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INFORMATION AND BEHAVIOUR

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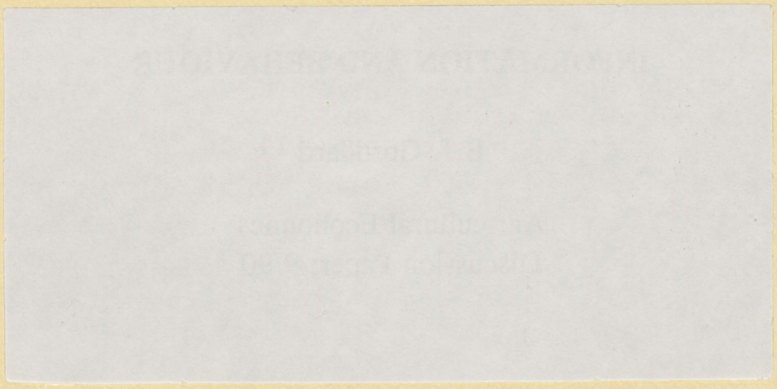

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There is a vast literature on the relationship between information and human behaviour, and a detailed review is not the intention of this paper. Nevertheless, there are a number of areas of potential interest to agricultural extension, and these are examined along with suggestions for practical application in the field.

Background

Agricultural extension is about behaviour change by farmers through the communication of information. While a range of opinions and policies exist over the extent to which this behaviour change is, or ought to be, governed by the interests of the individual farmer or by the interests of the state or community, the extension business is essentially about voluntary change through persuasion rather than by coercion. Regulation and legislation are often used as adjuncts to education and extension, and the impact of compulsion on behaviour change is a subject in its own right. I am not aware of any research in this area in the agricultural - regulatory field, but there is a considerable literature in other areas of social science, a review of which is outside the scope of this paper.

The vexed question of **whose interests** extension represents, or should represent, was addressed (inter al.) by Bardsley (1982). All professional extension officers should be thoroughly familiar with the issues and arguments of the "individual versus the state" conundrum, to which Bardsley's paper is an excellent introduction For the purposes of simplicity and clarity, this paper will treat extension as a non-coercive, educational process which takes a client-centred approach to the individual farmer.

A major problem for extension is that its research base lies in the behavioural sciences, in which extension officers are generally ill-equipped, at both undergraduate and postgraduate levels. Not only does this present problems in accessing the literature, but the applied research required to test and develop the concepts originating in the behavioural sciences has all but disappeared. In the vacuum, the extension practitioner is left without a professional base.

A related problem is that the literature relevant to extension is expanding rapidly, not only in the traditional areas of social psychology and education, but in emerging disciplines such as cognitive science, expert systems, artificial intelligence, and in certain branches of economics. The following is not intended as a detailed review of any or all of these areas, but merely as a sample of some relevant work

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in social psychology and economics, and an indication of potential applications in extension.

Information and Decision

Our interest lies in the means whereby normal, mature, human behaviour interacts with information from the external environment. Our emphasis is on the process as seen BY THE INDIVIDUAL, rather than BY THE CHANGE AGENT.

The key finding from research into adult learning is that adults are **active seekers of information** in the service of their individual goals (Knowles 1984, Tough 1971, Kelly 1955). This process of active search is thought to be motivated by a person's attempts to meet his/her perceived needs, as determined by personal beliefs, attitudes and values. The notion of a person as a free, motivated, self-directed, seeker of information is basic to an understanding of adult learning and behaviour.

(a) Active Search

An active search for information requires **effort** and incurs **costs**, both direct and indirect. Direct costs include the price of the information and the costs of acquiring it. Indirect costs are those associated with forgone income due to delayed adoption while searching for information, assuming that the innovation is potentially profitable. [Economists view information search as a normal responsibility of management, as an integral part of decision making. This responsibility is seen to include finding out **what** information exists, and is therefore consistent with the idea of a person as a self-directed information -seeker.]

A considerable body of research (Rogers 1983) indicates that the mass media are the primary source of new ideas for most farmers, though many "innovators" obtain their ideas directly from research contacts. While most farmers seem to become aware of the existence of innovations very quickly, there is evidence that, for some farmers and for some innovatons, there are considerable delays in the discovery process (Lindner 1982).

