

## HYBRID VIGOUR OF BEHAVIOURAL THEORIES IN THE AGRIBUSINESS RESEARCH DOMAIN. IS IT POSSIBLE?

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### ABSTRACT

Motives, values and attitudes are key components of the decision-making process. Behavioural studies in agribusiness focus on using these three components to understand the decision-making processes of farmers (Morris & Potter 1995). Literature on three behavioural theories is reviewed with the aim of concluding if the theories can be combined for agribusiness research. Fishbein and Ajzen's Theory of Reasoned Action (1975), Ajzen's Theory of Planned Behaviour (1991) and Rogers' Diffusion of Innovations Theory (1995) are empirically described and their application to agribusiness research is discussed. Findings suggest that although these behavioural theories lost popularity in applied research in the 1980s, they still have application to current rural sociology research. Research is also reviewed to show that the strengths of each behavioural theory can be "hybridised" to construct new valid and reliable theoretical frameworks.

### KEY WORDS

Behavioural theory, agribusiness, adoption, Diffusion of Innovations, Theory of Planned Behaviour, Theory of Reasoned Action.

## INTRODUCTION

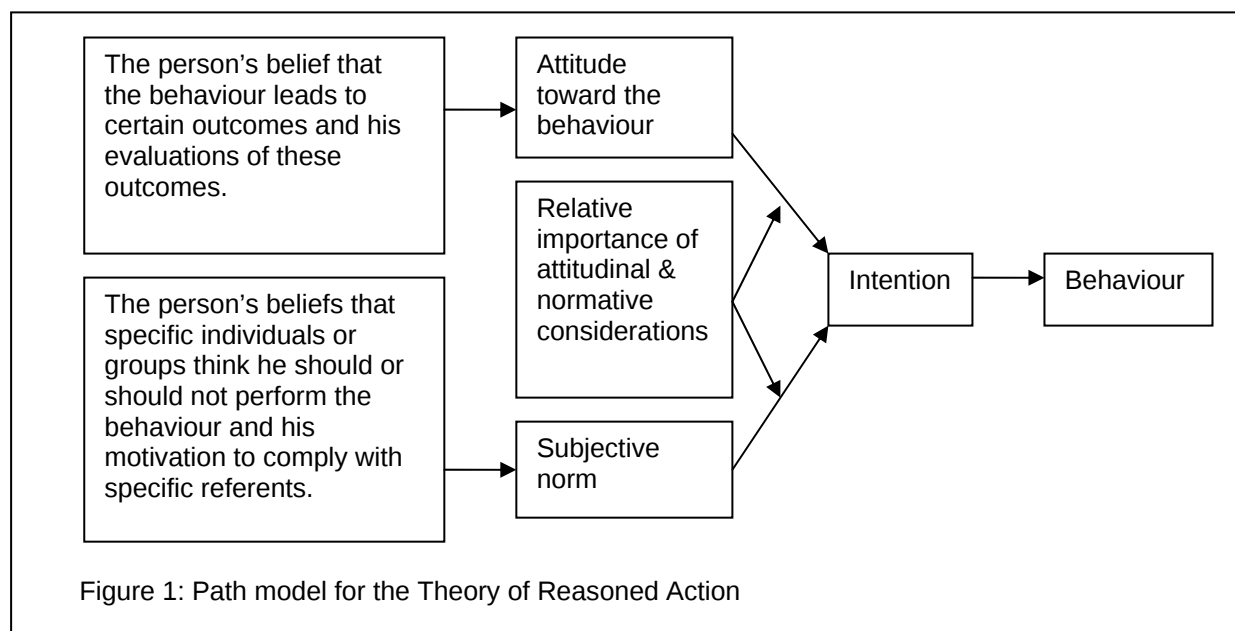
Agribusiness related studies based on the Theories of Reasoned Action and Planned Behaviour are sparse but those reviewed principally focus on farmers' conservation behaviours. In contrast, a plethora of literature on the Diffusion of Innovations shows its successful application in rural contexts since the 1940s (Fliegel 1993). The main focus of diffusion research is on the adoption of agricultural innovations such as herbicides, hybrid seed and fertilisers (Rogers 1995) with the most recent studies considering the uptake of genetically modified crops and modern agricultural practices in developing countries.

The aims of this paper are to present three behavioural theories used in agribusiness research and to determine if these can be successfully combined. Each theory is described and followed by a comprehensive, but not exhaustive, discussion of relevant studies. The discussions demonstrate that the theories have been successfully applied to the field of agribusiness and are reliable predictors of farmer behaviour. Conclusions are drawn regarding a combined approach to these theories.

## THEORY OF REASONED ACTION (TRA)

Fishbein and Ajzen's (1975) seminal text on the distinction between beliefs, attitudes, intentions and behaviours aimed to develop a "cumulative body of knowledge in the attitude area" (p. 520); and this it did. It was from this work that the authors' Theory of Reasoned Action was borne and, despite criticism (Charng, Piliavin & Callero 1988, Sheppard, Hartwick & Warshaw 1988), has remained a powerful tool for predicting an individual's intention or behaviour (Madden, Ellen & Ajzen 1992) within specified limits (Sheppard, Hartwick & Warshaw 1988).

Fishbein and Ajzen (1975, p. 511) argue that attitude and subjective norm indicate intention, all of which are said to be "the primary determinants of behaviour". The TRA therefore posits that intention is the mediating variable between attitude and subjective norm to predict any given behaviour of an individual (Figure 1).



The theory takes its name from a critical assumption the authors make, that is, “human beings are usually quite rational and make systematic use of information available to them.” (Ajzen & Fishbein 1980, p. 5). It also needs to be explained that this theory is based on determining the influences on an individual, and that a person acts with thoughtfulness and rational motives (Ajzen & Fishbein 1980).

Literature on the Theory of Reasoned Action is sparse in the field of agribusiness with few relevant studies located. Thompson and Panayiotopoulos (1999) tested the TRA in the context of UK dairy farmers and their attitude to buying feed for their herds. It was found that attitude is the key predictor of behavioural intention ( $r = 0.96$ ) while subjective norms did not improve the efficiency of the model ( $r = 0.29$ ). The latter finding was explained by the routine nature of buying cattle feed and also by the animal nutrition expertise held by the farmers in question. It was concluded that farmers buying feed for the first time may be more susceptible to complying with the expectations of salient referents than those who have been performing this behaviour for some time.

