Farming Systems Research and Consumer Behaviour Theory

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Abstract

Farming systems research has underpinned much of the successful development and dissemination of new farming practices in both the developed and developing world. The farming systems approach is founded on the idea that new agricultural practices must be capable of being integrated into, and so consistent with, the biophysical, economic, and social environments within which the farm enterprise is embedded. A key element in the farming systems approach is participation of farmers to ensure these environments are properly described and the implications for the design of new agricultural practices is correctly understood. However, in attempting to develop practices for farmers across a range of heterogeneous environments the identification of relevant heterogeneity and the recruitment of an appropriate sample of farmers become key questions.

We believe that part of the solution to the difficulty for farming systems research of coping with variety in farming contexts can be found in the integration of farming systems approaches with approaches to understanding adoption behaviour based on consumer behaviour theory. We believe the consumer behaviour approach to understanding adoption provides a conceptually sound and systematic procedure for classifying producers into segments based on the criteria they use to evaluate an innovation. We believe this approach is conceptually consistent with, and complementary to, the foundations of farming systems research and adaptive research.

Introduction

Farming systems research has underpinned much of the successful development and dissemination of new farming practices in both the developed and developing world. The farming systems approach is founded on the idea that new agricultural practices must be capable of being integrated into, and so consistent with, the biophysical, economic, and social environments within which the farm enterprise is embedded. A key element in the farming systems approach is participation of farmers to ensure these environments are properly described and the implications for the design of new agricultural practices is correctly understood. However, in attempting to develop practices for farmers across a range of heterogeneous environments the identification of relevant heterogeneity and the recruitment of an appropriate sample of farmers become key questions. We shall argue in this paper that procedures founded on marketing theories such as consumer behaviour theory can contribute solutions to these questions. In doing so we believe that the ideas in this paper have the potential to contribute significantly to the identification of innovations that will improve the sustainability of small scale farming systems.

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The farming systems approach

Norman (2002) describes how the farming systems research was developed in response to the failure of traditional scientific reductionism to develop technologies for small scale, resource-poor farmers in less favourable, heterogeneous production environments. The farming systems approach was based on the notion that researchers had to begin with understanding the problems of farmers from the perspectives of farmers; and that solutions had to be based on a proper understanding of farmers' objectives and their environments, including both biophysical and socioeconomic (Norman 2002, Collinson 2000). This notion meant farmers' inputs were essential in the technology development and evaluation process. Key features of farming systems research were a whole system approach to the analysis of farming contexts, collaborative research involving scientists from a range of biophysical and social disciplines, and partnerships between farmers and scientists (Collinson 2000).

According to Norman (2000) and Collinson (2001) the application of farming systems research has resulted in the development of flexible technological options rather than standardized packages for farmers. However, Collinson (2001), Norman (2002), Kobrich et al (2003) and others have expressed a concern that the application of the farming systems approach has been limited by the difficulty of coping with diversity in farming contexts. Diversity in farming contexts means that the results of field work can be highly location specific thereby decreasing the potential multiplier effects of developmental efforts (Norman 2002). In other words, the set of criteria used to define a typology of farming systems are only a sub-set, at best, of the set of criteria that determine adoption (Dorward et al 2003).

The diversity in farming contexts creates pressure to classify farms into typologies which can be used to help set priorities and directions for research. The question of coping with variety in farm contexts becomes, at least in part, a matter of finding meaningful ways of classifying farms into typologies (Gibon et al 1999, Kobrich et al 2003). Diversity in farming contexts also creates pressure to develop appropriately flexible technological solutions (Collinson 2001).

Expressed another way, diversity in farming contexts creates a need for procedures to recruit farmers from a relevant range of contexts to participate in adaptive research activities (Dorward et al 2003). Such recruitment is essential to ensuring that the adaptive research process yields a sufficiently rich variety of adaptations of the initial prototypical technology. While a range of techniques and procedures have been developed to facilitate farmer participation in 'adaptive' research (see Dorward et al 2003 for examples) few, if any, techniques or procedures appear to have been developed that allow researchers to systematically identify in collaboration with farmers the diversity in contexts relevant to the development of a technology (Dorward et al 2003).

