"We Work as a Team Really": Gender Homophily on Australian Cotton Farms

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Abstract

This paper is based on an ongoing study that looks at farm management practices by Australian women cotton growers using farm management software, most particularly an agricultural decision support system, *CottonLOGIC*. The study is informed through a theoretical framework of structuration theory as a metatheory for probing the recursiveness of farm management and technology usage, and diffusion of innovations theory as a lower-level theory for analysing software adoption characteristics. Empirical research indicates that effective information exchange flows from homophilous communication. In this paper, the principles of homophily and heterophily in communication networks were initially drawn from diffusion theory. The findings suggest that despite apparent gender disparities, the presence of empathy and shared goals between farming partners overrides 'gender heterophily' to become gender homophily. Therefore cotton growers are informed of scientific research through homophilous communication, influencing the construction and reconstruction of innovative software usage and existing farm management practices.

Keywords: Communication, homophily, heterophily, gender, networks, diffusion theory, structuration theory, farm management, cotton, Australia

Introduction

In an earlier paper (Gartshore, 2004), the author explored the importance of communication and cooperation in information exchange and its influence on the effective reconstruction of farm management practices and technology usage. The paper was based on a pilot study into women's use of an agricultural computer-based decision support systems (DSS), *CottonLOGIC*, for farm management in the Australian cotton industry. This paper advances the theme of technology transfer by looking at the impact of homophilous communication within rural social networks on technology diffusion. In particular, the paper explores the concepts of gender homophily and 'gender heterophily'. The findings are from an extended study that includes the pilot study and several field studies.

Despite only some 1200 cotton growers in Australia, cotton has become Australia's fourth largest agricultural export (Cotton Research and Development Corporation, 2004). Nevertheless, cotton management is becoming increasingly complex with the need to sustain reliable crop production while making the best use of water and soil resources, utilising effective pest and weed management, as well as limiting environmental impacts (The Australian Cottongrower, 2004). Innovative technologies such as agricultural DSS are considered keys to

the adoption of sustainable farming systems (Hearn & Bange, 2002).

The portrayal of women in farming has been the subject of many studies both in Australia and overseas. Stewart (1997), in a case study which explores the gendering of interactive communication technologies in use on Australian family cotton farms, found that farm women's lack of confidence as controllers of data meant that they often avoided responsibility for utilising computer-based information systems for decision making purposes. Even so, there is evidence that many rural women are increasingly aware of the possibilities of computers for decision making encompassing new and innovative farm management practices.

In her research into the lives of Australian farm women, Alston (1995) argues that farm roles have developed based on gender stereotypes and that traditional divisions of labour prevail. Male farmers are participants in the 'more important' public sphere of outdoor work while farm women have become associated with the less visible private sphere of housework and children. This "domestic work has come to be devalued because it is unpaid and not directly geared to agricultural production and the marketplace" (Alston, 1995, p.24). The theme of the 'invisibility' of women farmers emanated from research by Sachs (1983) and has resonated through feminist studies of Australian rural women. Further, James (1989) in the introduction to her book claims that despite the increase of legal farm partnerships, the participation of women in decision making on the Australian family farm is unclear. Moreover, Australian government studies found evidence that divisions of responsibility in farm management, largely based on gender, may actually contribute to poor decision making (Daniels & Woods, 1997).

The value of women's work has engaged sociologists beyond the farm gate. Sharpe (1992) in a reader on human societies edited by Anthony Giddens, discusses the difference between paid work outside the home and unpaid domestic work in a British urban setting. She argues that women's self-esteem may become bound up with the care and services provided to family members, and notes that "this unrecognized work is in effect the service and maintenance of the workers of today and tomorrow. It *is* related to the external world of production, but indirectly" (Sharpe, 1992, p.56).

The structure of this paper is such that the research strategy is described, then the theoretical framework and its significance is explained, followed by the analysis and discussion sections where interview data is interwoven with theoretical concepts from the literature. Where relevant to the paper, existing theories are confirmed, refuted or extended by the findings of the study.

Research Methodology and Design

The research design for this study follows the interpretive traditions of IS research. This approach assumes that the reality of gender, farming, and technology, such as agricultural DSS, is socially constructed. Consistent with this stance, a subjective and relative approach is adopted. Data collection for the study relies on triangulation and the use of a variety of data sources to enhance rigour and relevance. Data collection is through document analysis, participant observation, and semi-structured, in-depth interviews of stakeholders in the Australian cotton industry. Several studies were conducted in Queensland and northern New South Wales between November 2002 and July 2004. In all, fifteen (15) women cotton growers, and nine (9) women and seven (7) men cotton industry professionals were interviewed at locations chosen by the participants. Only six (6) participants were interviewed via telephone. On several occasions, the male farm partners of the women cotton growers participated in the interviews. Their presence appeared not to distract any of the interviewees. In fact, the contributions of the farm partners appeared to enrich both the interview process and the quality of the dialogue.

