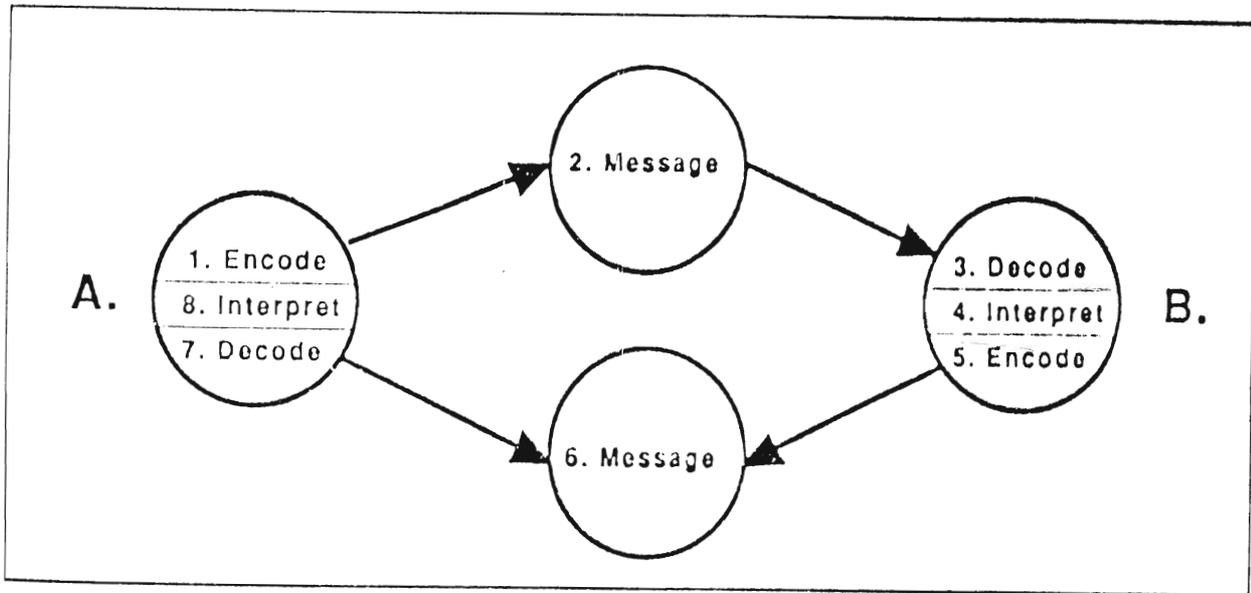
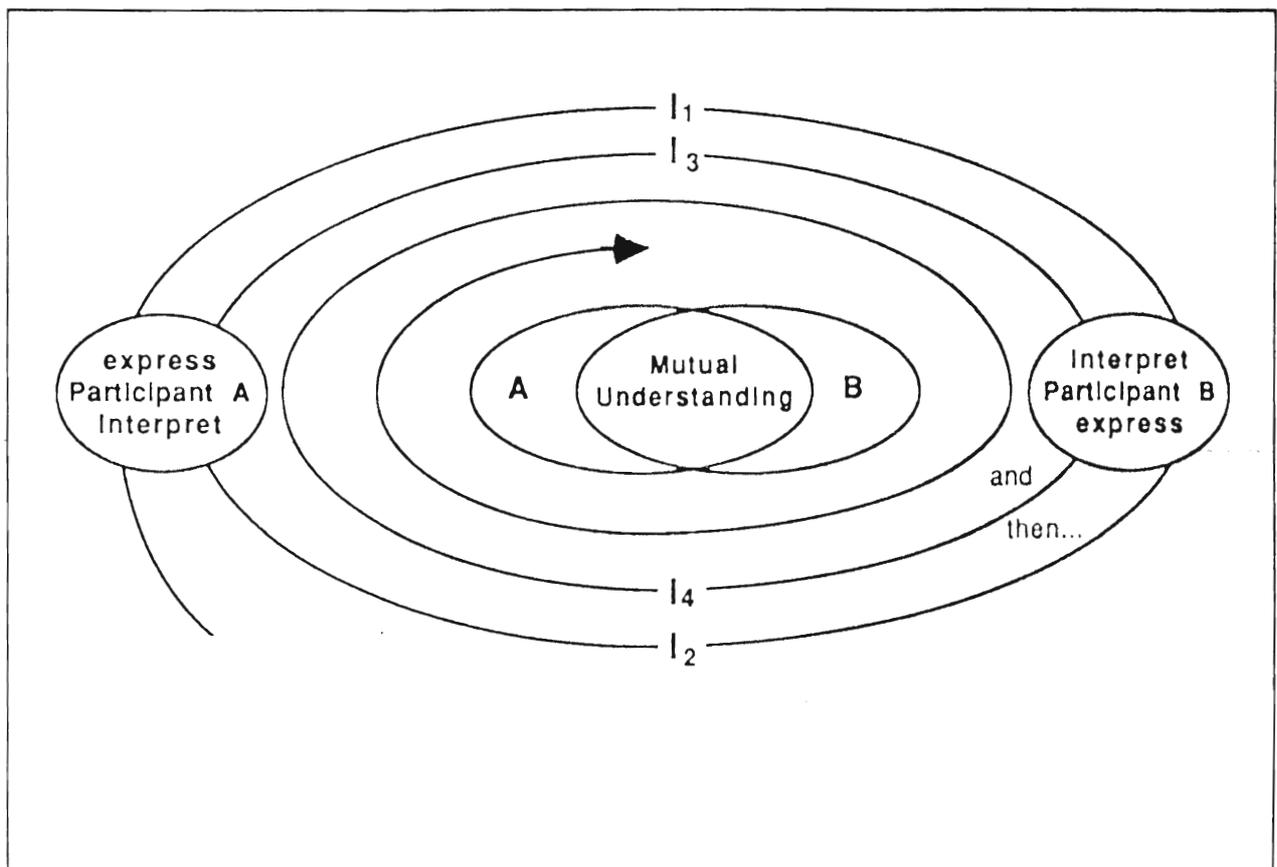


Fig. 2 — A Convergence Model of Communication (Rogers and Kincaid, 1981, p.65)



who needs it. This contrasts sharply with the dependency relationship between the sender and receiver of information that characterises the linear model.

