Action research as a means of enhancing dairy farmer learning for management.

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Abstract

At this conference in Gatton, 1997 a work-in-progress paper on farm extension methods was presented which described a process proposed for exploring farm extension methods relevant to the New Zealand dairy industry. An objective of that project was to identify practices and extension tools with the capacity of enhancing farmer learning. This paper reflects on experiences gained through the use of action research (AR) as one alternative method. In the context of a case study in farming learning behaviour with dairy farming women, AR was used as a method of resolving a particular technical issue on their farms. This process was compared with and evaluated against the discussion group method used widely in the New Zealand dairy industry.

Introduction

The dairy industry is an important sector in New Zealand, and views itself as having a progressive approach to scientific research and the acquisition and adoption of technology. It is also generally accepted that, in order to remain price competitive in international markets, technological improvement is a continual necessity. As a result the industry needs to increase production efficiency by continually encouraging farmers to adopt new methods and processes.

Traditionally sectors such as the dairy industry have approached this issue with the farm extension methods that are already known about and used. In practice this means that the dairy industry has given more emphasis to the linear transfer of technology model than the cyclical learning model, despite the latter being paid lip service over recent years. In the former the concern is with the processes used by transferors to create outputs (how many people attended/ adopted). In the latter the concern is with the processes used by transferees (the producers) and their ability to cope with and adapt to changing environments.

This process has been successful on the whole. However, in the increasingly competitive environment in which the New Zealand dairy industry finds itself today, it needs to be continuously evaluating the methods it uses for enhancing the ability of individual farmers to learn about (and apply) more effective ways of operating. It also

needs to consider the changing characteristics of the individual members of the industry – as New Zealanders in general have become less tolerant of centralised control (either by government or industry bodies), business people (including farmers) have voiced their desire to become more involved in planning industry goals. In a variety of recent meetings, including a producer forum that was part of this project (November, 1998), an APEC meeting on small and medium sized enterprises (April, 1999) and the 'Five Steps' business forum sponsored by a grouping of government agencies (May, 1999), individuals have indicated a particular willingness to become more involved in "setting the research agenda".

Consistent with these separate dynamics (a need for effective assessment of the value of different models of extension, and the desire expressed by farmers to be more involved in industry development), in 1997 the New Zealand Dairy Board sponsored a research project into extension methods in the dairy industry. The project was based on the premise that farmers had failed (or were slow) to utilise some potentially highly productive technologies. The project had a specific focus on exploring farmer learning behaviour, with a view to improving methods of technology transfer and uptake by the farmers of New Zealand.

A literature review, an industry exchange forum and its evaluation (Stantiall & Parker 1998) formed the backdrop to a case study in farmer learning behaviour. This paper draws upon the case, in which a group of dairy-farming women worked with two researchers on a particular technical problem. Using action research (AR) as a framework, the group devised a problem-solving process that was structured around three elements (consultancy advice, research findings and self-directed learning), within a structurally coupled action researching system (Bawden 1991). The authors describe the model that was used, and reflect upon the way in which the participants were able to apply their learning in their farming systems.

The rationale for learning

In recent years individual and organisational learning (i.e. not individual) have become topics that are frequently addressed in the management literature. This is based on the proposition that competitive advantage is "the rate at which an organisation can learn" (Senge 1994 p18), and that organisational learning is "the process of improving actions through better knowledge and understanding" (Fiol & Lyles 1985 p 803). It is claimed that successful enterprises are "those that consistently create new knowledge, disseminate it widely throughout the organisation, and quickly embody it in new technologies and products" (Nonaka 1991 p 96). Similarly, Argyris (1992) comments "organisational learning is a competence that all organisations should develop" (Argyris 1992 p 1).

It is clearly implied that organisational learning is valuable because of the outcomes that may be achieved. Learning is "the process whereby knowledge is created through the transformation of experience" (Kolb 1984 p 38), and provides organisations with; a way of increasing knowledge (Dixon 1994), an increasing capacity to take effective action (Kim 1993) and a greater ability to be innovative (Gopalakrishnan & Damanpour 1997). From this perspective organisational learning is the "process that allows the organisation to continually generate new states" (Dixon 1994 p 3).