As the main subjects of the study, the women cotton growers were expected to offer insights of their experiences as users of farm management software, in particular the agricultural DSS, *Cot-*

tonLOGIC. The women were purposefully selected. They were on a database of registered *CottonLOGIC* users, and / or were members of *WinCott* (Women's Industry Network Cotton). All the participants demonstrated an awareness of high technology and environmentally responsible farming practices.

The cotton industry professionals selected for interview were DSS designers, developers, educators, experimental scientists, research scientists, rural extension officers, agronomists as well as consultants. All these participants have some knowledge of agricultural DSS either through development, usage, research or training. With their in-depth industry knowledge, these participants contributed to the study by being informed observers of the farm women participants.

Documentary data is being collected throughout the study. This data particularly applies to the multitude of information coming in for growers from cotton industry sources. Participant observation has been implemented during attendance at several recent *CottonLOGIC* workshops. These qualitative research methods informed an understanding of the context of the study. This paper however focuses on data drawn from the interviews. Interview guides are attached to this paper in Appendix 1 and 2.

Theoretical Framework

The view of information systems (IS) taken in this paper is that they are concerned with the "interaction between information technology, individuals, and organisations" (Shanks, Hodgson, & Darke, 1996, p.1). Increasingly, information systems researchers appropriate theories from other disciplines as conceptual frameworks with which to enrich their theorising (Lam & Singh, 2002). For this study, theories are borrowed from sociology. They are Gidden's structuration theory, used as a metatheory for probing the recursiveness of farm management and technology usage, and Roger's diffusion of innovations theory, used as a lower-level theory for analysing software adoption characteristics.

The following sections attempt to justify the theoretical stance of this study. From the classic sociological debate, two paradigms have emerged. They are assumptions about the nature of social science based on the subjectivist-objectivist dimension with interpretivism or social relativism on one hand, and functionalism and structuralism on the other. Giddens acknowledges the existing incommensurability of the paradigms. In the introductory chapter to *The Constitution of Society* (1984), Giddens declares:

> *of prime importance in this respect is a dualism that is deeply entrenched in social theory, a division between objectivism and subjectivism… Structuration theory is based on the premise that this dualism has to be reconceptualized as a duality – the duality of structure.*

Therefore in Gidden's own view, structuration theory represents a reaction to the perceived deficiencies of the two prevailing schools of sociological thought for social research.

More recently, Orlikowski and Baroudi (1991) contend that a single research stance for studying technology innovation phenomena is restricting. They suggest a plurality of philosophical assumptions and research perspectives with which to explore the complex relationships between technology, people, and organizations. Orlikowski and Baroudi (1991) claim that a more integrated approach needs to be developed to go beyond the apparent opposition between paradigms. Structuration theory is purported to be a means of breaking free from the weaknesses of functionalism that underplays the importance of human action, and interpretive sociology which is 'strong on action, but weak on structure' (Jones, 1999, pp. 106-107). Further, structuration theory is proffered as a high-level conceptual scheme or metatheory within which other perspectives, theories, and methodologies can be contained (Walsham & Han, 1990, p.53).

Diffusion theory as advanced by Rogers provides an inadequate explanation of the relationship between technological innovations and social relations. Nevertheless, with its objective research perspective and deterministic outcomes, it is an ideal lower-level framework with which to analyse the processes of technology transfer and the features of an innovation.

Giddens' own preference (cited in Jones, 1999, p.112) is that structuration theory in empirical research should be used, not so much as a 'concrete research programme', but the principles from it be used as 'sensitising devices'. In this paper, structuration theory provides sensitising concepts for exploring the recursiveness of social life in the Australian cotton industry.

There are other arguments to justify the use of structuration theory as a broad theory and diffusion theory as a lower-level theory. Giddens (1984) posits that structures are 'memory traces' instantiated only when humans act. Therefore, to talk of rules and resources of structures being imbedded in material artefacts such as technology is inconsistent with Gidden's views. Rose (2000) contends that Giddens' conceptualisation of structure is somewhat loose and abstract in comparison with the structuralist tradition of social thought. Meanwhile Orlikowski (1992) argues that technology is distinctly material. Therefore, the material aspects of technology remain an uneasy concept of structuration theory (Jones, 1999).