The key features of the convergence model which make it more effective in communication are that it is:

1. cyclical (rather than linear)
2. focuses on the total context, not just the information to be communicated
3. considers the timing and presentation of the message as well as the message itself
4. works primarily toward mutual understanding, consensus and collective action, rather than persuasion
5. concentrates on how the message will affect relationships between people as opposed to its psychological effect on the individual
6. focuses on interactions of people who share a mutual interest in the information.

The two models are not alternatives of explaining the way farmers behave when acquiring and using new information. Each has its own value. Therefore one is not necessarily better than the other for explaining or planning communication. For example the linear model is likely to be the most desirable and efficient method of conveying information about the use of a new agrichemical or fertiliser or plant cultivar whereas the convergent model would be essential for finalising the details of a long term sheep cross breeding programme which was introducing some exotic genetics to the flock.

The convergence model requires that the change agent reconsider his or her role in the technology transfer process. The change agent is more than a disseminator of information, or a person who attempts to persuade a farmer to alter practices. He or she is also a translator of information with knowledge of both the scientific and the practical side of a problem or a solution to a problem. He or she also has knowledge of social networks, and how to bridge those networks to assist farmers to gain access to the information they need.

Furthermore, the change agent needs skill and sensitivity to interpret the principles underlying any given technology so that together with the farmer they can explore both the technology and the farmer's particular situation in order to determine how the former can be adapted to help achieve the farmer's objectives. The evidence indicates that this closer, more intensive relationship pays off in more effective adoption of new technology. The question may be whether or not extension workers and the organisations that employ them can accept that their role in today's information-laden world is not just as disseminators of information but also as translators and network linkers. These roles could include assisting farmers to formulate specific goals and objectives (which will, in turn, dictate the kind of information that may be required) as well as providing support through the entire technology transfer process.

Recognised methods of influencing human behaviour

Compulsion or coercion.

Power is exerted by an authority, forcing somebody to do something. The person applying coercive power requires the following conditions:

- * he must have sufficient power;
- * he must know how he can achieve his goals; and
- * he must be able to check whether the person being coerced is behaving in the desired manner.

Application of coercive power means that the person applying the power is responsible for the behaviour of the person he is trying to change. It is possible to achieve behaviour change with a large number of people in a relatively short time using this method.

However, it can be very expensive to maintain and control, and the people being coerced may not always behave as required. The method is unsuitable for changing behaviour that requires initiative by the people being coerced. Extension may be essential to make the sanctions known, and to try to persuade the people being coerced to follow regulations of their own free will. Many government regulations and laws relating to public health, traffic control, etc. are of this type. Dairy inspectors sometimes have to coerce dairy farmers to follow more hygienic practices in their milking sheds, using regulations and the threat of fines and other sanctions to achieve their goals.

Exchange

Goods or services are exchanged between two individuals or groups. The conditions necessary for applying this method are that:

- * each party in the exchange process considers the transaction to be in their favour;
- * each has the goods or services desired by the other; and
- * each can only deliver his part when the exchange goods or services have been delivered by the other, or he can trust that this will be done.

Exchange is often a very efficient method for meeting the needs and interests of different groups, parties or individuals. However, it is not always efficient or fair. Sometimes the other party is inclined to deliver as little as possible of the expected exchange. We see this situation in industrial negotiations between employers and employees, and in trade negotiations between peasant farmers and city merchants. Extension can play a useful role by drawing the attention of a potentially disadvantaged partner in an exchange to ways of preventing the other partner from gaining an unfair advantage. For example, farmers in a remote part of a developing country can be given information about the prices paid for the produce in urban markets. They can also be given advice about ways of ensuring fair and legal trading arrangements with their urban-based trading partners.

Advice

Advice is given on which solution to choose for a certain problem. We can use this method if:

- * the farmer agrees with us about the nature of his problem and the criteria for choosing a 'correct' solution;
 - * we know enough about the farmer's situation and have adequate information to solve his problem in a way that has been tested scientifically or in practice;
 - * the farmer is confident that we can and will help him with a solution to his problem;
 - * we don't think it necessary or possible for the farmer to solve the problem himself;
- and
- * the farmer has sufficient means at his disposal to carry out the advice.

The change agent is responsible for the quality of her advice. While the change agent's specialised knowledge may be put to good use, there is usually little development of the farmer's capacity to solve his own problems. Doctor-patient relationships and many advisory situations between extension agents and farmers are good examples of this method.

Openly influencing a farmer's knowledge level and attitudes.

This method may be applied when:

- * we believe the farmer cannot solve his own problem because he has insufficient or incorrect knowledge, and/or because his attitudes do not match his goals;
- * we consider the farmer can solve his own problems if he has more knowledge or has changed his attitudes;
- * we are prepared to help the farmer collect more and better knowledge to help him change his attitudes;
- * the farmer trusts our expertise and motives, and is prepared to cooperate with us in our task of changing his knowledge or attitudes.

It is possible to achieve long-term behavioural change using this method. The farmer's self-confidence and capacity to solve other similar problems in the future by himself is increased. It is a labour intensive method which is often used in extension and education programmes.

It is also possible to try to influence only knowledge level or only attitudes. Most of the conditions mentioned remain valid in both cases.

Manipulation

This involves influencing the farmer's knowledge level and attitudes without the farmer being aware. Conditions using this method are:

- * we must believe it is necessary and desirable for the farmer to change his behaviour in a certain direction;
- * we think it is unnecessary or undesirable for him to make independent decisions;
- * we control the techniques to influence farmers without them being aware of it; and
- * the farmers do not actively object to being influenced in this way.

In this situation the change agent bears responsibility for the consequences of her actions. At times she may have her own interests in mind, as we find in many commercial advertising campaigns and in political propaganda., it is possible to have the best interests of the farmer in mind, as we find in many government-sponsored health and safety campaigns. Dangerous chemicals are widely used in agriculture to control plant diseases and insect pests. Most farmers would agree it is in their best interests if extension agents influence them to use these chemicals safely and correctly.

Extension also has an important role to play in making farmers aware of subtle or hidden attempts to influence them made by people who stand to gain financially. For this reason we see reports published on official and impartial tests of tractor and farm machinery performance. Farmers can then check these performances against the claims made by the manufacturers in their advertising campaigns.

The methods detailed so far are directed at influencing the farmer himself. Important changes can often be achieved by directing influence at the farmer's situation. The following methods are examples of changes to the farmer's situation.