In the search for understanding how learning occurs, different types of learning have been identified. Fiol and Lyles (1985) note the difference between lower-level and

higher-level learning, McKee identifies incremental, discontinuous and organizational learning (McKee 1992), and Argyris and Schön (1978) make the distinction between single-loop and double-loop learning. A related area is that which identifies models for effective learning is a recurring theme, particularly in the practitioner literature (Fulmer 1994; McKenna 1995; Watkins & Marsick 1993), and empirical studies of the effectiveness of these models are starting to appear in academic journals (DiBella, Nevis & Gould 1996).

One of the more important dimensions of the literature has been that which distinguishes between "the acquisition of skill or *know-how*, which implies the physical ability to produce some action, and the acquisition of *know-why*, which implies the ability to articulate a conceptual understanding of an experience" (Kim 1993 p 38). This distinction between operational and conceptual learning is consistent with an understanding that is less about 'finding someone else's answer' than of acknowledging that the situation within an organisation is complex, and as a consequence there are many right answers, and therefore many different ways to reach the same goal (Dixon 1994).

However, in practice, the 'many ways' are usually conceptualised in terms of the actions that are taken by individuals, who learn by going through continuous cycles of having a concrete experience, reflecting on the experience, forming abstract concepts based on the reflections and testing the ideas in new situations (Kim 1993; Kolb 1984). This foundation of experiential learning introduces the concept of learning as the act of interpreting experience, and implies that interpretation is unique to each individual (Dixon 1994). There is also some discussion of *why* individuals learn (Dixon 1994; Norland 1992), and *how* they learn best (Iddings 1992; Richardson 1994).

While there is a definite focus on the role of individual learning in the context of organisational learning, the literature also addresses the characteristics of the organisation that facilitate learning. Kim (1993 p 37) argues that we must "differentiate between levels of learning, take into account different organisational types, and specify the transfer mechanism between individual and organisational learning". Similarly, Dixon comments that while "an organisation learns through the capability of its members" (Dixon 1994 p 36), "organisational learning is not simply the sum of all that its organisational members know - rather it is the collective use of this capability of learning" (ibid. p 36).

The relationship between individual and organisational learning is made even more explicit by McKee (1992) who maintains that "individual learning is necessary but insufficient to produce organizational learning" (McKee 1992 p 233). This statement demonstrates the emerging understanding of the distinction between organisational and individual learning, an understanding that goes far beyond that mooted by earlier writers, who conceptualised an organisation as "an adaptively rational system that basically learns from experience" (Cyert & March 1963, cited in Kim 1993 p 41).

While the literature is diverse, it appears that there is an emerging consensus about organisational learning on a number of levels. Firstly, there is agreement that learning should be established as an essential aspect of organisational life (Senge et al. 1994; Solomon 1994). Secondly, there is agreement about the relationship between individual and organisational learning, based on an understanding of "organisational learning as the intentional use of learning processes at the individual, group and

system level to continuously transform the organisation in a direction that is increasingly satisfying to its stakeholders" (Dixon 1994 p 5). Thirdly, there is an implication that it is possible for an individual's knowledge to be "transformed into organisational knowledge valuable to the company as a whole" (Nonaka 1991 p 97). Finally, there is some agreement that while there is a relationship between organisational and individual learning, the organisational learning cycle is fundamentally different from the individual learning cycle (Kim 1993 p 40).

Encouraging farmer learning through extension

In New Zealand farmers are encouraged to learn through the farm extension programme, carried out primarily by the Dairy Board's 34 consulting officers and 21 Farmwise consultants. Farmwise consultants operate on a commercial basis, under license to the Livestock Improvement Corporation (a fully owned subsidiary of the Dairy Board). In terms of process, consulting officers focus on 'mass extension' activities, with discussion groups and field days. There is also occasional individual contact with farmers. Overall, the service currently achieves contact with 60-65 per cent of dairy farmers. They also achieve a large degree of contact via two extension media for dairy farmers - the Dairy Exporter (a monthly journal), Farming with Pictures (a quarterly video sent to dairy farmers) and Farm Adviser (a quarterly magazine). Surveys have indicated a 90 per cent audience for these media (Bodeker 1999).