Since the material aspects of technology in structuration theory remain unresolved, diffusion of innovations theory by Rogers (1983; 1995) seems an appropriate lower level theory with which to explore the diffusion aspects of an agricultural DSS under the wider umbrella framework of structuration theory. For this paper, the principles of heterophily and more particularly homophily drawn from diffusion theory provide fundamental models for exploring communication flows through interpersonal networks. This is discussed more fully in later sections of the paper.

Despite Rogers' focus on interpersonal networks, even in his most recent publication, he almost totally disregards social structures of gender. The exception is when Rogers (2003, p.132) discusses the contributions and criticisms of diffusion theory. In this chapter, he cites a study by Shefner-Rogers, Rao, Rogers and Wayangankar (1998) of women as dairy farmers in India. Findings of this study, located in a developing Asian country, were that "the empowerment of women gained attention, as it was realised that they were often subordinated to men in patriarchal societies and that the technological innovations being introduced made them more so". Correspondingly, Stewart (1997) maintains that by generally ignoring gender, diffusion theory also ignores the barriers many women face in using computer-based technology in modern societies.

While Giddens is sympathetic to many feminist themes (Tucker, 1998), the representation of gender is similarly inadequate in structuration theory (Schwandt, 1994). Feminist epistemologies agree that women's experiences are not captured in existing conceptual schemes. Since, in the author's view, gender is socially constructed, gender therefore should be an analytical category in its own right.

Analysis of Data from Interviews

During data analysis, the interview data from the field studies has been coded under theoretical concepts or categories drawn from the literature. In the next sections, the literature is reviewed and the concepts illustrated with extracts of interview data. Where discrepancies exist, these are explained. Accordingly, I endorse, oppose and extend existing theories.

Gender Differences: Inherent versus Socially Constructed

Gender "concerns the psychological, social and cultural differences between males and females" (Giddens, 2001, p.107). Since, in principle, gender refers to learned sexual identity, it concerns men as much as women (Giddens, 1992). Gender differences and information technology usage

are addressed through contrasting theoretical perspectives. One view, that of essentialism, claims that inherent socio-cognitive differences are the basis for observed gender differences. This approach was proposed by Turkle (1984) in early studies of computer usage by children, and more recently by Venkatesh and Morris (2000).

Inherent gender differences are emphasised in information systems research by Venkatesh and Morris (2000). Their study examines gender differences in technology acceptance and usage behaviour in the context of underutilised information systems. The findings of this research suggest that men and women are inherently different with respect to technology adoption and usage. Perceived usefulness is identified as a strong determinant for men. Their research implies that women typically display lower computer aptitude and higher levels of computer anxiety than men. Hence women are influenced by perceived ease of use and even subjective norms.

This study was continued by Venkatesh, Morris, Davis and Davis in 2003 when they developed a unified technology acceptance model. In their earlier research, inherent gender differences had been emphasised. The later study was more circumspect with statements such as "gender schema theory suggests that such differences stem from gender roles and socialization processes reinforced from birth rather than biological gender per se" indicating a revised outlook on gender differences in the adoption of technology (Venkatesh et al, 2003 p.449). This revised outlook reveals a social constructivist perspective where gender differences are not grounded in biology but recognised as learned behaviours, reinforced by patriarchal structures in society (Tucker, 1998). As an endorsement of this approach, during one of the field studies, a male researcher commented on prevailing perceptions of farm women in the cotton industry:

> *The women are starting way behind the eight ball. Even if they are intellectually far ahead of the farmer, they are perceived as way behind the eight ball.*

Studies by Johnson and Powell (1994) and Powell and Johnson (1995) evaluate the psychology literature on the role of gender differences in managerial decision making and risk propensity. Their literature search determined that pre-1980, the accepted view was that there were clear gender differences. Post-1980 literature implies that gender differences were in the degree of confidence in decision choices and in risk propensity. Powell and Johnson subsequently performed their own empirical studies. One of the premises for their research was that gender differences have been ignored by the designers of DSS. Their studies found that, despite stereotyping, gender is not explicitly identified as a moderating factor in the performance of cognitive tasks. Empirical evidence suggests that in a formally trained population, with similar levels of experience and intellectual ability, and with equal access to information, gender differences in the nature and quality of decisions are not significant.