Providing means

We can apply this method under the following conditions:

- * the farmer is trying to achieve certain goals which we consider to be appropriate;
- * the farmer does not have the means available to achieve these goals, or he does not wish to risk using these means and
- * we have these means and are prepared to make them available to the farmer on a temporary or permanent basis.

Specific means in agriculture have historically included short- and long-term credit for the purchase of land or inputs such as fertiliser, certified seed, sprays and building materials, farm machinery and earth-moving equipment, production subsidies, and so on. Correct and timely application of these means, which are usually financed by public funds, have in the past generated large rises in individual farmers' incomes. While this may help distribute wealth more widely among the population it may also concentrate the wealth among those with the greatest power or influence in obtaining the means. Costs of providing the means have been attempted to be recovered through higher taxes on the increased incomes, although there is also the danger that loans and other means will not be repaid or replaced in full, thus making them an expensive form of influence if not carefully controlled and supervised. The 'providing means'

approach has been seen by some as a temporary measure to stimulate farmers to try an innovation. Given the experiences of the last decade its success is probably arguable. Most of New Zealand's agricultural competitors however still employ this method.

Government departments, including the extension service have used this method for making financial and physical means available. Even if the extension service is not directly involved in distributing credit and inputs, it has an important role to play in drawing farmers' attention to the availability of these means for improving their situation. Change agents have previously helped farmers to apply for subsidies, credit, etc. and assist them in making decisions regarding when to use these means.

It is unlikely that we will see the "providing means" system of inducing change in New Zealand for some decades to come.

Providing service

This involves taking over certain tasks from the farmer. The method can be used if:

- * we have the knowledge and/or means available to perform the task better or more economically than the farmer;
- * we agree with the farmer that it is useful to perform these tasks; and
- * we are prepared to perform them for him.

Changing the farmer's social and/or economic structure

Methods for changing the socio-economic structure in rural areas may be important means of influence when:

- * we agree with the farmer about his optimal behaviour;
- * the farmer is not in a position to behave in this way because of barriers in the economic and/or social structure;
- * we consider changes in this structure to be desirable;
- * we have the freedom to work towards these changes; and
- * we are in a position to do this, either through power or by conviction.

Attempts to change social structure will usually be opposed by some individuals or groups, especially when they think these changes will lead to them losing power or income. Farmers who join together in an association may have sufficient power to overcome this type of resistance.

Methods of influence vary according to the degree of harmony or conflict of interest between those who influence and those who are influenced, the extent to which both parties are aware of any conflict of interest, and the amount of power each possesses. It is important for the farmer and the change agent to be aware of their common interests in an extension topic. Each depends on the other, with a change by either one possibly destroying a mutually beneficial relationship. It is usually easier for the farmer to break this relationship as he is not constrained by the same ethical considerations as the extension agent.

Empathy, active listening and the implications of defensive communication

I believe that the weakest links in the area of information transfer in New Zealand agriculture is in the area of sociological aspects of decision making.

To quote Clive Dalton again:

"The real problem is that we technocrats don't seem to be able to put ourselves in clients' shoes."

This breaches one of the most basic tenets of marketing. Successfully putting ourselves in the client's shoes involves huge doses of empathy and accurate perceptions of the situation.

Social Perception

(Information in this section is largely drawn from an essay in *California Management review* by Massarik and Wechsler)

Social perception plays an all pervasive role in our lives. Forming impressions of people is a part of our daily experience, yet very few of us are aware of the complexity of the process. Most people are convinced that they can judge people in a dispassionate objective manner. However, whenever there is interpersonal contact a range of impressions is formed which influence subsequent behaviour.

Social perception is the means by which people form impressions of and understand each other. Empathy or social sensitivity is the extent to which they succeed in developing accurate impressions or understanding.

Social perception is not always rational or conscious. Therefore empathy is not necessarily the result of conscious rational effort.

In the context of technology transfer there are three basic components to social perception:

1. the perceiver - the person who is "looking" and attempting to understand;
2. the perceived - the person who is being "looked at" or understood
3. the situation - the total setting of social and non-social forces within which the act of "social perception" is lodged.

Cues in the perception process

Cues are often direct through words, gestures, facial expressions and specific behavioural acts. They are transmitted to the perceiver directly by the perceived both consciously and unconsciously. Cues can also be indirect, eg. via gossip, overheard comments or incongruous actions.

The perceiver's background can have a major effect on the outcome of a perception forming. The demographic characteristics such as age, religion, sex, occupation and economic level tend to be specific and easily definable. Their influence on social perceptual skill can be quite variable, eg. ability to judge emotional expression in

others increases with age in children, but does not increase further in adulthood. Some highly (now) contentious research review work by Taft concluded that sex differences in empathy are minimal though there appears to be a slight edge in favour of women. Personality characteristics tend to have much more influence on empathy. The link between emotional adjustment and empathy is substantial. Emotional adjustment hinges primarily on self concept. Self concept consists of (a) publicly held attitudes; (b) privately held attitudes and (c) subconscious and unconscious attitudes - the feelings about who we are, what we are that we cannot face up to.

Barriers and aids to empathy

Individuals who have resolved most of their internal conflicts are in a better position to direct their energies at all levels. The healthy personality has fundamental self-acceptance at all levels - public to unconscious. This relies on an openness to experience, a willingness to respond realistically to relevant cues - a lack of dogmatism and a capacity for dealing with the world flexibly and dynamically. Individuals under pressure or in a state of anxiety are less likely to perceive the motives and actions of others accurately. Human relations judgements can only be accurately made when we are in a state of fair give and take balance between ourselves and the world.

Ironically, however, "perfect" psychological equilibrium will not result in absolutely accurate social perceptions. In order to understand others some motivating or driving force must exist. This implies a problem with the existence of some tensions within the perceiver. In a tensionless state - a hypothetical state of perfect adjustment there can be no reason to care about understanding anything or anybody. As a result there would be little meaningful social perception or social interaction. Excess tension reduces empathy but insufficient tension induces apathy.

The only available tool to understand others is our own personality. The cues we receive from the outside must be processed through the perceptual equipment that is us as communicators and change agents. To be successful in assessing the meaning of cues that impinge on us we must be aware of the distortions that may be introduced by our "built in" perceptual equipment.

It seems that we must adopt a more realistic view of our perceptual limitations, eg. if we are aware that a person who appears to be weak or submissive makes us irrationally angry then we should try to develop safeguards against our own unreasonable anger and ultimately gain a more realistic understanding of the motivations of the other person.