The resolution of these issues lies in constructing a conceptually sound procedure for classifying farms within a farming system into categories that are meaningful with respect to the adoption of an innovation. Farms are classified into farming systems to facilitate identification of a constraint that is shared by most farms in that system. The next step is to classify farms within a farming system into groups based on the variety of contexts into which a proposed solution to that constraint must 'fit' or be adapted. This needs to be done bearing in mind the possibility that the solution to a constraint in one farming system may also offer a solution to a different constraint in another farming system. As Dorward et al (2003) note, the criteria used to correctly diagnose constraints on farmers and possible solutions do not ensure the adoption of innovations by farmers.

We believe that part of the solution to finding meaningful ways of classifying farms within a farming system with respect to variety in farming contexts can be found in the application of marketing theories, particularly consumer behaviour theory, to adoption behaviour in agriculture. In the next section we briefly describe the use of consumer behaviour theory as a model for understanding the adoption of agricultural innovations. We then discuss the implications of this application for defining typologies of farms for farming systems research.

Consumer behaviour theory

The approach we take to understanding the adoption of new agricultural technologies draws on the conceptual foundations of Consumer Behaviour Theory (Assael 1998). This theory proposes that consumers use a variety of decision processes when purchasing products. The type of decision process they actually follow depends partly on the importance of the purchase to the consumer, partly on how routine the purchase decision is and partly on how familiar the consumer is with the products and brands available. In this section we describe the different types of decision processes used by consumers, the circumstances in which they are used, and the implications of these for understanding adoption decisions.

Consumers make purchase decisions in a variety of ways depending on circumstances (see table one). The way in which a purchase decision is made is determined by two key factors. These are the level of consumer involvement in the product and the degree of effort the consumer is willing to invest in making a purchase decision. When involvement is high consumers tend to engage in complex decision making process or brand loyalty depending on the degree of effort they invest in the purchase decision (Assael 1998). When involvement is low consumers tend to engage in variety seeking behaviour or habit depending on the degree of effort they invest in the purchase decision (Assael 1998).

Consumer involvement depends on how important the purchase is to the consumer (Arora 1982, Kapferer and Laurent 1986, Celuch and Evans 1989, Assael 1998, O'Cass 2000). High involvement purchases are purchases that are important to the consumer. High involvement products are generally expensive, rarely or infrequently purchased and closely tied to self-image and ego. High involvement purchases usually involve some form of risk - financial, social or psychological. Where this is the case the consumer is more likely to devote time and effort to careful consideration of alternatives before making a purchase. Typical high involvement purchases are homes, motor vehicles, white goods, clothing and perfumes (Kapferer and Laurent 1986).

Low involvement purchases are purchases that are unimportant to the consumer (Assael 1998, O'Cass 2000). These purchases are commonly inexpensive products that are routinely purchased and involve little risk. The consumer is unlikely to devote much, if any, time and effort to consideration of alternatives for low involvement purchases before making a decision. Typical low involvement purchases are groceries, toiletries, and laundry products (Kapferer and Laurent 1986).

We believe that the adoption of most agricultural innovations can be characterised as a form of high involvement purchase for primary producers. Usually the adoption of a new agricultural practice or technique has significant consequences for the future financial performance of the farm enterprise. The new technology or practice must be integrated into the existing mix of technologies, practices and resources that exist on the farm (Crouch 1981; Kaine and Lees 1994). This means, generally speaking, the likely outcomes of adopting a particular technology or practice are difficult to predict as the compatibility of the technology or practice with the existing farm system, and the resulting benefits, depends on a range contextual factors that are specific to the circumstances of each farm enterprise. Consequently, the decision to adopt an agricultural innovation is often financially risky. As such they entail social risks and psychological risks for the individual in that the outcomes affect the wellbeing of family members and can influence producers' feelings of achievement and self-fulfilment.