The aforementioned study concluded that attitude is a better predictor of behavioural intention than subjective norm. This finding was confirmed in another agribusiness related study on the adoption of olive oil in British kitchens in which Thompson, Haziris and Alekos (1994) found that attitudinal beliefs were the best predictors of intention to adopt ( $r = 0.71$  and  $p = < 0.001$ ); a correlation not as strong as Thompson and Panayiotopoulos' results but nonetheless still high. It was also found that including subjective norms as a measure of intention did not add any statistical strength to the model; an extraordinary result considering the 1999 study. Interestingly, the authors note that a preliminary study showed that perceived behavioural control, like subjective norms, did not contribute to the robustness of the model so the TRA was chosen as the research framework, rather than the Theory of Planned Behaviour.

Gorddard (1992) also found that the perceived behavioural control construct of the Theory of Planned Behaviour did not add significance to his research on Western Australian farmer conservation behaviours. His research found significant relationships between all the TRA constructs at the  $p \leq 0.10$  level. In this study, Gorddard showed how relationships will change between constructs in the presence or absence of particular variables. It was demonstrated that when attitude and subjective norms were disregarded in the model, behavioural beliefs, such as the influence of various tillage practices on factors such as wheat yield or soil structure, become significant (at  $p \leq 0.10$ ) whereas constraint beliefs, such as ability to access the organic market, remain significant, other constraint beliefs increase in significance, like the need to use conventional methods for crop establishment.

In another agribusiness related study on wine consumption, Thompson and Vourvachis (1995) reported results that contrasted with those above. They found that both subjective norms ( $r = 0.54$ ,  $\beta = 0.39$  and  $p = < 0.05$ ) were a better predictor of intention to drink wine and alcohol-free beer than attitude ( $r = 0.51$ ,  $\beta = 0.3$  and  $p = < 0.05$ ). This study showed that the opinions of friends, family and guests were unexpectedly the primary determinants of behaviour which, although this study is not considering the opinions of primary producers, agrees with many farmer-orientated behavioural studies (Gasson 1973, Gasson & Errington 1993, Kerridge 1978, Wilkening & Guerrero 1969, Albrecht & Albrecht 1992).

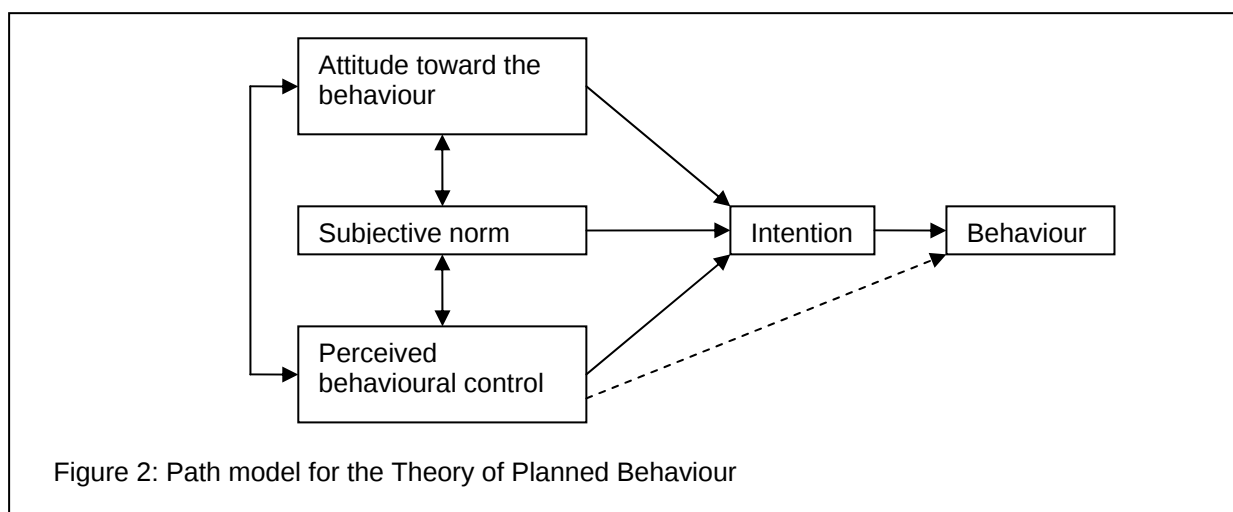
It therefore appears from the findings of Thompson and Vourvachis (1995) that subjective norms, as a construct, are better predictors of behavioural intentions than attitudes. However, since this paper is principally considering research from the agribusiness domain, the findings of Thompson and Panayiotopoulos (1999) are more poignant as they are more directly related to farmer behaviour.

Charng, Pillavin and Callero (1988) identified a limitation in the TRA in that while past testing might have produced good support for predicting a one-off type of behaviour, such as using a coupon or political voting preferences, there was little evidence to show that the TRA was useful for predicting repeat behaviours, such as continuation of smoking or psychological therapy. This research, conducted on the repeat behaviour of blood donors, found that the TRA provided the best results when supported with variables from identity-theory such as role-person merger, social relations and habit. They also found that as frequency of a behaviour increases, or “career” as it was termed, the importance of attitude and subjective norms eventually decreases.

From observations on the robustness of the TRA, researchers such as Thompson and Thompson (1996), Sarver (1983) and Bagozzi (1992) claimed that vital elements had been omitted from it and conducted research to test their hypotheses. These researchers said that the TRA failed to take into account situations where behaviour was not completely under the individual’s control. While many studies had failed to prove the TRA to be inadequate or incomplete in using intentions to predict behaviour, it was this fundamental idea that led to the next major development in attitude and behavioural studies: Ajzen and Fishbein’s Theory of Planned Behaviour.

## THEORY OF PLANNED BEHAVIOUR (TPB)

An extended model of Fishbein and Ajzen’s 1975 Theory of Reasoned Action, the Theory of Planned Behaviour, was first published by Ajzen in 1985 in a book edited by Kuhl and Beckmann and again by its creator in 1991. As can be seen from Figure 2, while ‘Intention’ is still the central construct of the theory, the construct of ‘Perceived behavioural control’ has been added. This enables the measurement of the extent to which an individual believes the outcomes of a behaviour can be controlled (Burton 2004). The addition of this new construct was borne from criticism that the TRA failed to account for behaviours associated with incomplete volitional control (Ajzen 1991, Madden, Ellen & Ajzen 1992). In essence, the theory uses knowledge of attitudes, subjective norms and perceived behavioural control to understand beliefs and thus predict behaviour. It is important to note, however, that the TPB uses perceived behavioural control to predict behaviour in two ways: through motivational factors and the intention to perform the behaviour (via the ‘Intention’ construct) and also through actual control via the direct link between the ‘Perceived behavioural control’ and ‘Behaviour’ constructs which is not mediated by intention (Madden, Ellen & Ajzen 1992).