(b) Information and Uncertainty

Once a decision maker is aware that a potential innovation exists, the adoption process involves the search for information about the characteristics of the innovation: that is, **a search for information to reduce the person's uncertainty about how the innovation might affect his/her welfare - would they be better off or worse off by adopting?**

Adoption will be delayed until the person believes that he/she is sufficiently informed to decide on adoption or rejection. During the period from discovery to adoption, the person seeks

information about the potential impact of the innovation on his/her farm, initially from any available source but, as information accumulates, from sources both geographically and socially closer to the individual.

Geographic distance may be underestimated as a factor that increases the difficulty and cost of information acquisition, because farmers are known to be keen to find out how well the innovation might perform on THEIR farm, under THEIR conditions. This is a major source of uncertainty, especially when the innovation has been tested only under research station conditions, perhaps some distance (both physically and managerially) from the farmer's property.

For innovations which are divisible, the information gathering activity may reduce the farmer's uncertainty to the extent that an **on-farm trial** is undertaken. Henceforth, most information about the innovation will be gleaned from personal experience and that of neighbours and "intimate experts". If the innovation is **not** divisible, considerable delays may occur while the farmer waits for someone else to try it under similar conditions. Similarly if the results of a practice are **not very visible**, are **relatively complex**, or are **not compatible** with existing practices.

In this model, a farmer may procrastinate indefinitely or may consciously choose to defer a decision while seeking more information. The possibility also exists that the farmer may adopt or reject prematurely and incorrectly, before he is fully informed, leading to dis-adoption at a later stage. In either case the farmer has on-going opportunities for additional learning about the innovation.

Eventually most farmers become sufficiently well informed to decide whether or not the new practice is likely to be in their own best interest. An exception is the "laggard" who often adopts late, primarily in response to social pressure.

(c) Decisions

In decision theory, the manager is seen to face two basic tasks in decision making:

(i) the acquisition of information (learning) and
(ii) risky choice (where outcomes are uncertain).

Decision theory can become quite esoteric, but it does provide an empirical basis for studying the use of information by decision makers under uncertainty, and as a useful model of the adoption process.

Basically, a decision is risky because the person is **uncertain** as to whether he/she will be **better off** or **worse off** by adopting the innovation (Lindner 1986). The concept of "better or worse off" is complex, but is normally thought to be synonymous with the person's perceived, best, self-interest.

There is now compelling evidence that the rate of adoption of innovations is mainly determined by the extent to which the innovation is capable of serving an individual's best, self-interest (Gladwin 1979, Perrin and Winklemann 1976, Feder et al 1985). Best self-interest extends well beyond maximum net income, to include likely impacts on factors such as independence, lifestyle, personal preference, effort and all factors in an individual's utility function.

The mechanics of "risky choice" need not concern us here, though they are fundamental to anyone interested in helping farmers make better decisions. In addition there is now some evidence that **risk preference** may be less important than **risk perception** in determining farmers' choices under uncertainty. Hence extension may be more effective if it attempts to present information in such a way as to help farmers cope with the variation in possible outcomes in a decision problem. This is generally difficult, as remarkably few experiments are designed to produce data on the variance of yield responses across seasons at the one site.

(d) Information Processing and Time

The information-processing model below is potentially more useful in extension than the older "awareness - interest - evaluation - adoption" models (Rogers 1983), which did not take explicit account of information gathering over time and its relationship with decision making. The information processing model treats the dependent variable as the time-lag to adoption (Lindner et al 1982), with cumulative knowledge and information-related factors as the principal independent variables.

Time lags are represented in the model as the:

DISCOVERY STAGE LAG: the time from the generation / publication / release of a technology to the time it is discovered by a farmer.

EVALUATION STAGE LAG: the time from discovery until first trial on the farm, i.e. the period of search for off-farm information.

TRIAL STAGE LAG: the time from first trial until adoption or rejection.

The basic issue for extension is: **how to reduce the three Lag Stages to a minimum, thus maximising the rate of adoption.**

An obvious approach is to look more closely at information about the characteristics of the innovation, and at how information might affect the decision process.

Beliefs, Attitudes and Information

The decision process takes place under **uncertainty about the characteristics of an innovation**, and the potential impact of

that technology upon the future welfare of the decision-maker. At any point in time, knowledge (about the innovation) must be based upon a person's subjective beliefs about the attributes of the innovation, and his or her personal evaluation of these attributes. Uncertainty can also be represented by the variance of a person's set of relevant beliefs about the likely consequences of a decision. (Decision theory offers a formal method of incorporating new information into these existing (prior) beliefs to form revised (posterior) beliefs about the innovation (Anderson et al 1977)).