Complex decision making

Consumer behaviour theory suggests that consumers follow a complex decision-making process with high involvement purchases (Assael 1998). Complex decision-making is a systematic, often iterative process in which the consumer learns about the attributes of products and develops a set of purchase criteria for choosing the most suitable product.

Complex decision making is a decision making process consistent with explanation based decision theory (Pennington and Hastie 1989). Complex decision making is facilitated when there is adequate time for extensive information search and processing (Beatty and Smith 1987), adequate information is available on product characteristics and the consumer has the ability to process the available information (Greenleaf and Lehmann 1995). These conditions seem likely to be reasonably well satisfied in the case of family farms in developed economies.

Table One: Consumer purchase behaviour

	High involvement purchase decision	**Low involvement purchase decision**
Decision making (More effort)	Complex decision making (e.g. cars) • High motivation to search for information • High effort into learning and discovery • Evaluation both prior to and after purchase •	Variety seeking (e.g. snack foods) • Low motivation to search for information • Some effort into learning and discovery • Evaluation after purchase
Habit (Less effort)	Brand loyalty (e.g. athletic shoes) • Less effort into learning and discovery as consumer already has a product they are satisfied with • Evaluation based on experience with the product	Inertia (e.g. laundry detergent) • No motivation to search for information • No effort put into learning and discovery • Evaluation after purchase

Among traditional small scale farms the condition of adequate product information may be less likely to be satisfied. In such circumstances individuals will endeavour to follow a complex decision making process as closely as possible. The absence of information on the product is likely to at first prompt the consumer to devote greater efforts to searching for product information. If the consumer is unable to satisfy their information needs then they are likely to postpone purchase of the product. In a farming context this means postponing adoption of an innovation and continuing with existing technologies and practices.

The benefit or purchase criteria represent the key benefits sought by the consumer and generally reflect their usage situation. In the case of consumer goods the usage situation is often a function of the consumer's past experiences, their lifestyle and their personality (Assael, Reed and Patton 1995). For example, economy, dependability and safety are key purchase criteria for many consumers with families that are buying motor vehicles that will be used daily to transport family members, especially children. Having settled on a set of purchase criteria for deciding between products, the consumer then evaluates the products against the criteria and makes a choice.

Consumers can be grouped into market segments on the basis of similarities and differences in the key purchase criteria that they use to evaluate a product. Knowledge of the key purchase criteria that will be used by consumers in a segment can be employed to tailor products to meet the specific needs of consumers in that segment and promote products accordingly.

In the case of agriculture the purchase criteria that producers use to evaluate new technologies should reflect the key benefits the technology offers given producers' usage situations. In this instance the usage situation is likely to be a function of the farm context into which a new technology must be integrated. Broadly speaking, the farm context is the mix of practices and techniques used on the farm, and the biophysical and financial resources available to the farm business that influence the benefits and costs of adopting an innovation (Crouch 1981; Kaine and Lees 1994). Similarities and differences among farm contexts for an agricultural innovation will translate into similarities and differences in the key purchase criteria that producers will use to evaluate that innovation.

Given that the usage situation for agricultural innovations is defined by farm contexts, differences in farm contexts will result in different market segments for an innovation. Logically, the market for an innovation will be defined by the set of farm contexts for which the innovation generates a net benefit (see Kaine and Bewsell (2000); Bewsell and Kaine (2002); Kaine and Niall (2001) and Kaine and Niall (2003) for examples).

As is the case with consumer products, knowledge of similarities and differences in the key purchase criteria that will be used by producers to evaluate an innovation can be used to classify producers into segments, to tailor the innovation to meet the specific needs of producers in a segment, and to promote the innovation accordingly.