Unfortunately many factors militate against self insight. Psychological defences are the most significant of these. These are systematically and unconsciously used to protect ourselves from facing real or imagined threats to our personal security. These protective distortions which frequently concern our perceptions of others help us to make reality more palatable. No human is without some pattern of psychological

defences. The cost of excessive use of these defences is the progressive removal from reality. Some degree of self-delusion is, however, essential for every day adjustments. The defences we continually use seduce us into various states of unreality. They make us see that which is not there and hide that which might be apparent. One personal defence which seriously affects empathy is authoritarianism. This causes rigidity in perception and intolerance of ambiguity. In this context there is no room for gradations - things are clearly good or abominably bad, people friendly or hostile. The problem is a difficulty in recognising subtle differences in interpersonal phenomena.

Extreme non-authoritarian personalities also encounter difficulties in understanding others. Attitudes serve as the organising forces that give order to the complex chaos of signals and give meaning to what we are prepared to see and hear.

Stereo typing can have different effects on accurate social perception. If a given stereotype is an inaccurate perception of a group then it will be a barrier to empathy. However, broad and flexible generalisations are also essential. These are in essence "accurate stereotypes" and may increase the odds for accuracy in perception because of the additional volume of information they instantly carry.

Understanding people involves relative probabilities of being correct. Changing circumstances will provide a constant flow of new information which may help to alter perceptions.

The grave danger in this whole process is fossilisation - the irrational hardening of perceptions.

Link between perceiver and perceived

The personality of the perceived has a major effect on the accuracy of social perception. Communication between perceiver and perceived involves sampling of small units of behaviour that come from the perceived. Thus the communication model used (linear or convergent referred to previously) can determine how distorted the perception becomes. It is therefore vital that the perceiver elicits cues from the perceived which will do the most to reveal on a sample basis the relevant aspects of the perceived's feelings, thoughts and potential behaviour. This ability to break through a person's veneer has two facets -

- 1) the perceiver's skill in facilitating the sending of cues by the perceived, and
- 2) the perceiver's skill in picking up and interpreting properly the cues that have been sent.

The situation

Regardless of the specific situation in which perception takes place some positive feelings of varying intensity will be exchanged between perceiver and perceived - these set up halos which reduce the accuracy of empathic judgements and they prevent accurate assessments of less desirable characteristics of behaviour. Inversely,

pervasive hostility and prejudice also obliterate any chance for a realistic appraisal of people's positive characteristics.

The relative stress with which people relate to one another also influences their ultimate empathy toward each other. Superiors may find it easy to assess the feelings and attitudes of subordinates. But the anxieties of subordinates may obscure the perceptions of the intent and attitudes of superiors. Most accurate social perceptions occur under conditions without changed feelings. "Seeing red" in anger and "love is blind" when infatuated are classic examples of the effect of strong emotions on social perception.

In summary, the key points a change agent should bear in mind when dealing with clients are:

- 1) Knowing oneself makes it easier to see others accurately;
- 2) One's own characteristics affect the characteristics you are likely to see in others;
- 3) The person who accepts himself is more likely to be able to see favourable aspects of other people.
- 4) Accuracy in perceiving others is not a single skill.

Active listening

Running parallel with considerations of empathy and perception is the topic of active listening. I regard this as one of the most under rated components of interpersonal communication. In the agricultural extension scientist /adviser /farmer situation it is easily the most neglected and most poorly developed skill.

To be effective, active listening must be firmly grounded in the basic attitudes of the user. It is useless unless fundamental attitudes are completely sympathetic with the concept.

Active listening is known to be an important way to bring about changes in people. Compelling research evidence has shown that sensitive listening is a most effective agent for individual personality change and group development. People who have been actively listened to become more emotionally mature, more open to their experiences, less defensive, more democratic and less authoritarian.

When people are listened to sensitively they tend to listen to themselves with more care and make clear exactly what they are feeling and thinking.

Not the least important result of listening is the change within the listener himself. Listening provides more information about a person or people than any other activity. It also builds deep positive relationships and tends to alter constructively the attitudes of the listener. I believe that active listening is probably the most poorly taught subject in our education system and consequently one of the most poorly understood skills in the agricultural extension process.

In the course of my literature review I encountered a chapter on the subject of active listening by Rogers and Farson in the text, "Organisational Psychology," ed. Kolb, Rubin and McIntyre. Because I believe this topic is vitally important in regard to technology adoption the section on the mechanics of active listening is reprinted verbatim as appendix 1.

Defensive communication

All approaches to influence people and to alter behaviour, eg. to encourage a farmer to adopt a new concept, rely on some kind of communication between the people involved.

The words used and the way they are used affect the climate of a communication as well as longer relationships between the parties. The messages and signals can generate either a defensive or supportive climate.

If a defensive climate develops the change target is likely to feel threatened and consequently will either attack, attempt to withdraw from the situation and will invariably fail to comprehend the message accurately. Conversely if a supportive climate is created a much more accurate and full exchange of information is likely.

It is generally much easier to create a defensive climate than a supportive one. Reliable methods of creating an undesirable defensive environment involve:- (a) ensuring that the listener sees the change agent as an evaluator attempting to control his actions, (b) communicating a feeling of superiority in the relationship, (c) being impersonal, (d) providing the impression that the communication has been strategically planned in advance.

In contrast creating a supportive climate involves personal direct communication, description rather than evaluation, spontaneous rather than strategic behaviour, empathy rather than neutral attitudes and demonstration of openness rather than convinced certainty.

A short article on defensive communication by Jack Gibb is reprinted from the Journal of Communication as appendix 2.

The Application of Agricultural Research Findings

The application of most agricultural research results must depend on biological, managerial, economic or other variables which are probably unknown to most research scientists, and to many extension workers. Economic decision making is only one of several parts of application of research results. Specialists such as systems analysts, working with engineers, management experts, economists and sociologists, are needed to bridge the information gap. It is not simply a matter of communicating the result, but of investigating the implications of, and adapting, a suggested practice to the farm as a whole, including the farmer.

Systems analysis will not produce good plans from bad data. Neither is good extension of unsound advice very productive.

The components of a system of agricultural research and its application might include the following processes.:

1. Identification of a problem or potential improvement.
2. Investigation by survey, experiment, or other research technique.