The TPB is an extension of the TRA in that perceived behavioural control over performing the studied behaviour is added to subjective norms and attitude as constructs for predicting intention. Therefore, while there was contention over the primary predictor of intention in the TRA, perceived behavioural control now dominates as the key determinant of intention. While there are studies related to farmer decision making and the TPB, research in this area is sparse.

The TPB has been successfully used to understand farmers' adoption of conservation behaviours. Lynne *et al.* (1995) studied the conservation behaviour of North American strawberry farmers and found perceived behavioural control to be an important factor determining intention as adding it as a construct to the model provided a  $\chi^2$  of 9.49 and  $p < 0.05$ . The analysis of interviews from this study also found that all four constructs of the TPB (attitude, subjective norms, perceived behavioural control and intention) are necessary for the practical application of the theory if farmer behaviours are to be targeted for change.

Beedell and Rehman (1999 & 2000) also researched farmers' conservation behaviour using the TPB. Their mixed-method study (interviews and survey) compared the hedge-management behaviours of two types of UK farmers (those belonging and not belonging to an advisory group) and found that perceived behavioural control was not a significant determining factor of behavioural intention.

This study found that social pressure and moral obligation determined hedge-management behaviours with members of the "Farming and Wildlife Advisory Group" feeling more social pressure to maintain their hedges than the control group. The motivation to comply with five referent groups provided the measure of social pressure. It was found that the most significant levels of pressure came from within the farmers' own group (the Farming and Wildlife Advisory Group) and the local county council.

Of the measures for each TPB construct, it was found that good/bad attitude, agree/disagree for subjective norm and likely/unlikely for perceived behavioural control were the only measures statistically significant ( $\chi^2 = 6.46, 4.63$  and  $5.80$  respectively where  $p < 0.05$ ). The measures of most statistical significance were the sums of outcome evaluation and belief strength ( $\chi^2 = 11.05$  where  $p < 0.001$ ) and motivation to comply and normative belief ( $\chi^2 = 11.51$  where  $p < 0.001$ ).

Beedell and Rehman in 2000, using the same data set, however tested different hypotheses. First, to determine the frequency and intensity of conservation behaviours amongst the participants and second, to test the efficiency of the TPB in determining behavioural variation amongst farmers.

The findings were largely the same as those previously described although there was some variation in the outcomes of the social pressure and moral obligation constructs. While there was evidence for these constructs being associated, analysis revealed that farmers did not feel as much social pressure as self-generated internal pressure towards actively pursuing conservation behaviours. Similar to the 1999 study, perceived behavioural control was not a significant factor influencing intention to perform a conservation behaviour as the two groups in question were neutral in their attitudes towards hedge management, in terms of being very easy or very difficult, and both groups held very different perceptions of the behaviours being studied. The conclusion from this study was that the TPB is a good method of understanding variations in farmer behaviour but it was interesting to note the comments regarding the complexity of a TPB questionnaire. It was said that the questionnaire must be very precise and individual questions can often be regarded by participants as contorted; a finding also noted by East (1993).

Other studies on farmer conservation practices, by Gorddard (1991 and 1993), show that the TPB's perceived behavioural control construct added statistical significance to the TRA/TPB model. Gorddard's 1991 study showed that including this construct lifted the model's adjusted  $R^2$  value from 39.3 to 51.3 while significance remained at  $p \leq 0.001$ .

More recent research by Bergevoet, Ondersteijn, Saatkamp, van Woerkum and Huirne (2004) shows how studies using the TPB have developed in complexity. A survey of Dutch dairy farmers used factor analysis and stepwise regression to understand the relationship between farm size (measured by milk quota size) and individual farmer's goals. The findings from this study largely agree with those of other TRA/TPB studies although, unlike much rural sociology work (Dumas 1987, Lee & Stewart 1983, Makus, Lin, Carlson & Krebill-Prather 1990, Beedell & Rehman 1999 & 2000), farm size as an experimental factor was found to have no relevance to fulfilling farmers' intrinsic, expressive and social goals but was mainly explained by instrumental goals.

Analysis of the data began with testing farm size in association with off-farm income and owning a stud-breeding farm. There was a highly significant relationship between these variables ( $p < 0.001$ ) although  $R^2 = 0.25$ . The  $R^2$  value showed that the three test factors accounted for 25% of the variation in milk quota size. The  $R^2$  value increased to 0.38, without decreasing statistical significance, when the traditional TPB constructs of attitudes, subjective norms and perceived behavioural control were added to the model. While these  $R^2$  values are quite low, the research showed that variation in the amount of milk Dutch dairy farmers produce is explained by the emphasis these farmers put on attitudes, subjective norms and perceived behavioural control.

Like the research of Lynne *et al.* (1995) and Beedell and Rehman (1999 & 2000) this study concluded that the TPB can explain farmer behaviour and, most importantly, can identify the drivers that influence farmers' decision-making processes. It was found that goals, attitudes, perceived behavioural control and subjective norms greatly influence farmer behaviour and people who target these drivers can influence economic and non-economic-based behaviours. It also showed that barriers imposed by industry and past experiences also influence farmer behaviour.

So far it has been shown that the TPB is suitable for agribusiness related research. However, are there many cautionary tales providing insight into some negative aspects of this theory. The first criticism of the TPB comes from the author himself (Ajzen 1991) in his seminal paper in which he admits that, at the time of publication, the strength of correlation between the constructs was not as strong as desired in terms of "global measures". It was also said that while the relationships between the theory's constructs had been proven, their exact form was unknown. However, shortly after the theory's release empirical studies proved that it was a reliable, standardised tool for predicting and explaining behaviour (Ajzen & Driver 1991).

Since the TPB was first published, research has shown that not only is there significant relationships between the theory's constructs but that it is possible to include other factors in the theory. Ajzen (1991) forecast that this would be the case and, more than ten years later, Burton (2004) cites studies that have successfully integrated additional factors to the TPB on an "as needed" basis. Such factors included habit, moral obligation and self-identity although only the construct of self-identity was nominated as worth using in farming social psychology research. As previously explained, "past behaviour" is another construct that proved to be worth considering.