This was validated in my studies. An experienced male lecturer within a regional university had observed the performance of both his female and male agricultural students. He acknowledged that female students appropriately trained were as confident and competent as their male peers and to some extent even more so:

> *The female students tend to be very confident and some clients prefer to have access to the female consultants. A lot of male students tend to rely on the gift of the gab or the bullshit factor to communicate with growers whereas female students don't tend to be comfortable with that and they rely on ability. With some of the male students, they use the art of conversation to mask lack of ability whereas the female students are a little more honest and rely on their knowledge skills.*
>
> *We're finding that the girls are more employable. All girls from last year's group walked out into jobs. There's one who came back to do honours, four of them went out straight*

> *to cotton, few of them came from a cotton background or from cotton areas. There are no major male / female concerns other than that the females are more competent than the males. They tend to focus a little bit more on their study in a more meaningful way. I tend to concentrate a lot on learning experiences and individual development in my students and from what I can tell, the females students reflect on development more effectively than the male students, more effective thinking. Whereas the male students are short-sighted or have goals which are more immediate rather than more long-term and that's evident in the reports that they write for me.*

He also acknowledged that when women, in particular women cotton growers, had difficulties implementing software programs such as CottonLOGIC, training programs should be directed towards reducing the intellectual effort of acquiring proficiency:

> *That's where training programs are essential. For those who are experienced in the growing of the crop, it's just an issue in training them in how CottonLOGIC works and how to get the most out of it. But for the females in the industry, the training must be more wide than that.*

The value of formal training as an agronomist was evident in the comments made by a woman cotton grower when discussing the ease with which she had learnt *CottonLOGIC*:

> *No. I'm self-taught. It's [CottonLOGIC] not a difficult program to use really. I don't find it difficult.*

A female extension team coordinator expressed her awareness of diminishing gender differences at the professional or formally trained level. However at the farm gate, she observed that traditional gender divisions of labour still existed for a variety of reasons:

> *When the women have a professional background, the distinction between men and women disappears. If we look at the female consultants, they have the same issues as the men, generally speaking distinctions disappear. It's when they come back in the family roles, women on the farms always have had a strong orientation to the strategic positions, not the day-to-day decisions.*

Both the research literature and my own studies confirm perceived gender differences are diminished in situations where the women have access to information, are formally trained, and have experience in the field of expertise. However gender divisions of labour reappear in the family farm setting. This paper proceeds to explore gender differences through a conceptual framework of communication networks drawn from diffusion theory.

Gender Relations and Social Networks

Rogers (1995) developed the classical model of the diffusion of technological innovations during the 1960s from investigations conducted in peasant communities in developing countries. Then in the 1980s, Rogers began to apply his theory of technology adoption to the spread of home computers in the United States (Murdock, Hartmann, & Gray, 1992)

The theory of technology transfer had a deterministic outcome with distinct stages in the adoption process with an emphasis on 'information exchange'. Rogers posits the importance of interpersonal networks in a successful adoption process since it is essential to communicate if an innovation is to be recognised and adopted.

Homophily and heterophily

Of utmost importance is the premise that most people depend on a subjective evaluation of an innovation from adopters like themselves. This is termed homophily, considered by Rogers (1995) to be the transfer of ideas between two individuals who are similar in attributes such as social status, education, interests and beliefs. When individuals share common meanings, the communication of new ideas is regarded as more likely, more effective and more rewarding. In an earlier paper (Gartshore, 2004), the author recognised homophilous communication in the Australian cotton industry as occurring between neighbours, family, and especially, farm partners. In that paper, its opposite, heterophilous communication, was regarded as occurring between farmers and industry professionals such as rural extension officers, agronomists, consultants, researchers and educators who may apply different meanings to the use of the innovation, such as *CottonLOGIC,* than do the cotton growers. This paper advances that earlier work.

The basic principle of homophily, the tendency of people in friendship pairs to be similar, was recognised before the 1900s. In 1964, Lazarsfeld and Merton (p.23; cited in Rogers & Shoemaker, 1971, p.15) delineated homophily as 'affiliation or communication with a similar person'. Lazarsfeld and Merton (1964) defined heterophily, the mirror opposite of homophily, as 'the degree to which pairs of individuals who interact are different in certain attributes'.

Research since then has identified homophily in a variety of characteristics such as gender, age, class, race, and occupation, and in a range of social settings such as organisations, cultural communities and families (McPherson, Smith-Lovin, & Cook, 2001). McPherson and Smith-Lovin (1987) broadened the definition of homophily and referred to it as the tendency for people to interact more with their own kind. Brass (1995; cited in Monge & Contractor, 2003, p.223) noted that "similarity is thought to ease communication…".