3. Correlation of results with possible or existing whole farm situations, to identify biological, managerial, economic, or social limitations or possibilities.
4. Adaptation to by pass or overcome limitations, possibly involving further investigation.
5. Communication of results to potential users, perhaps with advice on whole farm implications.
6. Integration by the farmer into his whole farm operation.
7. Evaluation on the farm, with identification and feed back of new limitations of research. This may start another cycle, or other cycles. Agricultural research in New Zealand generally occupies itself with (2). and to some extent with (1).
Extension is generally concerned with (5). at a declining level. The other parts of the cycle are largely left to the farmer and his advisers. Often stages (3) & (4) are overlooked and stage (6) is a matter of trial and error. Seldom is there an adequate level of feed back from farm to the researcher.

Links between risk exposure and innovation

Dr Sandra Martin of the Department of Farm Business Management at Lincoln University has been conducting surveys on farmers ' exposure to financial risks. Though the research was not designed to relate any trends to innovation per se she was able to form some impressions of a general nature on this subject.

For farmers at differing levels of risk she found the following trends:

1) High risk exposure farmers fell into two categories:- (a) either they were very cautious and would not try anything new for fear of adding to their risk burden, or (b) they were behaving very impulsively by grasping at anything new on the assumption that they were in so much trouble that a bit more risk in the form of a new enterprise or technology could not make things worse and might help. Their decisions were seldom rational.

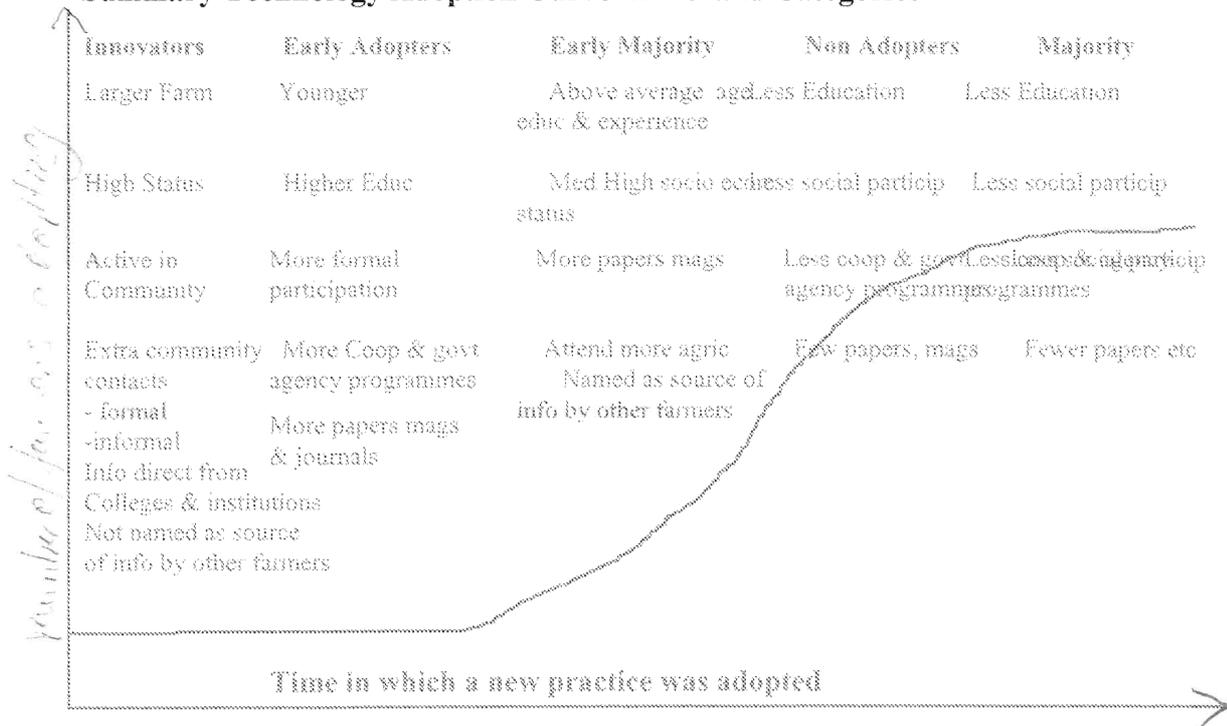
2) For farmers with only moderate risk exposure she found that no clear relationship exists between receptivity and risk. There tended to be a relationship between attitude risk (as opposed to exposure risk) and adoption. More entrepreneurial farmers seemed to find out as much as they could about an innovation and if they felt it was appropriate for their situation they would adopt it without waiting for others to do so first. Although it would appear to outsiders that they were taking big risks because they were doing something new, the risk to them did not appear to be as great as might be perceived because of the way they had used information to reduce the risk of a poor outcome from their decision.

She also believes that different farmers have different attitudes to risk from different sources, eg. a farmer may be very happy operating in the production domain, but very hesitant about operating off farm, eg. marketing or financial. Because of this on farm confidence, on farm adoption of technology could be quite rapid if it was thought to be appropriate.

A model for the uptake of innovation by farmers

In 1970 Southland farm adviser E. Delahunty proposed a hypothetical adoption versus time curve for various categories of farmers which he described. He proposed that the diffusion process begins with the new idea being tried by an innovator or by an early adopter, then by the early majority of the population, the late majority, and finally by the laggards. These categories are based on the relative speed with which new ideas are accepted. The innovators tend to be venturesome, early adopters as the more highly educated leaders in their communities, early majority as deliberate, late majority as sceptical, and laggards as traditional localites.

Summary Technology Adoption Curve Time and Categories



Obviously this is a rather simplistic description and there are many exceptions. However it does indicate the most fruitful areas to target a programme to introduce new technology to a community.

Innovation studies in NZ

The NZ innovation project was formed two years ago at Victoria University Wellington by Dr Dai Gilbertson in the Management and Commerce department. Though not concerned directly with innovation in agriculture the study identified nine key barriers to innovation in New Zealand.

- low incentives for idea champions
- creative people are squashed and controlled
- top management are short - term orientated
- accountants and lawyers have too much influence in management
- high personal risk if the innovation fails
- limited incentives for organisational entrepreneurs
- problem of institutionalising attitude change
- decision - making is too centralised
- a reluctance to invest in "problem oriented training" as opposed to courses

The project conducted case studies of a number of innovative and successful companies. They identified the following common threads in successful innovative NZ organisations.