Despite criticisms, research by Beedell and Rehman (1999 & 2000) proved the TPB to be a suitable tool for measuring farmer behaviour in two ways: to find out if all farmers behave in

the same way and if not, are differences in their beliefs explained by difference in their behaviours? The TPB was also successfully used by Lynne *et al.* (1995) in predicting the technology adoption behaviour of strawberry farmers. In conclusion, there is agreement that the TPB is useful for understanding behaviour by identifying major influencing factors and that this research framework is not widely used due to its complexity in terms of its questionnaire development and analytical requirements.

## DIFFUSION OF INNOVATIONS

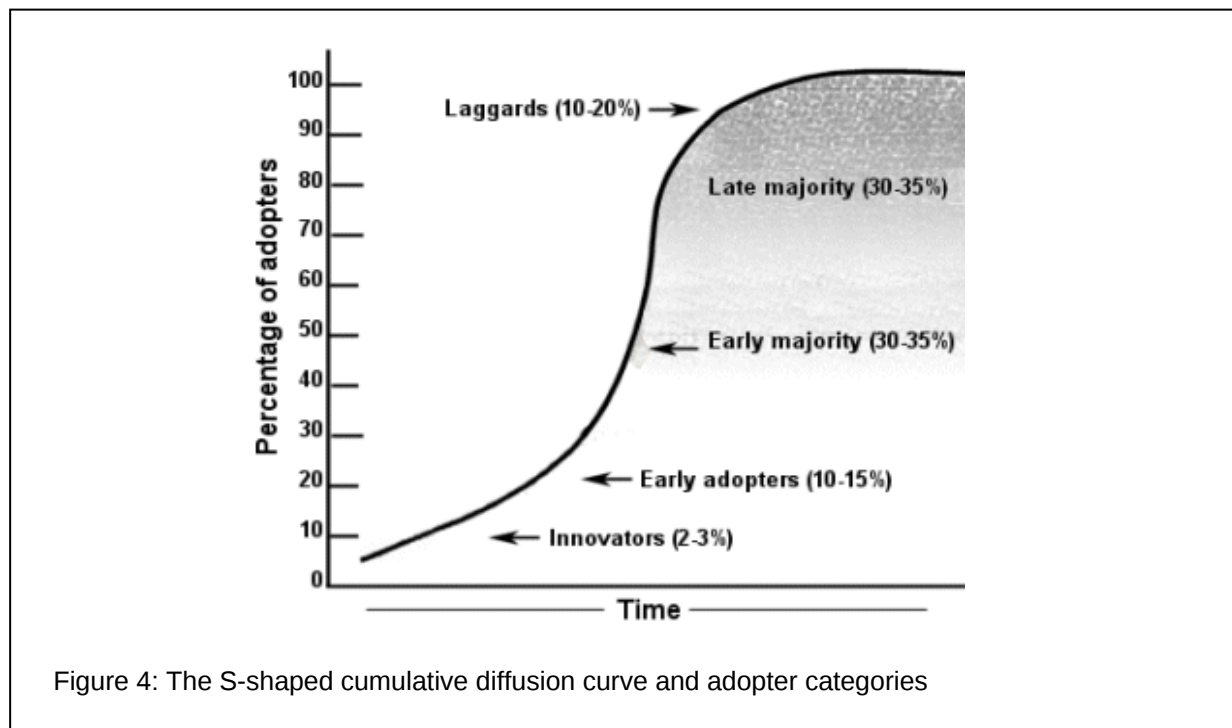
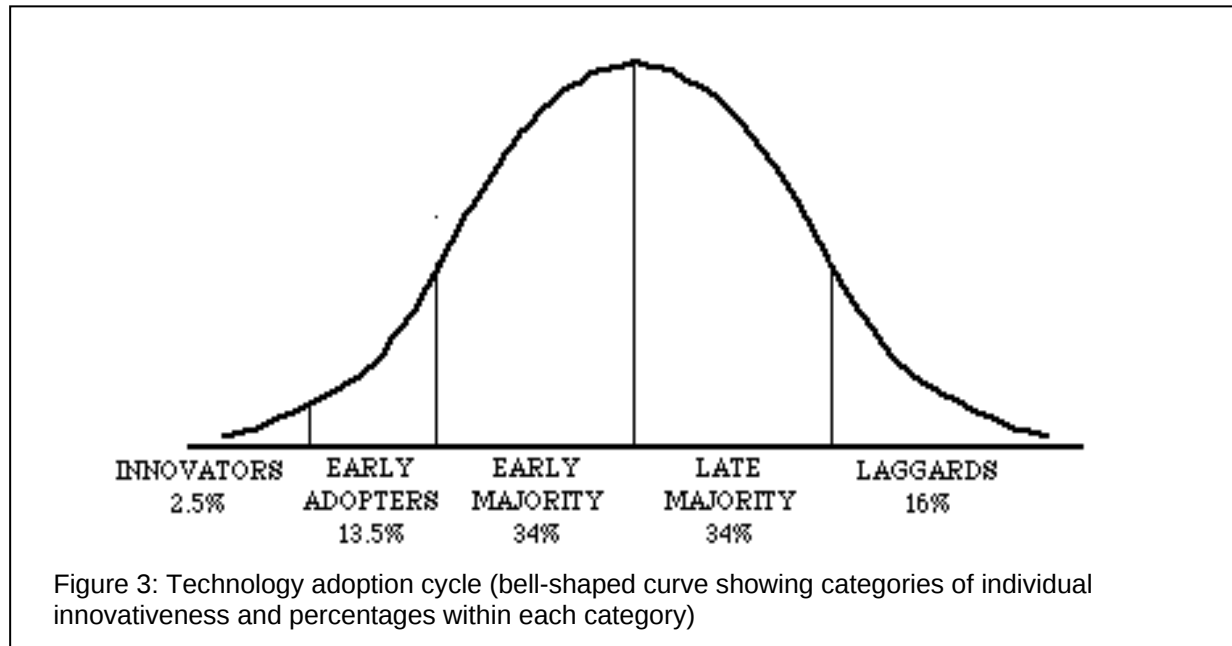
Diffusion is defined by Rogers (1995, p. 5) as “the process by which an innovation is communicated through certain channels over time among members of a social system.” and has successfully been applied in rural contexts since the 1940s (Fliegel 1993) with the focus being on the uptake of agricultural innovations such as herbicides, hybrid seed and fertilisers (Rogers 1995). Fisher, Norvell, Sonka and Nelson (2000) explain that diffusion differs from adoption in that it is the process by which new technologies are spread among users whereas adoption is said to be an individual, internal decision.