The primary role of information is in the reduction of uncertainty about the characteristics of an innovation, so that the farmer becomes better informed as to how the innovation might or might not serve his best self-interest.

For these reasons there has been considerable interest from economists, decision-theorists and market researchers in developing techniques for the elicitation of subjective beliefs. More recently they have been joined by cognitive scientists, anxious to better represent human knowledge in expert systems and in artificial intelligence.

Unfortunately, the valid elicitation of human beliefs is fraught with problems and controversy, and a paradigm is yet to evolve. A reliable, valid technique for the elicitation of human beliefs has long been the holy grail of cognitive psychologists, and the search continues. In addition to the accurate elicitation of beliefs and the degree of uncertainty associated with them, it is also necessary to understand the relative strengths and inter-relationships of these beliefs, as a basis for understanding or predicting behaviour.

Considerable success has been achieved using Personal Construct theory to map belief systems on a Repertory Grid (Bardsley 1982, Brewin 1980), and the technique has been developed for use in agriculture by Dr Hawkins' group at the University of Melbourne. Applications to date have stopped short of use in designing and evaluating extension messages. A more sophisticated technique using multidimensional scaling (Woelfel and Fink 1980) is currently being adapted to agricultural applications in Victoria (Cary 1988). This method is claimed to have high predictive validity, with the additional capacity to generate "key words" that can be used in the construction of persuasive messages for a target audience.

A relatively simple method of elicitation has been developed by Ajzen and Fishbein (1980) involving a system of bipolar scaling across an array of salient beliefs. Respondents indicate their beliefs about the expected outcomes of using the desired practice, and their subjective probability that each outcome will occur. As with the above methods, predictive validity for behaviour is relatively high, and the method is currently being developed with cropping practices in the Avon Valley (Gorddard and Nash, in press). Other applied approaches to the representation of beliefs may be found in the field of expert systems.

The relevance for extension lies not only in the prospects for improved decision aids and expert systems, but in **the potential to change beliefs through information which is targetted at those beliefs.** Such an approach potentially accommodates both major schools of extension: client-centred and institution-centred, as discussed above.

Information Processing

Knowledge of a person's beliefs about a practice or object do not, per se, tell us anything about the impact of information on those beliefs, nor on the relationship between beliefs and ultimate behaviour. Hogarth (1987) cautions that "we know relatively little about how the human mind works and its influence on behaviour" (p.233).

What do we know and what's in it for extension?

(i) Limitations

The active processing of information is a serial process, occurring in a memory of limited capacity to input or retrieve information from more permanent storage (Payne 1980). The need to store, process and retrieve large amounts of complex information leads people to use heuristics (simplifying rules or mental "short-cuts") in cognitive tasks. Heuristics can be learned in lieu of, or additional to, more detailed and complex items of information, and can be used to access, recall and value this information.

A second limitation concerns the task environment, and the manner in which the decision-maker perceives the task. Since a decision or elicitation problem is essentially an interaction between a person's cognitive system, and the "problem space" as perceived by that person, there is obvious scope for a mismatch between this problem space and the task environment as perceived by a researcher, or by a source delivering information to that person.

There are many other sources of bias in information processing, the details of which are of importance in all elicitation and survey procedures, but which need not concern us here. These include Representativeness, Availability, and Anchoring (for details, see Hogarth 1987).

(ii) Implications

An immediate consequence of limitations and biases in information processing is **susceptibility to framing.** This arises from a sensitivity to differences or deviations with respect to a norm or to the "status quo", and to the observation that people experience or value gains and losses with different levels of intensity. Thus a prospective loss is valued more highly than the same amount expressed as a gain. A related and persistent bias is that a certain outcome tends to

be valued more highly than a statistically equivalent, though uncertain, outcome.

A combination of these biases creates the possibility of framing questions or problems in such a way as to bias the response or outcome. (Consider the case of a choice of treatment made on the basis of information provided as survival as against mortality rates; see Hogarth 1987 pp.103-111).