- they are led by people who have a passion and vision for their innovation
- they lead from the front as opposed to administering and managing from an office on "walnut row"
- they have wide experience of jobs at various levels
- they have travelled overseas or have perspective on cultural issues
- they have very explicit values - one in particular - that innovation and profit comes from people not structure
- they tend to have well developed processes which enhance innovation in their organisations

One of the main conclusions of their study is that the essential component for organisations and individuals to be innovative is an "enabling culture". This should be seen as a pervasive attitude of mind or a leadership style which creates the culture where making and letting ideas happen is the key phrase.

They also found that a major hindrance to progress and development in New Zealand was the common misconception that innovation needs to be " high tech", very expensive, to do with scientists and predominantly for large organisations. The unfortunate sequel to these false beliefs is that innovation is remote from and beyond the reach and realm of ordinary New Zealanders.

Quotations related to innovation and technology adoption

In the course of reading during the preparation of this report I came across a number of quotes which distil considerable thought and reflection in the space of a few lines. This section includes a few of them.

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"He who would do good to another must do it in minute particulars. General good is the plea of the scoundrel, hypocrite and flatterer"

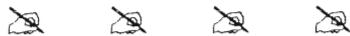
----William Blake



*"There are one hundred ways to get a farmer to change.
One of them involves paying him more.
The other ninety nine don't work."
--- Derek Daniel*



*Failure to use the results of research means either:
(a) the research is irrelevant
(b) the extension is inadequate*



" The most obvious way to look at a problem may not be the best way."



Great spirits have always encountered violent opposition from mediocre minds.

--- Einstein

er er er er er

*Telling does not equate with teaching.
- Getting told doesn't equate with learning.*

no no no no

Incompetence is the only human resource in abundant never failing supply.

hourglass hourglass hourglass hourglass hourglass

The study of innovation is highly fragmented. It has not been adopted by any discipline as its own and is in need of integration both with theory and other fields of study. A wider more holistic appreciation is required of the phenomena involved. Innovation should be seen as a dynamic process with more emphasis on technology push rather than demand pull.

sun sun sun sun sun

Few knowledge based innovations this century have benefited humanity more than the hybridisation of seeds and livestock.

snake snake snake snake

To be successful a knowledge based innovation has to be "ripe". ie there has to be receptivity. This risk is inherent in knowledge based innovations and is a function of their unique power.

--- Drucker

& & &

*The adoption process is not a single act or moment of inspiration
but always a pattern of well defined mental processes
involving six stages.*

- Awareness
- Interest
- Evaluation
- Trial
- Adoption
- Continued use



*"Much of the technology offered to farmers is cold technology. It is not of immediate
use or certain value. Farmers are unable to assess its value until it has been tried."*

--- Pete Hodgson



*Defending yesterday (ie not innovating) is far more
risky than "making tomorrow"*

--- Drucker
x↗ x↗ x↗ x↗

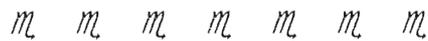
*"Extension is not simply a matter of communicating the results of research but
of investigating the implications of and adapting a suggested practice to the
farm as a whole, including the farmer"*

-- Prof Fred Morley



We have designed spaceships for farmers who really only want motorbikes

---- Clive Dalton



*The use of research results by the majority of NZ farmers
does not provide any ground for complacency.*



Change is:

- * Inevitable**
- * Creates Problems**
- * Creates Opportunities**

γ γ γ γ γ γ γ

Livestock breeding proceeds largely as if quantitative genetics is as yet undiscovered

---- Prof Fred Morley



Knowledge based innovations have the longest lead time of all innovations

* * * * *

*"If data is processed it becomes information;
if information is studied it becomes knowledge;
if knowledge is reflected upon it becomes wisdom.
In its broadest sense information technology
concerns itself with all of those steps."*

---Pete Hodgson



"The trouble with specialisation is that while it increases knowledge, it does not necessarily increase understanding. While it increases knowledge it also fragments it. Knowledge tends to be possessed by the specialists and guarded rather jealously. The knowledge of the specialist tends to be valued in relation to immediate applicability in narrow areas. Knowledge pertaining to ultimate effects on the whole of what we do as a land based community tends to be devalued.

Progress and Efficiency are key words in the world of a specialist.

"Progress" tends to be seen as going in a straight line. This denies the naturalness of cycles in seasons and generations and people which we understand so well in farming. When the inevitable period of decline comes along, the worshippers of the linear progress search for someone to blame. When things are on the up and up they project that trend into infinity. We only need to look at the story of central power in direction of the sheep industry over the last 30 years to see that. "Progress" in this expression means conquest of people and land and technology rather than working with them. It involves training as distinct from education, extension as distinct from communication. It idolises whatever's new and brassy, devalues the processes of renewal which lie at the heart of any farming system.

"Efficiency", doesn't ask what you can do well, but what you can do fast and cheap. This concept of efficiency seldom looks far ahead or far to the side. In New Zealand farming it has been imposed too often as piecemeal solutions to highly complex human and biological problems. The specialist who talks of efficiency is, therefore, not necessarily talking of any such thing. The people at both the beginning and the end of the market pipeline tend to be thought of in terms of the "great unwashed" - objects to be manipulated, rather than essential partners to be linked."

----- Boyd Wilson - former editor NZ Farmer



Some personal views and issues

This short section lists a few rather random thoughts and ideas which I personally believe are related to the problems and difficulties and sub optimal levels of innovation and technology adoption in New Zealand Agriculture.

Compartmentalisation of subjects within the education system

New Zealand's primary education system and teaching methods and general curriculum are internationally very highly regarded. However, I believe that we could be missing out badly on considerable innate creativity from within the population simply because the essential ingredients and skills and attitudes are not adequately developed in our school pupils and students. This relates to some of the research and writings of Witkin who coined the terms *field dependent* and *field independent* to describe the poles of a continuum that describes the extent to which people can make sense of ideas in isolation to the wider context in which the ideas fit. A field dependent person operates in a holistic fashion, requiring ideas to be in context to fully appreciate them. In contrast someone who operates in a relatively field independent fashion can address ideas in isolation. They can take ideas and structure them into an appropriate form to give them meaning. Most creative and innovative people tend to have a more holistic perspective of issues than less creative persons.

In relation to schooling, separating ideas into disjoint subject areas (ie compartmentalising knowledge) can work against the field dependent student who is most comfortable dealing with ideas in a holistic fashion.