Rogers (1958 & 1995) and Fliegel (1993) refer to the seminal research by Ryan and Gross (1943) who studied the diffusion of sowing hybrid corn by Iowa farmers in the USA. It was this research that provided the fundamental characteristics of the theory: the classic “diffusion of innovations” paradigm. This study promoted the significance of communication as a construct in the diffusion model and provided the generic bell-shaped (Figure 3) and sigmoid (Figure 4) curves of adoption on which a plethora of rural sociology research has been based.

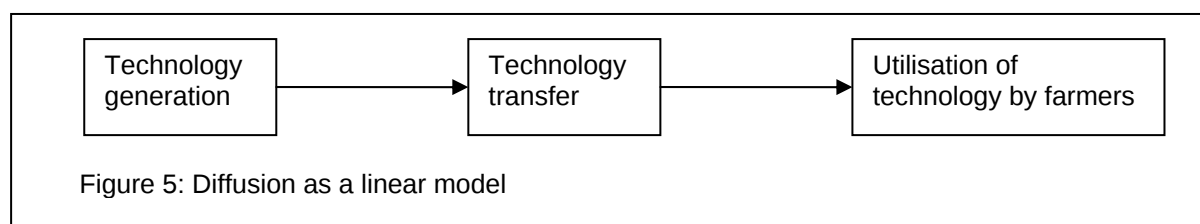
Communication was one of the recurring themes in Rogers’ (1995) description of each category of adopter. Among other characteristics, members of each category were described in terms of their communication activities with other members and how far they reached outside the boundaries of their system to access information on a new idea. For example, the term “cosmopolite” (p. 263) was used to describe vast geographic distances between communication networks of innovators whereas those adopters more towards the middle of the bell-shaped curve, were seen as “localites” (p. 264-5). This term describes the information networks of Early Adopters, Early Majority and Late Majority people who tend to seek information from local sources. Laggards were the most fervent localites whose adoption behaviour is at the far right of the bell-shaped curve and were viewed as “near isolates in the social network” (p. 265). Their point of reference for the adoption of a new idea was not associated with social networks, but with how things were done in the past.

Ryan and Gross (1943) identified communication as being extremely important to the diffusion of innovations process. Rogers (1995) provides a definition immediately after that for diffusion: “Communication is a process in which participants create and share information with one another in order to reach a mutual understanding.” (p. 5-6).

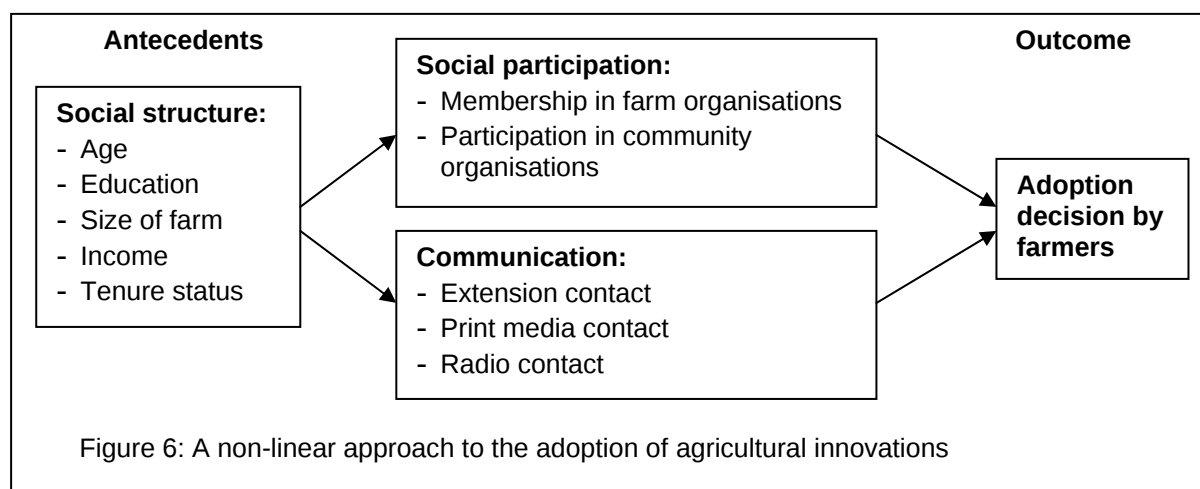
So far communication has been discussed in terms of social networks, however research findings emphasise the importance of information networks in aiding the diffusion of innovations. Research published as early as 1950 (Wilkening) reports the importance of agricultural agencies and mass media as conduits for information diffusion; research has continued to find support for these methods ever since (see Longo 1990, Saltiel, Bauder & Palakovich 1994). However the most important means of information transfer has been found to be peer relationships (Wilkening 1950, Copp, Sill & Brown 1958, Longo 1990, Saltiel, Bauder & Palakovich 1994), with social class and size of land holding also found to be factors influencing information uptake (Wilkening 1950, Feder & Slade 1984).



Now that the components of the Diffusion phenomenon have been described, the process can be detailed. Many authors who have studied the empirical nature of diffusion (such as Ryan & Gross 1943, Ajzen & Fishbein 1980, Quaddus & Xu 2005) take a classical, linear view of the process with external factors contributing to perceptions which, in turn, give rise to diffusion. Rogers (1995) provides a linear model of the diffusion process within agriculture (Figure 5).



However, Fliegel (1993), with support from Feder and Umali (1993), proposes a more widely accepted, non-linear approach to the adoption of agricultural innovations. He argues that the linear approach tends to restrict diffusion to a rational, planned process that relies on institutions such as government departments, rather than viewing the farmer as a passive individual who responds to random forces related to social participation and communication (Figure 6).



In terms of diffusion of innovations in agriculture and rural sociology, Rogers (1995) reviewed 3,890 publications and found rural sociology to have provided the greatest contribution to research in the field of diffusion. Some 845 rural sociology publications were identified with the next greatest contribution coming from marketing and management with 585 publications. It was said that research on diffusion of agricultural technologies provided useful leads to agricultural scientists to have their work used by farmers.

Rogers (1995) and Ruttan (1996) claim that surplus food production and the farm crisis in the USA started the demise of diffusion research in rural sociology in the 1970s. However it appears that there has been a resurgence in the popularity of agricultural diffusion research as shown by studies on the adoption of modern farming systems in developing countries (Masters 2005, Abdulai & Huffman 2005, Weir & Knight 2004, Munshi 2004, Rahman 2003, Neill & Lee 2001, de Sousa & Busch 1998, Mishra & Hossain 2000), the uptake of

conservation practices in farming (Pampel & van Es 1977, Forte-Gardner, Young, Dillman & Carroll 2004, Neill & Lee 2001, Feder & Umali 1993) and the use of biotechnology in farming systems of developed countries (Hategekimana & Trant 2002, Stewart, Harding & Day 2002) or both (Qaim & de Janvry 2005, Pelaez & Schmidt 2002). Research has also re-emerged on the diffusion of grain production technology (Walburger, Klein & Folkins 1999, Forte-Gardner et. Al. 2004, Rajesh & Varadarajan 2000).