However whether these avenues influence learning outcomes is open to question. In a study designed to find out what dairy farmers considered to be their most important sources of information Butcher (1998) found that producers were not maximising the resources available. Given the considerable literature on organisational and individual learning, including Sligo's (1996) proposition that information is one of the key factors that allows employees to learn, Butcher's findings are important. He also reported that farmers gain little information from discussion groups and field days, and commented that although "there is plenty of information available", the individual farmer needs to know where to look for it. Significantly, farmers commented that the information was not always *in an appropriate form* for their use. Butcher concluded that individual farmers have their own preferences for delivery methods of new information or technology. By implication, this will not always be the discussion group format.

Butcher's findings are particularly significant, given the way in which technology transfer was defined in this study; as "the specific process by which farmers or growers become aware of, gain access to, interpret, and then apply, new knowledge, ideas or technologies" (Butcher 1998 p 12). This definition emphasised that technology transfer must do more than just ensure that clients are aware of new technology and ideas. To be successful there must be more than just knowing about the technology. It must result in the implementation of the new idea and a change in farming practice.

Another New Zealand study also found that farmers saw technology transfer as being primarily concerned with results. Summarising the findings of an industry exchange forum, Stantiall and Parker (1998) also defined *technology* as being more than just information: "Technology is an 'idea' or a 'concept' that brings improvement or change to achieve a goal or purpose" (Stantiall & Parker 1998 p 6). Similarly,

technology transfer was defined as "the transfer of information and ideas from one person or group to another" (ibid. p 7). Farmer members of the exchange defined it as "the passing on of ideas (information) in order to raise the level of awareness and understanding so that individuals could choose whether or not to successfully use the ideas to realise perceived benefits" (ibid. p 8).

These definitions imply an understanding of technology transfer as a complex set of ideas that requires in-depth consideration, evaluation and choice. However, more importantly in the context of this paper, is that the concept of technology and technology transfer embodied by these definitions is one of farmers being the passive recipients of technology which has been developed by scientists and transferred to the farmers by extensionists. In this linear model of development, knowledge is gained and solutions to problems are devised by those in the research sector and passed on to those in other sectors who are then responsible for making them work. An assumption is that research and hence knowledge is the province of the researcher, whilst the producer's role is to apply the knowledge. Another assumption is that innovation is of itself development and will in time become universal, by virtue of innovative farmers adopting the technology which will then diffuse to others (Hamilton 1995).

At present the New Zealand dairy industry model primarily depends on an implicit view of technology *transfer* as the most effective means of facilitating farmer learning. This is despite that fact that elsewhere this method has been found wanting. In particular, researchers have noted its ineffectiveness as a means of identifying appropriate objects of change and the means by which change can be generated (Russell et al. 1989). The consequence is that until recently active learning by the farmers themselves has rarely been acknowledged as a suitable method for technology transfer.

Encouraging farmer learning through participatory research

By contrast with the model of discussion groups, a participatory research approach is concerned with the generation of knowledge by co-researchers. The characteristics that distinguish this approach include its use of a defined and systematic learning process, multiple perspectives and a group inquiry process in a specific context (Pretty & Chambers 1994). The purpose is facilitated learning leading to sustained action.