Various researchers have attempted to explain the emergence of communication networks on the basis of homophily. While homophily rather than heterophily theory has engaged more researchers, findings from studies into heterophilous communication suggest that heterophily makes interaction more difficult since it is conducted between individuals with differing beliefs. An alternative view is that a certain degree of heterophilous communication might be the basis of positive 'creative dissidence' or synergy between the interacting parties (Sumberg, Okali & Reece 2003, p.744). Rogers and Shoemaker (1971, p.14) offer this perspective:

> *A further refinement of this proposition includes the concept of empathy… Heterophilous individuals who have high empathy are, in a psychologist sense, really homophilous.*

Gender homophily

Several studies have focussed specifically on gender homophily. All the same, it is worth noting that diffusion theory, despite regular revisions, fails to consider gender homophily as a factor in communication networks. Research by Brass (1985) found that communication networks in an organisation are largely clustered by gender, and that same gender networks are associated with effective communication. Notwithstanding more effective communication, however, they have also been identified as a "mechanism [for] maintaining inequality of status for minorities within organisations" (Borgatti and Foster 2003, p.999). Women within all-female organisational workgroups have been found to be less influential with reduced access to valuable information, resources, and support than men in more powerful male networks. This homogeneity limits the social capital of women. That is, women overall have not acquired the status and authority of males in an organisation (Brass 1985). The exception is for women who are members of non-segregated networks (Borgatti & Foster 2003).

This paper explores the effects of gender homophily on interpersonal networks both outside and inside the family farm situation. The existence of gender homophily in informal single sex networks is indisputable, as is the worth to the individuals within them in terms of providing channels for information exchange. A female cotton agribusiness consultant was very aware of the male social networks, and the access to knowledge provided by informal interaction:

> *The bloke always knows what's going on and it's purely because he goes into town and pick up parts. That circle in itself of picking up parts, picking up the paper, picking up fertiliser…, in that little circle of doing jobs like that, he's actually spoken to most of the people who speak to all of the farmers all of the time. In doing that, he's going to run into at least five other farmers doing the same thing. That in itself is actually quite an important social link.*

This meant that with gender divisions of labour in widespread practice on family cotton farms, the women were unlikely to be able to avail themselves of information in similar ways to their male counterparts. The recent establishment of *WinCott* as a resource and support network by the women of the industry denotes a recognition of their restrictions in accessing knowledge. *WinCott* encourages members to ask question and seek answers without embarrassment. It is a source of motivation, support and confidence to many of its women members. However it does appear to face some opposition from men in the industry:

> *… some of the men are a little bit threatened about the formation of women's group. They don't know why they need to and they don't see that, cause the blokes aren't intentionally trying to cut people out of being involved in a grower's association or an area wide management group, however what they don't realise is that a lot of women don't have that science and fulltime background, then they'll never be engaged as an equal in those sorts of the conversation, even if they do know exactly what they are talking about. I know with the formation of the WinCott group up here, there's been a few blokes, oh why do you need to do that, why do need something special for you guys?*

Nevertheless, research suggests that when women are integrated with men into networks, the status and influence of the women is perceived as equivalent to their male counterparts (Brass 1985). My field studies show that professional women in the industry have few hesitations and encounter limited opposition to being committed participants at industry gatherings. A female cotton agribusiness manager observed:

> *You have two groups here, the east side, east Nogoa and west Nogoa…. You see Anita there and probably Zoe, she is one of the key agronomists for Queensland Cotton, but generally you don't see a lot of women there except for bug-checkers. The wives don't come to those meetings.*

Murdock et al (1992) in their study of networks as a key factor in the adoption of sustainable computer practices, found that promotional discourses may be an explanation for gender differences in technology adoption. That is, the marketing strategy for home computers depended on activities and identities associated with masculinity. The female cotton agribusiness manager in my study was attuned to the fact that the marketing of technology in the cotton industry had been traditionally directed towards the male growers. The contribution of technology as an information resource was not lost to this consultant:

> *The thing that I see why CottonLogic, … and those sorts of things, haven't been picked up, the marketing of the extension of those programs has been directed towards men and*

not so much the women. One of the reasons, and it's just a theory, it's safer and easier, and it's in one of those grey areas.