A second major outcome of research into information processing is the realisation that there are at least two major processing pathways: **cognitive** (or central, or systematic), and **heuristic** (or peripheral). The two paths can occur in parallel or separately (Chaiken and Stangor 1987). Conditions that determine which pathway an individual uses in a given situation are not yet clear, but in general:

* Cognitive processing is controlled, attentive, systematic, analytical and critical. It involves an active search for, and processing of, information in support of personal goals. Cognitive processing is thought to integrate new information with present knowledge, hence updating and revising beliefs and attitudes. The amount of effort expended appears to depend directly on the level of motivation.

* Heuristic processing (sometimes called "low-level" or "passive") occurs partly in response to information overload, when simplifying rules or generalisations are used to aggregate and store or retrieve information. Other conditions known to favour heuristic processing include:

- a low level of intellectual ability or cognitive skill
- a lack of knowledge about the subject
- when the person is tired, disinterested or inattentive
- stress, emotion or pressure.

* In both systems, the strength of the resultant beliefs and attitudes depends upon the amount of processing, elaboration and use. Strongly held (learned) belief systems are notoriously resistant to change.

* Persuasive messages appear to have maximum impact when subjects are NOT actively processing. Under these conditions, manipulation of:

- source credibility
- source attractiveness
- message length
- number of arguments
- consensus information

has maximum effect.

* Manipulation of feelings/moods is more effective with subjects who are NOT highly knowledgeable about the topic.

. * Heuristics are recalled and used to judge the validity and acceptability of incoming messages, especially when subjects are processing peripherally. Research indicates that the heuristics and their reliability can be manipulated by priming. Emotions appear to evoke and be processed by the heuristic route.

* Under cognitive processing, the strength and logic of arguments is most important. Source credibility and its manipulation have little impact when motivation and ability are high, and the receiver is processing cognitively.

* To be persuasive, a message needs to be targetted at a person's primary beliefs, behavioural and normative. An effective message has at least two components, **arguments** and **evidence** in order to obtain both **acceptance** and **yielding**.

Interestingly, work by Ajzen and Fishbein (1980) has shown that message structure can have a significant effect on yielding to a persuasive message. In addition to accurate targetting at beliefs, they found that messages emphasising the likely negative consequences (losses) of not performing the desired action were more effective in obtaining behaviour change than those emphasising the positive (gains) consequences of the same behaviour.

Practical Implications

Some implications for extension of recent work in the related social sciences are as follows:

1. The major rationale for public investment in extension is the increase in social welfare arising from high rates and levels of adoption of new technology, ignoring for the moment the role of extension in the amelioratiopn of the social and environmental adjustments which are also generated by technological change. High adoption rates require the minimising of time lags caused by inefficiencies in information search and evaluation by farmers.

2. The "discovery" lag and transition to the "evaluation" lag might be reduced by greater attention to research in the advertising (persuasion) business. The discovery lag is largely the province of the media. In particular, knowledge of information processing pathways, the role of goal clarification in motivation, the impact of affective messages and of message structure may all help to increase the impact of mass media use in extension. The field of marketing research has a great deal in common with extension, especially in the use of advertising to stimulate motivation in a disinterested audience. However, top-level market research and advertising services are not cheap; they may be justified where important externalities, market failure or social welfare issues are involved.

3. The evaluation stage lag is about the active search for off- farm information by an interested and motivated farmer. The information provided needs to be focussed on the farmer's belief system and on the farmer's uncertainty about how the innovation would perform on his farm. Information needs to be provided in several forms, in order to impact upon three key areas: (1) cognitive, (2) affective and (3) behavioural (practical). Information needs to include both cognitive and heuristic messages, the latter being particularly good as "take-home messages".

Relevance to the farmer is obviously important at this stage (what's in it for me?) in maintaining interest and motivation to seek further information. Numerous research studies have confirmed the importance of other farmers as information sources, and it is at the evaluation stage that these effects are thought to be strongest.

Changing strongly entrenched, negative attitudes may be beyond the reach of extension, but those willing or compelled to try should first consult the literature or a consultant on attitude change, and then address themselves to an analysis of the client's belief and value systems before wasting effort on traditional extension methods.

4. The evaluation stage is essentially a motivated, adult learning process. Farmers in this stage need access to information, **from sources which they regard as credible**, about the performance of the innovation in their area, under their conditions. Involvement of farmers in trial / demonstration / testing activities is one obvious answer, with the proviso that the activities are practical and not subject to foul-ups. Small-plot experiments are unlikely to suffice, and may even be counter-productive at this stage. Evidence is accumulating that this "adaptive research" phase is the weak link in the adoption process, so that it ought to have a higher priority for extension resources than activities which merely reiterate what happened at a (distant) research station or site, and leave it to the farmer to adapt the technology to his area.