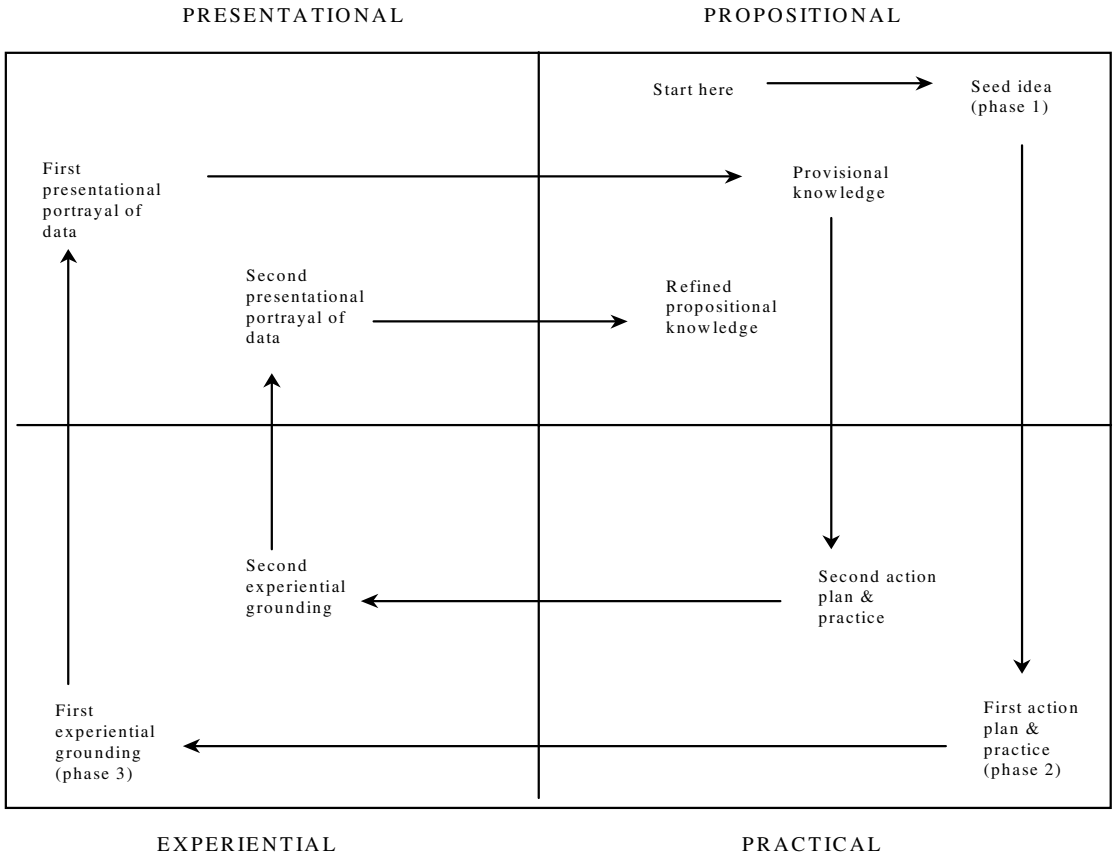
In the study funded by the Dairy Board through the New Zealand Foundation for Science, Research and Technology (FRST), one of the approaches that was assessed within the context of the study was action research (AR). AR is a participatory process that encourages learning through the establishment of practitioner groups that undertake research that is relevant to their particular needs. The group is usually assisted by an 'expert researcher', who is "generating knowledge about a social system while at the same time attempting to change it" (Elden & Chisholm 1993 p 121). However, unlike the traditional model of research, in AR the researcher becomes part of the research setting – rather than standing outside it as an objective systems analyst. Bawden (1991) describes this as a 'structurally coupled action researching system' in which the researcher works with co-enquirers to learn about the issues that are important within a particular system.

This approach allows the practitioner groups to become much more actively involved in the creation of knowledge. It is argued that involving the participants in the process improves the relevance of the knowledge generated and "links practice and the

analysis of practice into a single productive and continuously developing sequence" (Bunning 1994, adapted from Winter 1989, p 1). The central issue is the provision of a context in which the *simultaneous focus* on 'improving practice' and 'developing theory' is possible.

The dual focus of AR (on practice and theory) results in an approach that is considerably different from that of 'traditional' research in terms of planning and implementation. Whereas traditional research is based on the researcher observing the subject in order to prove a hypothesis (generated by the researcher), in AR the research question is developed through an interaction between the researcher and subject, based on their joint interests (Elden & Chisholm 1993). This question provides an 'agenda' for the practice component of the research, which is subsequently used as the basis for the theoretical component.

Figure 1: The action research cycle



Although the origin of AR is in sociology, and more recently has come to be associated with educational research, its value is beginning to be acknowledged by those working within organisations of all types. One description of AR makes this link explicit; AR is "a distinct form in organisational development"; a "process of diagnosing, taking action, rediagnosing and taking new action" (French & Bell 1995 p 7). This definition is consistent with the argument that AR is useful in "planned change in social organisations" (Ledford & Mohrman 1993 p 1355), and capacity building of individuals who are "engaging in a human process of building communities of inquiry" (Reason 1993 p 1268).

In this project, the adoption of AR as the research approach affected every aspect of the research process. For example a key characteristic of AR is that the development of the research plan is not a discrete step that can be completed before the data can be collected, but continues to develop throughout the term of the study, with the input of the research participants. While the researcher may begin with a number of 'organising principles' that he or she hopes will provide a plan for the research, the input of the research participants may modify all or some of these principles. As a result' planning the research' and 'undertaking it' are more or less simultaneous, as the researcher goes through successive cycles of planning, researching, reflecting on the research and refining the design. This was the case in this study, as depicted in Figure 1.