Gender heterophily

These discourses highlight the existence of gender homophily within single sex social networks while between the men's and women's networks, there is less harmony. By definition, this lack of empathy should be referred to as 'gender heterophily' (if such a term existed) not gender homophily. Similarly for interactions between husband and wife partners on a family cotton farm. It could be presumed that gender differences and demonstrated inequalities would hinder the flow of communication between the partners. This is not the case as proposed in Gartshore (2004) and in the dialogue reproduced below from recent field studies. This confirms research by Sumberg et al (2003) of 'creative dissidence" and Rogers and Shoemaker (1971) that 'heterophilous individuals who have high empathy are, in a psychologist sense, really homophilous'.

The following extracts from interviews with two women cotton growers support and illustrate the homophilous perspective revealed many times by women cotton growers. They highlight the importance of collaboration and cooperation in a family farm setting:

We work as a team really. I'm more focussed on the administration side of things. X [farm partner] is more focussed on the day-to-day running, and keeping out of the office which he shouldn't do. He needs to be more involved.

You were asking about women's roles but in the cotton industry, it's more of a team.

Undoubtedly gender homophily in the Australian cotton industry encourages the existence of single sex networks. Professional women in the industry with the appropriate formal training appear to be less disadvantaged by gender homophily than the women cotton growers on the family farm. Women cotton growers, recognising their reduced access to resources, in response have established their own rural industry network, *WinCott*. Out on the family farm, despite documented gender discrepancies, a functioning and productive farming partnership has been created between husband and wife. In this situation, homophilous communication applies, justifiying the very effective flow of information within the family farm enterprise.

Discussion

This paper has examined communication flows to inform an understanding of gender homophily in interpersonal networks within the context of Australian family cotton farms. The principle of homophily, the degree to which pairs of individuals who interact are similar in certain attributes such as social status, education, interests and beliefs, was drawn initially in this paper from diffusion theory. More recent research has extended the homophilous concept to charactertistics such as gender, age, class, race, and occupation, and in a range of social settings such as organisations, cultural communities and families.

While gender difference and inequalities arguably exist on the farm, at a professional level within the industry, gender distinctions are less apparent. This confirms past research that associates formal training, as for agronomists and industry service personnel, with improving women's confidence as independent decision makers and managers. This also endorses the social constructivist perspective that gender is a socially constructed concept rather than biologically determined. The following related comment was made by a woman manager in a cotton service organisation:

> *It's really interesting actually because there's a lot of women working in cotton. If you look at agronomists, then male and female, there's no real difference in the information acquired. There's differences in how they interact and how they seek information. But generally pretty much the same. So in terms of the agronomists, they're pretty much similar. In terms of growers, there's not a lot of female managers. There are some but not a lot.*

This study also validates previous research that suggests that communication networks in an organisation are largely clustered by gender and that same gender networks are associated with effective communication (Brass, 1985). It is apparent that while informal all-male networks are a valuable medium for knowledge exchange for the men, the women have to strive harder to overcome some hostile reactions before establishing more formal social contacts such as *WinCott*. The author argues that gender homophily exists within the single sex networks but it would be more accurately described as 'gender heterophily' between the all-male and all-female networks.

As identified in studies by Murdock et al (1992), marketing strategies for technology seem to be focussed towards male members of a family network. This could be due to the conservative nature of rural life. As the woman manager of a cotton service organisation observed:

> *I worked in rural marketing until I came into this job. I would say it [marketing] isn't really focussed [towards the male farmers] but by default it is because it's been traditional. I wouldn't say that it's anything intentional. It's just the way it's been done. It's the way they perceive, they know their market is.*

All the same, existing patterns have been challenged by rural women demanding greater access to resources with the resultant increase of social capital:

> *If women can do CottonLOGIC, they also have a far better exact knowledge of what's happening on the farm so therefore are far better equipped to have a very equal involvement in decision-making whereas a lot of decision-making happens in the garage [barn or shed] and then they talk about it.*

In the setting of the cotton farm, despite the existence of 'gender heterophily' through disparate gender relations as in the traditional gender divisions of labour, a more compromising and harmonious atmosphere prevails to facilitate effective communication. As Rogers and Shoemaker (1971) propose, a shared vision produces homophilous communication. My study found that it applies not just to a husband and wife farming operation, but to the extended family enterprise:

> *We all operate together so we all have the same system. We all have the main office at Y which is the other farm. All the computers are there. Everything is set up there as a central base. We have an office here for our personal use – if I'm at home using CottonLOGIC etc but basically everything is stored at the other big office.*

Homophilous communication is crucial for transmitting knowledge about the features of *CottonLOGIC* as well as its novel possibilities for improved farm management. This was encapsulated in a statement by an independent cotton researcher:

> *DSS [such as CottonLOGIC] have the potential to put the management of diseases back into the hands of the people who live there, so far it's mainly the male partners, the man. But increasingly both, if they are given this sort of technology [CottonLOGIC] where they can put all these specialist things into context, by that simple process, they take the excess power away from the expert and back into their own hands where it belongs. And they have the ability through technology to weigh options.*

Evidence from this study endorses the existence of gender differences and inequalities in rural Australia. Nevertheless the environment is dynamic, with transformations in social structures occurring. Women are taking the future into their own hands. With confidence gained through involvement in interpersonal networks, participation in training, and the acquisition of technological skills, they are shaping and reshaping their lives. In particular, computer-based software such as *CottonLOGIC* is instrumental in enabling them to challenge and influence the reconstruction of existing farm management practices. This reflects a central principle of structuration theory concerning the recursiveness of social life.

Conclusion

This paper was based on a recent study of women's use of farm management software in the Australian cotton industry. The interview data was analysed using sensitising concepts drawn from diffusion of innovations theory as a lower level theory and structuration theory as a metatheory. The emphasis of the paper is gender homophily and effective communication within interpersonal networks. The value of single sex networks such as WinCott for information exchange, support, and motivation is confirmed by this study.

Also of particular interest is the relationship between husband and wife as partners in a cotton farm business. While gender differences and inequalities still prevail, and are indicative of 'gender heterophily', in the main, communication between parties is harmonious and effective. With the emphasis on teamwork, this empathetic communication is regarded as homophilous.

While there is an overall acceptance of existing social structures in cotton farming, some individuals, in particular industry professionals and intrepid women cotton growers, are challenging the norm. Farm management software such as agricultural decision support systems is recognised as a resource for women to access industry knowledge thereby enhancing decision making and farm management. However marketing of these resources need to be focussed more towards the women in the industry. As well, formal training and greater participation in non-segregated networks have been identified as sources of empowerment.

The use of sociological theories to explore these concepts has proved to be a compelling since neither diffusion nor structuration theory explicitly address gender relations and matters of patriarchy. The concept of gender is too important to ignore and is a notable omission. This is especially valid for diffusion theory as demonstrated in this paper. However these theories overall provide a rich framework with which to inform the topic.

The focus of this paper is limited to gender homophily and 'gender heterophily'. To complete an investigation of this theme within the context of Australian cotton farming, it would be useful to explore homophilous communication as related to age, occupation, education, and beliefs. Further, heterophilous communication as between farmers and industry professionals such as rural extension officers, agronomists, consultants, researchers and educators warrants further study.

Dedication

This paper is dedicated to my mother who died unexpectedly on the 27th October 2004. She was a strong-willed, vibrant and loving person, who, with the support of my father, strove every day to overcome the physical and emotional scars left by poliomyelitis contracted in her youth.

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Terms and Definitions

CottonLOGIC: It is a software package of decision support modules to assist cotton growers and their advisors in the tactical management of cotton pests, soil nutrition, and farm operations. As an advanced farm management tool, it is being developed in Australia by the Commonweath Scientific and Industrial Research Organisation (CSIRO) and the Cotton Cooperative Research Centre (CRC), with support from the Cotton Research and Development Corporation (CRDC).

CRDC: The Cotton Research and Development Corporation is a partnership between the Australian Government and the Australian cotton industry to provide leadership and investment in research, innovation, knowledge creation and its transfer.

DSS: While there is no universally accepted definition, decision support systems may be identified as interactive computer-based systems that support decision makers.

Farm Management: Factors include decision making, production, marketing, human resources, financial, risk and change management.

Gender Heterophily: Heterophily, the mirror opposite of homophily, is the degree to which pairs of individuals who interact are different in certain attributes. There is no evidence of previous use of the term 'gender heterophily'.

Gender Homophily: Homophily is the tendency of people in friendship pairs to be similar. It was recognised before the 1900s. More recent research has identified homophily in a variety of characteristics such as gender, age, class, race, and occupation, and in a range of social settings such as organisations, cultural communities and families.

Information and Communication Technology: This refers to the range of technologies that facilitate communication. They include telephones, mobile phones, fax machines and personal computers which may or may not be connected to the Internet.

Technology Transfer: This principle of science-based intervention, also termed the 'transfer of technology' push, is the exchange of technical information between researchers and users. It has been criticised for ignoring the socio-economic context. This view implies that it is a one-way process. However more recently, technology transfer is recognised as a communication process allowing two-way information exchanges.