The increasing levels of specialisation at university can only exacerbate this situation. It is interesting to note that the national public good science fund from which all state financed research is supported has forty discrete output or subject areas. Currently there is minimal opportunity to conduct research across outputs. Many of the emerging problems in New Zealand agriculture which require research effort to overcome tend to be complex requiring a multi disciplinary approach. eg land degradation, rabbit and hieraceum in the South Island high country. Clearly effective solutions will be much more evasive and unlikely when a fragmented approach is adopted.

Declining Farmer Audience to National Rural Radio Programmes

New Zealand national rural radio programmes are among the best in the world. They are extremely useful in heightening farmers' awareness of new developments in technology and management practices. However recent audience survey information indicates a significant drop off in farmer listeners to the three regular programmes. No follow up data is available to pinpoint the reason for this. However it is believed that the proliferation of private muzak type radio stations since the deregulation of broadcasting by the last labour government has affected farmer loyalties to the National Programme. It is interesting to note that currently the majority of listeners to the National Rural Programmes are in fact urban based.

A & P Shows

Local Agricultural and Pastoral Association shows are a national institution. They are often a central activity in many rural communities. They have an extremely valuable social and commercial function. In many districts they have been held annually for more than a century. However the stock judging function of shows for which they were originally instituted before quantitative genetics was invented are in my opinion an annoying impediment to genetic progress in production animals. They are responsible for the slow adoption of objective evaluation and selection procedures.

Nearly all of the classes in the shows are judged by highly subjective criteria which are almost totally irrelevant to the production related characteristics and traits of the various breeds. The problem is exacerbated when show results are used to advertise or promote the stock for sale from "successful" exhibitor flocks.

In our current pastoral farming environment, the performance or characteristics of a single individual animal are largely meaningless. Most animals prepared and presented in A & P shows tend to be reared and kept under nutritional and environmental conditions which bear no relationship to commercial farming.

There has been strong resistance to introducing objective performance related criteria into these competitions. Even in the area of fleece judging where rapid objective metrology techniques are available, the allocation of points bears very little relation to the intrinsic value of the fleece in the processing context.

Preoccupation with pedigree and registration by seed stock producers

Linked to the A & P show comments is the "stud" culture which is a feature of sheep and to a lessening extent beef cattle seed stock industries in New Zealand. Again this results in a low emphasis on productivity traits, leads to only limited selection for adaptability and fitness traits. The most deleterious effect is that a vast resource of superior genetic material within commercial flocks is largely untapped.

Undue influence in farm decision making by accountants

It is almost a reflex response by many farmers to refer any new issue to their accountant before making a decision. Very few accountants have any understanding of the complexity of modern farming systems and consequently they tend to give fairly guarded responses to innovative ideas. When it comes to changes in long term animal breeding strategies, they have no expertise at all but are still frequently asked for and actually supply advice. One reason for this dilemma is that many veterinarians and geneticists who should be giving this advice are not adequately skilled in the economic consequences of their proposals.

Bad experiences with "Gee Whizz" high tech procedures

In the last decade many New Zealand farmers have blown huge sums of money on technology which was not appropriate for their situation. One of the main reasons for this has been that many of the suppliers have become more obsessed with the features of technology itself and are not particularly concerned with cost effectiveness considerations. The high tech efforts during the goat boom and the current preoccupation with exotic sheep and highly dubious ventures such as the Wagyu cattle breed are good examples. The end result is that the promised benefits seldom eventuate and neighbouring farmers become rightfully cynical about any new development. Ironically huge productivity gains are available and largely going to waste currently from very simple low cost procedures such as hogget fleece weighing, decreasing the ram to ewe mating ratios, libido testing of bulls, reducing generation intervals etc. The perception is that these are costly, high tech and might expose the farmer to ridicule.

General lassitude caused by the depressed economy

The current depressed rural economy appears to be exerting a stifling influence on farmers willingness to adopt new ideas or to fine tune their operations to improve their situations. This relates in some degree to the prevailing commodity market uncertainties as well as financial failure of a number of leading New Zealand farm innovators following the events of the 1987 share market crash. Previously there was a reasonably widely held attitude "that if you didn't stick your neck out you would never progress very far" that has now reverted to "you are unlikely to progress very far if you do". Unfortunately these sort of attitudes usually take in the order of a human generation to work their way out of the system and rural psyche.

Archaic commodity marketing systems

Linked to this concept of "general lassitude" is the accurate perception that farmers are not being adequately remunerated for their produce and work. The wool marketing system dinosaur especially is notorious in regard to its volatility and almost complete lack of accurate signals to producers to reward quality parameters appropriately. The problems (and potential solutions) have been clearly identified and defined in the last few decades but the general inertia of the industry appears to preclude significant changes even in the face of a crisis. The New Zealand wool industry appears to be suffering from a dynamism bypass.

Highly volatile current farming climate

Currently there is huge, almost unprecedented uncertainty and flux in the New Zealand farming environment. Farmers are perpetually reminded of a vast raft of issues which have not been resolved and which can potentially have dramatic influence on their future fortunes. Future of GATT, Waitangi tribunal land claims, sustainability issues, resource management act, land degradation, the viability of the wool industry, pastoral lease tenures, rabbit, possum and pest control, bovine tuberculosis spread and the restructuring of CRIs and changes to research funding are just a few of these. Given this uncertainty, research information which could be quite relevant today, might be totally irrelevant and useless tomorrow. These factors are strongly influencing the uptake of available technology currently. There is a major danger that this will become a mindset when some of the major uncertainties have eventually dissipated.