Field work

The researchers selected the initial participants from a list generated by a contact living within the area. Twenty-two dairy farm women were on this list and the researchers rang each one to invite them to the initial session. Twelve women indicated their interest and attended the first session. At this the researchers described the background of the project. They also undertook the exercises that had been developed for the farmer's forum as a way of getting the women to talk about the topic of technology transfer, and their understanding of extension. The session ended with the group selecting a particular topic that they wanted to address; magnesium deficiency in dairy cows. This problem was not of significance to all the participants. The six who were interested in this topic agreed to form a research group.

The next meeting started with a discussion of what the group wanted to achieve through their participation in the research. This generated a number of ideas and questions, all relating to the central topic of magnesium deficiency:

- Why don't other farmers have the same problem?
- Why are the symptoms of the deficiency worse in areas of high rainfall? Does it get worse as stocking rates increase?
- Why does it happen?
- What are the factors in its occurrence?
- Can we find a way of balancing the factors?
- What are the signs that it is about to happen?
- Is it inherited?
- Is it an issue on conversion farms?
- In what geographical areas does it occur?
- Are we making it worse for ourselves?
- How can we control it?

On the basis of this discussion, the group concluded that their desired outcome from the research process would be "a realistic and cost-effective way of preventing magnesium deficiency in our environment". A secondary objective was related to research. There was considerable feeling that **"**essential research on the topic should be done immediately".

The remainder of the session focused on planning the actions that members of the group would undertake in order to identify "a realistic and cost-effective way of preventing magnesium deficiency in our environment".

The outcome of this process was a research plan, which included:

- A review of the practitioner literature (e.g. Dairy Exporter Journal)
- Interviews with farmers who had experience of the problem, particularly those who have farmer in other areas, and those who have moved out of the area
- An investigation into what research has been done in the area, particularly in reference to i) fertiliser input, ii) herds in different areas, ii) genetics
- Interviews with professional advisors and independent experts
- Case studies of group members' experiences particularly on their own farms

This research plan formed the basis for the remainder of the process, in which the group met four more times, gradually moving through the plan, which was also modified as the group thought of new ways of corroborating (or disproving) various suggestion that were made about the nature and cause of magnesium deficiency. As a way of validating the data they accumulated, each would discuss the outcome of a group meeting with partners and other farming associates.

An example of how the research plan was modified was in relation to the research question occurred at the third meeting when the researchers asked the group "how will we know when we've achieved our objectives? After some discussion it was clear that a revised objective had been tacitly reached; "to move one or more steps closer towards understanding (or being able to do something about it) the problem".

Some important characteristic of the project were:

- The group was basically self-selected, not surprisingly since the topic turned out to be fairly technical and specific;
- That each research partner had a slightly different purpose. Individuals remained focused on their own objectives, while simultaneously contributing to the others and the development of theory through participation in the researcher's study;
- That each was quite clear when they had enough information to meet their own needs and be confident about implementing or not the changes which had been proposed.

Discussion

Action research lends itself to situations where there is no known answer that can be transferred 'from' the researchers 'to' the participants. To be successful the model also depends on skilled facilitators who are willing to share control of the process with participants. By implication, the process requires a high level of commitment from participants. If these conditions are met, 'knowledge creation' is possible. Based on the experience of this study, it appears to be a method that is most suitable in situations where there are complex, situation-specific problems, and where the participants have a high need for involvement in directing their own learning.

By contrast, discussion groups are suitable in situations where there are known answers, i.e. where information can be 'transferred'. Generally speaking, the discussion group facilitator controls the process, and participants are less involved in setting agendas and planning topics to be covered. These features make the discussion group format suitable for a wide range of situations, as there is less commitment needed by the participants, and, it may be argued, a lower level of skill needed by the facilitators. It is also possible that the long history of discussion groups in New Zealand gives participants a high level of comfort about their value.

While the differences listed in Figure 2 are significant, particularly to the Dairy Board as it seeks out those methods which are most effective in influencing farmer behaviour, an even more important difference between the two methods is that in action research there is a far higher degree of participation of the practitioners (in this case dairy producers).