Despite the apparent popularity of this concept, diffusion theory and its generic bell-shaped and S-shaped models has been criticised. Major areas of criticism include variation found in the rate of adoption of various technologies (Fliegel & Kivlin 1962, Linder 1986, Fisher *et al.* 2000), its application to agricultural systems in developing nations (Goss 1979 & Ruttan 1996) and its narrow application to individual farmers, as opposed to agribusiness firms (Jensen 1982 & 2001, van Everdinger & Wierenga 2002, Hausman 2005). While these studies present valid criticisms, there appears to be more successes than failures. The few instances in which diffusion of innovations has not been successful suggests that the theory's application is best restricted to research questions related to understanding farmer behaviours in community settings of developed nations.

## THE COMBINED APPROACH – AN EXAMPLE

The strengths and weaknesses of three behavioural theories have been discussed. From here, this investigation turns to finding if the strengths of these theories can be combined to provide theoretical frameworks that are equal to, or better, than their “parents”. Combining various behavioural theories has been applied successfully on numerous occasions in business and technology research (Intrapairot 2000, Xu 2003 and Hofmeyer 2005) but apparently only once in agribusiness (Tutkun & Lehmann 2006).

Tutkun and Lehmann (2006) combined the Theory of Planned Behaviour and Diffusion of Innovations to explain farmer conversion to particularly animal-friendly stabling systems in Switzerland. Their explanation for this approach was that the weaknesses of TPB can be bypassed and the traditional model enhanced by including diffusion constructs. In their study, the authors obtained data from 176 Swiss farmers and used structural equation modelling to test the reliability and validity of their combined model. Results were extremely encouraging in that seven of the eight relationships tested resulted in a  $p < 0.001$  level of significance with the all-important communication construct from the Diffusion of Innovations explaining an astounding 76% of the variation in adoption behaviour. The authors also calculated goodness of fit using four measures ( $\chi^2$ :Degrees of Freedom, Root Mean Square Error of Approximation, Goodness of Fit Index and Adjusted Goodness of Fit Index), all of which were reported to be satisfactory thus indicating that the model was consistent with its theoretical basis.

While there has only been one agribusiness related study that has taken a combined approach to behavioural research, the results provide a great deal of inspiration for development of this idea for future research. Tutkun and Lehmann's unique study exhibits theoretical power to suggest that it is possible to combine the strengths of these two influential behavioural theories. A truly exciting prospect.

## SUMMARY AND CONCLUSIONS

This review has shown that while there has been growth in complexity of the behavioural theories under consideration, there are themes within each theory that have stayed constant since their inception.

Agricultural studies on the TRA are relatively few since the theory was not fully appreciated until it had the “perceived behavioural control” construct added to make it the TPB. Reviews of the TPB showed that each of its constructs is highly applicable to agricultural research although “past experience” and “self-identity” also have a positive effect on TPB model’s strength.

Finally, studies reviewed on Rogers’ diffusion of innovation theory showed that the original bell-shaped curve and the categories of adopters are still appropriate for current agricultural research. It was also found that this research paradigm has been successfully applied in agricultural finance and economics. It has yielded sound conclusions about behavioural determinants regarding farmers’ choice of marketing options so will thus be highly applicable to agribusiness research.

In conclusion, description and discussion of the aforementioned theories have yielded both pros and cons for each. Research has found both praise and criticism for the theories however, in general, it can be said that there is sufficient empirical evidence to suggest that the TRA, TPB and Diffusions of Innovations theory all have value in agribusiness research. Furthermore, new research provides evidence that these theories can be “hybridised” opening the door to a broader range of research domains previously overlooked.

This paper has posed two questions: 1) Is it possible to combine the virtues of behavioural theories? 2) If so, will the results of such a combined model be valid and reliable? In order to address these questions, a critical analysis was undertaken of three traditional and popular behavioural theories widely used in agribusiness research. This analysis showed strengths and weaknesses of the theories and new research was reviewed to prove that it is possible to combine these theories and that the results will be reliable and valid. It is acknowledged that more research is needed to conclusively verify that a combination of the behavioural theories is possible however, the review undertaken herein provides a starting-point for more research to contribute to this body of knowledge.

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## **REFERENCES**

- Abdulai, A. & Huffman, W.E. (2005) ‘The diffusion of new agricultural technologies: The case of crossbred-cow technology in Tanzania’, *American Journal of Agricultural Economics*, vol. 87, no. 3, pp. 645-660.
- Ajzen, I. & Fishbein, M. (1980) *Understanding Attitudes and Predicting Social Behavior*, Prentice-Hall, New Jersey, USA.
- Ajzen, I. (1985) ‘From intentions to actions: A theory of planned behavior’, in J. Kuhl & J. Beckmann (eds), *Action-control: From cognition to behavior*, Springer, Heidelberg, pp. 11-39.