Research and Development expenditure - public and private

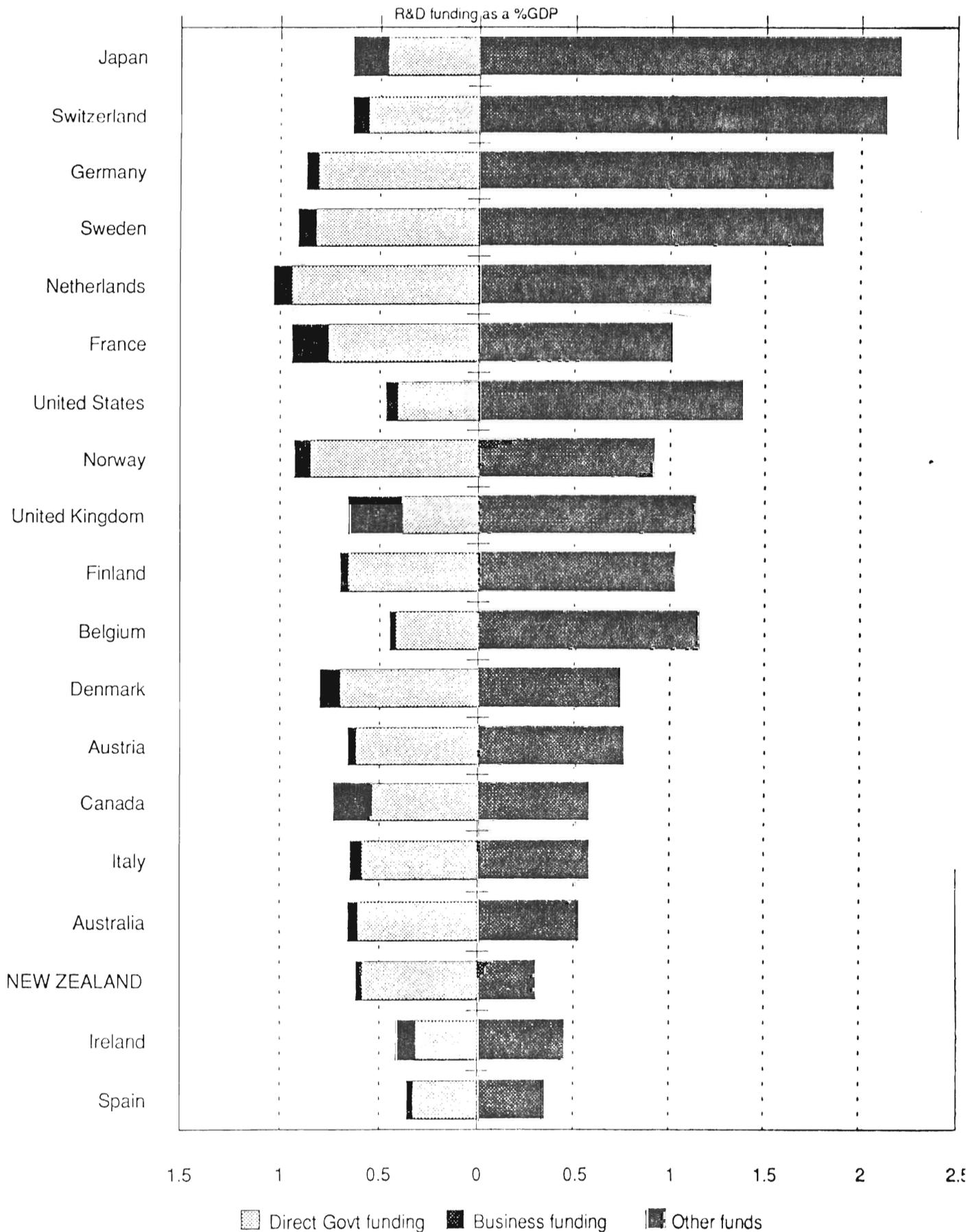
New Zealand has the third lowest total R & D expenditure as a proportion of GDP of all OECD countries. It has the lowest level of private expenditure on Research and Development within the OECD. (Refer to diagram on the next page).

As a result of this legacy the role of science and technology are grossly undervalued in New Zealand society. Because of the long lead times from research finding to implementation (typically the span of one human generation for most agricultural innovations), this situation is causing irreversible long term damage. Most of the research effort required in New Zealand agriculture is specific to New Zealand climatic, economic and management conditions. It is becoming more and more difficult to piggyback on the agricultural research of other nations. In fact our inadequate research effort may be actually limiting our ability to exploit the few overseas agricultural research findings which are applicable in our New Zealand farming environment. The flow of uncommercialised international technology into New Zealand is becoming inadequate because few organisations and institutions have sufficient in house research and development capacity to make best use of the overseas technology.

Transfer of overseas technology is limited by demand rather than the transfer mechanisms available. For institutions to be close to the frontiers of efficiency and development in their field a significant in house development capacity is a vital prerequisite to the effective use of overseas technology. A decline in New Zealand R & D capacity will reduce our ability to take advantage of developments in other parts of the world.

Conversely the most important benefit that may arise from an enhanced R & D effort publicly and privately is the increased ability to take advantage of the great amount of innovation occurring overseas.

OECD LEVELS OF FUNDING FOR R&D AS A PERCENTAGE OF GDP - EXCLUDING DEFENCE R&D



Lack of discernible career structure for extension agents

There is a general perception that agricultural extension personnel are people who are not quite good enough to be scientists. In fact their jobs are in many ways more important than those of the researchers. The role of extension agents has consequently been grossly undervalued resulting in difficulties in attracting consistently high calibre people to the profession. As the technology transfer component of research is contained in the FORST contracts, the CRIs ought to begin employing people to ensure that the information is delivered to the end user. FORST should be establishing expertise to monitor and ensure that this component of the work they have contracted is being delivered.

Conclusions

1. The current level of innovation and technology adoption in New Zealand agriculture is suboptimal.
2. The reasons for this lie with scientists, extension agents and farmers.
3. Traditional methods for conveying research information and scientific knowledge to farmers may no longer be appropriate.
4. It is likely that change agents can be more effective through a better understanding of the decision making and change process.
5. Empathy, active listening and avoiding the creation of defensive environments are the three primary keys in the change process.
6. Scientists and extension personnel are currently not adequately trained in interpersonal communication skills.
7. The sheer mass of information in some agricultural subject areas is in some cases reversing rather than advancing progress because of the "decision inertia" it creates.
8. New Zealand's low level of expenditure on research and development is likely to limit the future use that can be made of overseas research findings.
9. Because of considerable uncertainty in the current agricultural and research climate, "quick fix" approaches to try to improve technology adoption are unlikely to succeed.
10. A more holistic approach to agricultural information extension is desperately required. This should recognise the implications of suggested changes to the farm as a whole including the farmer. It also requires the involvement of a range of other disciplines.

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An example of the difference between theory and practice in Genetic Selection

FOOTROT FLATS



ALTHO' IT JUST ABOUT BROKE HIS HEART HE LEFT WEAK LAMBS TO DIE - THIS SHOULD ENSURE HE WILL DEVELOP A STRONGER, MORE TROUBLE-FREE FLOCK