They become co-researchers, and as with all researchers, their particular worldview becomes an important part of the research process (Moustakas, 1981)**.** While the worldview of the participants is an element of all research, in action research the involvement of practitioners is at such a high level that their particular 'worldview' is revealed to a greater extent within the research process that would be the case with a discussion group format. In the participatory research process, the knowledge and views of all parties to the process has value and farmer contribution is not seen as limiting but rather as enhancing (Okali, 1994).

Figure 2: Participatory research cf. discussion groups

	Participatory research	**Discussion groups**
History	Relatively recent	Traditional
Facilitator skill level	High	Medium
Participants' contribution to the learning process	High	Medium-low
Useful for	Complex, situation-specific problems	Generic problems
Participants' responsibility for learning outcomes	High	low
Participants' input is of significance	High	Often low

Worldview in this context relates specifically to the set of complex notions that individual farmers apply (consciously or unconsciously) to farm management. Noted by Morgan (1997) in his research on organisational metaphors, a worldview of any kind both provides a 'way of seeing' and a 'way of not seeing'. One aspect of an individual's worldview is the way they view the enterprises they own or manage, particularly in relation to their surrounding economic and social systems. A second aspect of a farmer's worldview is concerned with the way he or she views change and the development of these enterprises. A third aspect relates to the way farmers understand the 'management processes' that are used within these enterprises.

The significance of worldview rests upon the suggestions in the literature that the worldview held by individual enterprise owners influences the way they approach the tasks of management (Massey in press; Morgan 1997).

Dimensions of 'worldview'

In the literature change is described as incremental or radical, continuous and discontinuous (Van de Ven & Poole 1995), and first-order and second-order (Bartunek & Moch 1987). Another perspective identifies types of change; unplanned (evolutionary), planned (pro-active), imposed, participative, negotiated (Kubr 1986).

A different approach is provided by Van de Ven and Poole (1995), who identify four basic change theories; "life-cycle, teleology, dialectics, and evolution" (Van de Ven & Poole 1995 p 513).

According to this framework, the essence of the life cycle theory is that change is inherent in the unit of study, and that "the form that lies latent, premature or homogeneous in the embryo or primitive state becomes progressively more realized, mature and differentiated" (ibid. p 515). By contrast, teleology assumes that organisational change is constructed by the organisation, which undertakes a "repetitive sequence of goal formulation, implementation, evaluation, and modification of goals based on what was learned" (ibid. p 516).

The essential difference between the two approaches lies in the implied role for managers. Whereas adherents to the life cycle approach consider change as prefigured, those who favour a teleological approach assume a non-deterministic perspective, as discussed in earlier work by Astley and Van de Ven (1983). This in turn builds on writers such as March and Olsen who identify two fundamental processes for organisational change; "rational calculation and learning from experience" (March & Olsen 1975 p 147).

The way in which managers (in this case farmers) understand change in turn affects their understanding of the organisational processes that are available to them. For example, one of the most commonly discussed organisational processes is decision-making (French & Bell 1995; Mintzberg et al. 1976). Mintzberg and his colleagues built upon Newell and Simon's (1972) framework, to produce a process with three phases; identification, development and selection (Mintzberg et al.1976). This process is related to that of problem solving (Eden et al. 1983), and both imply that individual managers act as protagonists in the organisation's development.

Conclusions

This paper has described the part of the project in which AR was examined in terms of its suitability as an alternative model for developing the ability of farmers to acquire and use technology. The authors compared this to the discussion group format, and offer the suggestion that while the discussion group format is suitable for simple, or single-loop learning, AR provides a structure for facilitating individual learning of a more complex type. At one level individual participants 'learn about' the particular topic of interest, while at another level they develop their skill in '*learning* about' other topics in the future.

The authors also suggest that the AR format provides an effective mechanism for allowing individual participants to identify and articulate dimensions of their 'worldview' that impact on the way they function as managers. If the contention made by Morgan and others proves to be correct (that an individual's worldview is an influential factor in their ability to cope with changing environments), then this is an added advantage of AR.

Given these conclusions, the authors suggest that extension professionals need to consider their own skills, as well as those within the group, as well as identify the type of problem being considered, before selecting a particular extension method. Whilst the discussion group format will continue to be of value, it is suggested that action

research has much to recommend it to offer those who are seeking to encourage the development of organisations of all types.

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