- Ajzen, I. (1991) 'The theory of planned behavior', *Organizational Behavior and Human Decision Processes*, vol. 50, no. 2, pp. 179-211.
- Ajzen, I. & Driver, B.L. (1991) 'Prediction of leisure participation from behavioural, normative and control beliefs: An application of the Theory of Planned Behaviour', *Leisure Sciences*, vol. 13, no. 3, pp. 185-204.
- Albrecht, D. E. & Albrecht, S. L. (1996) 'Family structure among urban, rural and farm populations: Classic sociological theory revisited', *Rural Sociology*, vol. 61, no. 3, pp. 446-463.
- Bagozzi, R.P. (1992) 'The self-regulation of attitudes, intentions, and behavior', *Social Psychology Quarterly*, vol. 55, no. 2, pp. 178-204.
- Beedell, J. & Rehman, T. (1999) 'Explaining farmers' conservation behaviour: Why do farmers behave the way they do?' *Journal of Environmental Management*, vol. 57, no. 3, pp. 165-176.
- Beedell, J. & Rehman, T. (2000) 'Using social-psychology models to understand farmers' conservation behaviour', *Journal of Rural Studies*, vol. 16, no. 1, pp. 117-127.
- Bergevoet, R. H. M., Ondersteijn, C. J. M., Saatkamp, H. W., van Woerkum, C. M. J. & Huirne, R. B. M. (2004) 'Entrepreneurial behaviour of Dutch dairy farmers under a milk quota system: Goals, objective and attitudes', *Agricultural Systems*, vol. 80, no. 1, pp. 1-21.
- Burton, R. J. F. (2004), 'Reconceptualising the 'behavioural approach' in agricultural studies: a socio-psychological perspective', *Journal of Rural Studies*, vol. 20, no. 3, pp. 359-371.
- Charng, H., Piliavin, J.A. & Callero, P.L. (1988), 'Role identity and reasoned action in the prediction of repeated behaviour', *Social Psychology Quarterly*, vol. 51, no. 4, pp. 303-317.
- Copp, J. H., Sill, M. L. & Brown, E. J. (1958) 'The function of information sources in the farm practice adoption process', *Rural Sociology*, vol. 23, no. 2, pp. 146-157.
- de Sousa, I. S. F. & Busch, L. (1998) 'Networks & Agricultural Development: The case of soybean production and consumption in Brazil', *Rural Sociology*, vol. 63, no. 3, pp. 349-371.
- Dumas, T. L. (1987) An analysis of management practices - Louisiana Sheep Producers' Association, 1986, Educa.D. thesis, Louisiana State University and Agricultural & Mechanical College.
- East, R. (1993) 'Investment decisions and the theory of planned behaviour', *Journal of Economic Psychology*, vol. 14, no. 2, pp. 337-375.
- Feder, G. & Slade, R. (1984) 'The acquisition of information and the adoption of new technology', *American Journal of Agricultural Economics*, vol. 66, no. 3, pp. 312-320.
- Feder, G. & Umali, D. L. (1993) 'The adoption of agricultural innovation: a review', *Technological Forecasting and Social Change*, vol. 43, pp. 215-239.
- Fishbein, M. & Ajzen, I. (1975) *Belief, Attitude, Intention and Behavior – An introduction to theory and research*, Addison-Wesley Publishing Company, USA.
- Fisher, D. K., Norvell, J., Sonka, S. & Nelson, M. J. (2000), 'Understanding technology adoption through system dynamics modelling: implication for agribusiness management', *International Food and Agribusiness Management Review*, vol. 3, no. 3, pp. 281-296.
- Fliegel, F. (1993) *Diffusion Research in Rural Sociology*, Greenwood, Westport, USA.

- Fliegel, F. C. & Kivlin, J. E. (1962) 'Farm practice attributes and adoption rates', *Social Forces*, vol. 40, no. 4, pp. 364-370.
- Forte-Gardner, O., Young, F.L., Dillman, D.A. & Carroll, M.S. (2004) 'Increasing the effectiveness of technology transfer for conservation cropping systems through research and field design', *Renewable Agriculture and Food Systems*, vol 19, no. 4, pp. 93-114.
- Gasson, R. (1973) 'Goals and values of farmers', *Journal of Agricultural Economics*, vol. 24, no. 3, pp. 521-542.
- Gasson, R. & Errington, A. (1993) 'Objectives, goals and values in the family farm', in *The Farm Family Business*, Cab International, United Kingdom, pp. 88-113.
- Gorddard, B.J. (1991) The adoption of minimum tillage in the Western Australian wheatbelt, University of Western Australia, Agricultural economics discussion paper no. 3/91.
- Gorddard, B.J. (1992) 'Barriers to the adoption of conservation tillage in Western Australia', in *Proceedings of the 7th ISCO conference*, Sydney, pp. 391-403.
- Gorddard, B.J. (1993) Beliefs, attitudes and conservation behaviour, The University of Western Australia, Nedlands. Retrieved: 16 March 2006, from [http://auth.lis.curtin.edu.au/cgi-bin/auth-ng/eres\\_display.cgi?url=DC60003447.pdf&copyright=1](http://auth.lis.curtin.edu.au/cgi-bin/auth-ng/eres_display.cgi?url=DC60003447.pdf&copyright=1).
- Goss, K. F. (1979) 'Consequences of diffusion of innovations', *Rural Sociology*, vol. 44, no. 4, pp. 754-772.
- Hategekimana, B. & Trant, M. (2002) 'Adoption and diffusion of new technology in agriculture: genetically modified corn and soybeans', *Canadian Journal of Agricultural Economics*, vol. 50, no. 4, p. 357.
- Hausman, A. (2005) 'Innovativeness among small businesses: Theory and propositions for future research', *Industrial Marketing Management*, vol.34, no. 8, p. 773.
- Hofmeyer, G.D. (2005) An investigation of the factors that influence the intention to adopt business to business (B2B) trading exchanges in small businesses in Western Australia, PhD thesis, Curtin University of Technology.
- Intrapairot, A. (2000) A study on the adoption and diffusion of information and communication technologies in the banking industry in Thailand using multiple-criteria decision making and system dynamics approaches, PhD thesis, Curtin University of Technology.
- Jensen, R.A. (1982) 'Adoption and diffusion of an innovation of uncertain probability', *Journal of Economic Theory*, vol. 27, no. 1, pp. 182-193.
- Jensen, R.A. (2001) 'Strategic intrafirm innovation adoption and diffusion', *Southern Economic Journal*, vol. 68, no. 1, pp. 120-133.
- Kerridge, K. W. (1978) 'Value orientations and farmer behaviour - An exploratory study', *Quarterly Review of Agricultural Economics*, vol. 31, no. 1, pp. 61-72.
- Lee, L. K. & Stewart, W. H. (1983) 'Landownership and the adoption of minimum tillage', *American Journal of Agricultural Economics*, vol. 65, no. 2, pp. 256-264.
- Linder, R. K. (1986) 'Adoption and diffusion of technology: An overview', *Proceedings of the Australian Centre for International Agricultural Research Conference*, Bangkok, Thailand, pp. 144-151.