To the degree that the mix of farm practices, technologies and resources that influence the benefits and costs of adopting an innovation are different for different innovations, the purchase criteria used to evaluate innovations will change accordingly. This means purchase criteria are frequently innovation specific and often cannot be generalised across innovations. Gibon (1999), Dorward et al (2003) and other farming system researchers have also observed that the adoption of an innovation within a farming system often depends on a set of technical, economic and social characteristics that tend to be highly specific to the innovation.

Identifying purchase criteria

The use of complex decision making in high involvement purchasing implies that the purchaser develops explicit chains of reasoning to guide their decision making. This is consistent with explanation based decision theory, where the focus is on "reasoning about the evidence and how it links together" (Pennington and Hastie 1989). The idea is that farmers gather 'evidence' on the attributes of the technological alternatives available to them. This evidence is processed into a coherent causal model, or explanation, which is used to evaluate the extent to which the alternatives will meet their farming needs and upon which a decision is finally made (Cooksey 1996).

If the purchase criteria that producers use to evaluate innovations are defined by farm contexts, and if producers do base their evaluations of innovations on explicit chains of reasoning, then there should be shared and complementary patterns of reasoning among producers that adopt a technology and those that do not, and there should be an accompanying consistency in the decisions they reach. In other words, producers with similar farming contexts will offer similar explanations for the decision making, and these explanations will differ from those of producers whose farm contexts are dissimilar. Consequently, we interview producers that have adopted the technology of interest, those that have not, and (if they exist) producers that have tried and abandoned the technology. We seek to interview producers with different demographic characteristics and with agricultural enterprises that vary in terms of scale and location. Where necessary a 'snowballing' sampling technique (Cooper and Emory 1995) is employed to ensure we interview producers that differ on characteristics that emerge during the interviews to be influential factors in adoption decisions.

To identify the factors influencing producers' decisions we follow a convergent interviewing process (Dick 1998). Convergent interviewing is unstructured in terms the content of the interview. The interviewer employs standard laddering techniques (Grunert and Grunert 1995) to systematically explore the reasoning underlying the decisions and actions of the interviewee. Similar techniques are employed with groups to construct a shared understanding of an issue (see Parminter and Perkins 1996). In addition, we also interview researchers, extension and advisory staff to test our interpretation of interview outcomes against their particular perspectives.

Having identified the factors (purchase criteria) producers use to evaluate a technology we then distribute a mail questionnaire to gather statistical information on these criteria from a representative sample of producers. The survey provides data to statistically test hypotheses about relationships between purchase criteria and incidence of adoption, and to quantify the size of segments.

The results of the statistical analysis are used in workshops with researchers and extension or advisory staff to formulate priorities to guide research and extension strategies, often on a segment by segment basis. These priorities and strategies are then validated by interviewing producers from each of the target segments.

We have successfully applied these techniques to identify segments for technologies such as irrigation systems in the horticultural, viticultural, vegetable and dairy industries in Australia, breeding practices and animal health practices in sheep and cattle in Australia and New Zealand, and pest and disease management practises in horticulture and viticulture in Australia and New Zealand among others (see Kaine and Bewsell (2002); Burrows et al (2000); Bewsell and Kaine (2002); Kaine and Bewsell (2000); Kaine and Niall (2003); Kaine, Tarbotton and Bewsell (2003); Kaine and Bewsell (2003) and Bewsell, Kaine and Westbrooke (2003) respectively).

Note that in Australia and New Zealand these industries are mostly composed of family farms of varying scales together with a relatively small proportion of corporate farms. We have observed that the decision making principles described here apply with regard to the adoption of agricultural innovations with both types of enterprises. See, in particular, Kaine and Bewsell (2003) and Bewsell, Kaine and Westbrooke (2003).

Discussion

To summarise, the use of consumer behaviour theory as a model describing the adoption of agricultural practices suggests that family farmers can be classified into segments based on differences in the purchase criteria they employ to evaluate an innovation. These criteria reflect differences in their farming situation (or farm context).