5. The need to tailor information to each particular farm presents problems and challenges for extension in general, and for Information Technology in particular, including direct access to expert systems by farmers. A more promising direction may be the development of decision aids which adequately represent risk, uncertainty and time in a whole-farm context.

6. The Trial Stage Lag represents few opportunities for extension involvement, unless the extension officer is extremely close to the farmer (in a social network sense). One important intervention is the monitoring of initial paddock performance on the farms of innovators and early adopters. Extension needs to be aware of any problems as they arise and, if possible, correct them, before the early

adopters (who are also the opinion leaders) discard the innovation.

7. Priority areas for extension research include:

* development of reliable, valid and practical methods for the elicitation of beliefs and attitudes in target audiences

* the relationship between information, belief change and ultimate behaviour change

* comparison of information structure and content on awareness and motivation

* methods of presenting information in formats which facilitate decision making, by an adequate representation of risk, uncertainty and time.

References

Ajzen, I. and Fishbein, M. (1980) Understanding Attitudes and Predicting Social Behaviour. Prentice Hall, New Jersey.

Anderson, J.R., Dillon, J.L. and Hardaker, B. (1977) Agricultural Decision Analysis. Iowa State University Press. Chapter 3.

Bardsley, B. (1982) Farmers' Assessment of Information and its Sources. University of Melbourne Press.

Cary, J.W. (1988) Predicting the Effect of Communication Strategies on Attitudes and Beliefs using Galileo Analysis. School of Agriculture and Forestry, University of Melbourne.

Chaiken, S. and Stangor, C. (1987) Attitude and attitude change. Annual Reviews of Psychology 38:575-630.

Feder, G., Just, R.E. and Zilberman, D. (1982) Adoption of Agricultural Innovations in Developing Countries. World Bank Staff Working Paper No.541. World Bank, Washington, D.C.

Gladwin, C.H. (1979) Cognitive strategies and adoption decisions. Economic Development and Cultural Change 28:155-174.

Gorddard, B.J. and Nash, P.M. (in press) Farmers' Attitudes and Intentions Towards Conservation Cropping Practices. Proc 1990 National Soil Cons Conference, Perth, W.A.

Hogarth, R.M. (1987) Judgement and Choice, 2nd edn. John Wiley & Sons, Chichester.

Kelly, G.A. (1955) The Psychology of Personal Constructs, Vol.1. Norton, New York.

Knight, T.O., Johnson, S.R. and Finley, R.M. (1987) Extension program evaluation using normative decision models, Am J Agric Econs 69(2):338-348.

Knowles, M.S. (1984) The Adult Learner: A Neglected Species, 3rd edn. Gulf Publ Co, Houston.

Lindner, R.K. (1986) Adoption and Diffusion: An Overview. In Technological Change in Postharvest Handling of Grains in the Humid Tropics, eds B. Champ, E. Highley and J. Remenyi. ACIAR, Canberra, ACT.

Lindner, R.K., Pardey, P.G. and Jarrett, F.G. (1982) Distance to information source and the time lag to early adoption of trace element fertilizers. Aust J Agric Econs 26:98-113.

Payne, J.W. (1980) Information Processing Theory: Some Concepts and Methods Applied to Decision Research. In Cognitive Processes in Choice and Decision Behaviour, ed. T. Wallsten. Lawrence Erlbaum Assoc. New Jersey. Chapter 6.

Perrin, R. and Winklemann, D. (1976) Impediments to technical progress on small versus large farms. Am J Agric Econs 58:888-894.

Ramsey, C.L., Reggia, J.A., Nau, D.S. and Ferrentino, A. (1986) A comparative analysis of methods for expert systems. Intl J Man-Machine Studies 24:475-499.

Rogers, E.M. (1983) Diffusion of Innovations, 3rd ed. The Free Press, New York.

Tough, A.M. (1978) Major learning efforts: recent research and future directions. Adult Education 28:4.

Woelfel, J. and Fink, E.L. (1980) The Measurement of Communication Processes: Galileo Theory and Method. Academic Press, New York.