- Longo, R. M. J. (1990) 'Information transfer and the adoption of agricultural innovations', *Journal of the American Society for Information Science*, vol. 41, no. 1, pp. 1-9.
- Lynne, G. D., Casey, C. F., Hodges, A. & Rahmani, M. (1995) 'Conservation technology adoption decisions and the theory of planned behavior', *Journal of Economic Psychology*, vol. 16, no. 4, pp. 581-598.
- Madden, T.J., Ellen, P.S. & Ajzen, I. (1992) 'A comparison of the Theory of Planned Behavior and the Theory of Reasoned Action', *Personality and Social Psychology Bulletin*, vol. 18, no. 1, pp. 3-9.
- Makus, L. D., Lin, B., Carlson, J. & Krebill-Prather, R. (1990) 'Factors influencing farm level use of futures and options in commodity marketing', *Agribusiness*, vol. 6, no. 6, pp. 621-631.
- Masters, W.A. (2005) 'Research prizes: A new kind of incentive for innovation of African agriculture', *International Journal of Biotechnology*, vol. 7, no. 1-3, p. 195.
- Mishra, S.N. & Hossain, M.M. (2000) 'Role of Krishi Vigyan Kendra in diffusion of farm and allied technology among farmers of Kalahandi district, Orissa', *Indian Journal of Agricultural Economics*, vol. 55, no. 3, pp. 554-556.
- Morris, C. & Potter, C. (1995) 'Recruiting the new conservationists: Farmers' adoption of agri-environmental schemes in the UK', *Journal of Rural Studies*, vol. 11, vol. 1, pp. 51-63.
- Munshi, K. (2004) 'Social learning in a heterogeneous population: Technology diffusion in the Indian Green Revolution', *Journal of Development Economics*, vol. 73., no. 1, p. 185.
- Neill, S.P. & Lee, D. R. (2001) 'Explaining the adoption and disadoption of sustainable agriculture: The case of cover crops in northern Honduras', *Economic Development and Cultural Change*, vol. 49, no. 4, pp. 793-821.
- Pelaez, V. and Schmidt, W. (2002) 'The dissemination of genetically modified organisms in Brazil', *International Journal of Biotechnology*, vol. 4, no. 2, p. 211.
- Pampel, F. & van Es, J. C. (1977) 'Environmental quality and issues of adoption research', *Rural Sociology*, vol. 42, no. 1, pp. 57-71.
- Qaim, M. & de Janvry, A. (2005) 'BT cotton and pesticide use in Argentina: Economic and environmental effects', *Environment and Development Economics*, vol. 10, no. 2, p. 179.
- Quaddus, M. & Xu, J. (2005) 'Adoption and diffusion of knowledge management systems: Field studies of factors and variables', *Knowledge-Based Systems*, vol. 18, no. 2-3, pp. 107-115.
- Rahman, S. (2003) 'Environmental impacts of modern agricultural technology diffusion in Bangladesh: An analysis of farmers' perceptions and their determinants', *Journal of Environmental Management*, vol. 68, no. 2, p. 183.
- Rajesh, R. & Varadarajan, S. (2000) 'Constraints in diffusion of new farm technology in dry farming region: A critical analysis', *Indian Journal of Agricultural Economics*, vol. 55, no. 3, pp. 563-565.
- Rogers, E. M. (1958) 'Categorizing the adopters of agricultural practices', *Rural Sociology*, vol. 23, no. 4, pp. 345-354.
- Rogers, E. M. (1995) *Diffusion of Innovations*, 4th edn, The Free Press, New York.
- Ruttan, V.W. (1996) 'What happened to technology adoption-diffusion research?' *Sociologia Ruralis*, vol. 36, no. 1, pp. 51-73.

- Ryan, B. & Gross, N.C. (1943) 'The diffusion of hybrid seed corn in two Iowa communities', *Rural Sociology*, vol. 8, no. 1, pp. 15-24.
- Sarver, V. T. (1983) 'Ajzen and Fishbein's "Theory of Reasoned Action": A critical assessment', *Journal for the Society of Social Behaviour*, vol. 13, no. 2, pp. 155-163.
- Saltiel, J., Bauder, J. W. & Palakovich, S. (1994) 'Adoption of sustainable agricultural practices: Diffusion, farm structure and profitability', *Rural Sociology*, vol. 59, no. 2, pp. 333-349.
- Sheppard, B.H., Hartwick, J. & Warshaw, P.R. (1988) 'The theory of reasoned action: a meta-analysis of past research with recommendations for modifications and future research', *Journal of Consumer Research*, vol. 15, no. 3, pp. 325-343.
- Stewart, P.A., Harding, D. & Day, E. (2002) 'Regulating the new agricultural biotechnology by managing innovation diffusion', *American Review of Public Administration*, vol. 32, no. 1, pp. 78-100.
- Thompson, K.E., Haziris, N. & Alekos, P.J. (1994) 'Attitudes and food choice behaviour', *British Food Journal*, vol. 96, no. 11, pp. 9-13.
- Thompson, K.E. & Panayiotopoulos, P. (1999) 'Predicting behavioural intention in a small business context', *Journal of Marketing Practice*, vol. 5, no. 3, pp. 89-96.
- Thompson, K.E. & Vourvachis, A. (1995) 'Social and attitudinal influences on the intention to drink wine', *International Wine Marketing Journal*, vol. 7, no. 2, pp. 35-44.
- Thompson, N.J. & Thompson K.E. (1996) 'Reasoned action theory: An application to alcohol-free beer', *Journal of Marketing Practice*, vol. 2, no. 2, pp. 35-48.
- Tutkun, A. & Lehmann, B. (2006) 'Explaining the conversion to particularly animal-friendly stabling system of farmers of the Obwalden Canton, Switzerland - Extension of the Theory of Planned Behavior within a Structural Equation Modeling Approach', paper presented to the 80th Agricultural Economics Society conference, Paris, 30-31 March.
- van Everdinger, Y. & Wierenga, B. (2002) 'Intra-firm adoption decisions: Role of inter-firm and intra-firm variables', *European Management Journal*, vol. 20, no. 6, p. 649.
- Walburger, A. M., Klein, K. K. & Folkins, T. (1999) 'Diffusion of wheat varieties in three agro-climatic zones of western Canada', *Canadian Journal of Agricultural Economics*, vol. 47, no. 3, pp. 293-304.
- Weir, S. & Knight, J. (2004) 'Externality effects of education: Dynamics of the adoption and diffusion of an innovation in rural Ethiopia', *Economic Development and Cultural Change*, vol. 53, no. 1, pp. 93-204.
- Wilkenning, E. A. (1950) 'Sources of information for improved farm practices', *Rural Sociology*, vol. 15, no. 1, pp. 19-30.
- Wilkenning, E. A. & Guerrero, S. (1969) 'Consensus in aspirations for farm improvement and adoption of farm practices', *Rural Sociology*, vol. 34, no. 2, pp. 182-196.
- Xu, J. (2003) A study of the factors influencing knowledge management systems diffusion in Australia, PhD thesis, Curtin University of Technology.