WinCott: The Women's Industry Network Cotton was formed in 2000 to provide support, information and resources to encourage and empower women in the Australian cotton industry to have skills, confidence and an informed voice.

Appendix 1
Farm Women Interview Guide

General Farm Data

- Size of farm, length of time farming
- Partnership arrangements (spouse, family members)

Personal and Social Characteristics

- Age, education, children, interests off-farm, work off-farm

Gender Divisions of Labour

- Farm tasks & changes in tasks & roles over time. Wish to do things differently
- Farm decision-making and management – long & short term eg marketing, financial (farm & household budget) & technical (production, machinery)

Decision Support

- What do mean by record keeping / decision support
- Do your decisions change under different situations such as drought or heavy pest infestations
- Who provides information support (agronomists, suppliers, relatives, neighbours, community groups, field days)
- Which resources are used (faxes, information packs, newsletters, newspapers, Cotton Tales, software, Web)
- Awareness of environmental issues, BMP, IPM, Area Wide Management etc

Technology on Farms

- Computer users & usages eg how long, which software. Computer training
- Influence of farming neighbours, community (subjective norms)
- Changes in decision making since computer usage began
- Do you wish to influence the way software is designed

Use of CottonLOGIC or computer-based decision support software

- How long and how often? What aspect used most? Who? When? Why? What else? (PAM, PinPoint, FarmOffice, FarmTracker, WeatherLink, adVantage, etc)
- Should *CottonLOGIC* be linked to existing providers of record-keeping software
- Explain methods of data acquisition (notebook, verbal, agronomist)
- Does consultant / agronomist use *CottonLOGIC*, their name
- Problems (complexity, not used by peers)
- Benefits (relative advantage, quality, relevance, usefulness)

If *CottonLOGIC* not installed

- Why not (trialability, observability, compatibility, complexity, usefulness, usability, relevance, peer usage)

If *CottonLOGIC* no longer used

- Explain (compatibility, complexity, usefulness, usability, relevance, peer usage)

Future Development Issues of *CottonLOGIC*

- Workshop suggestions (childcare, times, location, cost)
- Could *CottonLOGIC* instructor visit you
- Software improvements (include, exclude)
- Thoughts on handheld version (PalmPilot)

End of Interview

Appendix 2
Industry Professionals Interview Guide

General Work Data

- Position held & for how long
- Job description
- Educational qualifications & experience

Software Usage

- What software do you use (*CottonLOGIC*, Excel, hand-written reports)
- How do you use it (record keeping – farm operations, decision support - bug-checking, predictive models – insect density, photos of pests & beneficials, learning tool)

- What do you mean by record keeping & decision support
- What do you consider is lacking with *CottonLOGIC*
- Should *CottonLOGIC* be linked to existing providers of record-keeping software
- Impact, if any, of BMP, IPM, Area Wide Management, Bollgard & InGard (GM cotton) on computer usage (mandatory / self-regulatory reporting)
- Do you see any advantages of a centralised database, Internet and / or wireless capability, Palm Pilot

Observations

- Perceptions of what's happening on farms (computer usage, users, software)
- Do decisions change under different situations such as drought or heavy pest infestations?
- Roles that women partners play / their involvement in farm operations eg marketing rather than production
- Roles played by women consultants / agronomists – difference with men in way jobs are performed, way seek information, networking
- Modules of *CottonLOGIC* more relevant to consultants & farmers esp. women
- Impact of technology (computers) on women & women's contribution to farm management & computer usage
- Changes over time (software usage e-farm management roles)

End of Interview

Biography

Dale Mackrell is currently on a full-time academic appointment with the Griffith Business School at Griffith University while undertaking her PhD into the structuration of women's use of farm management software in the Australian cotton industry. She is an active member of the women's industry network group in cotton (WinCott) whose role includes strengthening the links between research and government, and the women in the cotton industry.

Earlier studies by Dale were achieved in part-time mode due to the demands of a young family. During that period, she gathered practical experience as an owner operator of the family cattle property. As well, during that period Dale gained an Unrestricted Private Pilot licence. Her experiences as a woman pilot in the world of aviation, led her to join the Australian Women Pilots' Association (AWPA) of which she became State President, State Treasurer, Librarian and WebMaster over the course of ten years.

Prior to 1980, Dale worked as a computer programmer and analyst. She was employed in a permanent Government position in Canberra and later as a freelance contractor in the UK for multinationals such as Burmah-Castrol, Bayer Chemicals, and the Bank of America. Back in Brisbane, Dale worked as a systems engineer for Facom Australia.