Typically, in farming systems research farms are classified into systems or domains using a mix of biophysical, financial and physical criteria (Gibon et al 1999; Kobrich et al 2003). The objective is to classify farms into categories in such a way that the farms in a category are similar in that they are likely to face a common constraint. As the farms in a farming system are, in some sense, in similar circumstances then the same solution should apply to all farms in that system, more or less (Byerlee et al 1980). However, variety in farming contexts occurs within a farming system. In other words, the set of criteria that determine the commonality of a constraint are only a sub-set of the set of criteria that determine the fit of the prototypical solution to that constraint. This means that solutions are not universal and need to be adapted to different contexts within a farming system.

Consider, for example, laser graded, flood irrigated dairy enterprises in northern Victoria. These enterprises represent a major farming system in the Australian dairy industry. Automatic irrigation is feasible to implement on most, probably all farms in this system. However, the adoption of this technology is governed by farm layout in terms of paddock and channel layout (these determine the period of time that must be devoted to irrigation each day) and the extent to which irrigation must be undertaken outside daylight hours (Kaine and Bewsell 2000).

The procedure we have described in this paper to identify segments provides a conceptually sound and systematic means for identifying the broader set of criteria that influence the ‘fit’ of a solution within a farming system. This is done by identifying the diversity in farmers’ conceptions of their farming system. The application of this process provides information to better understand the degree of flexibility required of a prototype technology and a basis for recruiting farmer participants from a relevant range of contexts to participate in the adaptive research process (see Collinson 2001). For example, some irrigated fruit producers in northern Victorian have adopted micro-irrigation systems to save water; others have adopted this technology to improve their flexibility in timing orchard activities; while another group of producers in the same region have adopted this technology to save labour effort in their orchards (Kaine and Bewsell 2002).

The application of the process we have described is consistent with the philosophies underpinning farming systems research and participatory rural research in that the process for classifying farms into segments draws on the perceptions of the farmers themselves. Importantly, the consumer behaviour model explicitly acknowledges the widely recognised observation that resource poor farmers are rational-decision makers and effective managers of their resources (Chambers and Ghildyal 1985). Furthermore, the process we have described complements the application of many of the participatory techniques described by Dorward et al (2003) that have been developed in the conduct of farming systems research. Indeed, many of these techniques could be valuably employed in conducting the segmentation process itself.

Importantly, the principals underlying the process we have described should apply to decision making about the adoption of agricultural innovations by both commercial and non-commercial or traditional family farms, and corporate farms. While the set of factors that are used to evaluate an innovation might differ across these types of farm enterprises, the same principles will govern the decision making process that each follows. We have certainly found this to be the case for family farms and corporate farms across a range of industries and innovations in Australia and New Zealand.

Finally, the approach we have outlined also highlights the care that must be taken in interpreting the outcomes of group activities with farmers from a farming systems perspective. If the farmer participants in a group are drawn from a variety of farm contexts from within a farming system then the factors influencing the adoption of a prototype technology designed for that farming system will differ among members of the group. This may result in apparently conflicting claims among farmers regarding appropriate directions for adapting the prototype. In the absence of a clear understanding of the differences between segments the researchers, and the farmers themselves, may have difficulties reconciling the apparent conflict.

Conclusion

We believe that part of the solution to the difficulty for farming systems research of coping with variety in farming contexts can be found in the integration of farming systems approaches with approaches to understanding adoption behaviour based on consumer behaviour theory.

We believe the consumer behaviour approach to understanding adoption provides a conceptually sound and systematic procedure for classifying producers into segments based on the criteria they use to evaluate an innovation. We believe this approach is conceptually consistent with, and complementary to, the foundations of farming systems research and adaptive research and that the principles of this approach apply equally to corporate and family farming enterprises.

We believe that our approach provides farming systems research with a conceptually sounder and more systematic procedure for explaining and predicting the adoption of agricultural innovations. Consequently, the application of this approach has the potential to contribute significantly to the identification of innovations that will improve the sustainability of small scale farming systems.

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