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**Female Entrepreneurial Networks and Networking Activity in Technology-based Ventures:
An Exploratory Study**

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ABSTRACT

The ability to develop and manage effective networks is a crucial entrepreneurial competence for venture establishment and growth. Relatively little attention has been paid to the network development and networking activities of female entrepreneurs in general, and even less to such activities in technology-based ventures. The limited existing evidence suggests that female entrepreneurs may develop different approaches to network development and participation to that of their male counterparts. This paper presents findings from exploratory, qualitative research conducted in Northern Ireland, which focused on the nature and dynamics of female entrepreneurial networks in traditionally male-dominated science, engineering and technology-based ventures. Drawing upon information-rich evidence from 18 in-depth interviews with the lead female entrepreneurs of technology-based ventures, insights are presented into the nature and dynamics of female entrepreneurial networks and networking at different stages of the business lifecycle.

Keywords: New venture creation; entrepreneurship; female entrepreneurs; entrepreneurial networks; networking; new-technology ventures.

INTRODUCTION

Networking has long been recognised as an essential entrepreneurial skill vital for identifying opportunities and for accessing the strategic resources necessary to develop new and existing ventures. The resource requirements of new technology-based firms (NTBFs), particularly those that are product-based, can be complex and diverse (Cooper, 2000); effectiveness in networking, therefore, is critical for firm sustainability and growth. Traditionally, the technology sector has a masculinised culture and a business model which are difficult for women to penetrate. However, little attention has been afforded to the nature and dynamics of female entrepreneurial networking activity within this male dominated environment. Furthermore, few insights exist into how female venturers in technology-based sectors address key quality issues when developing and managing their networks to derive maximum benefit (Carter, 2000; Shaw et al., 2001). Therefore, this paper aims to provide insights into female entrepreneurial networks and networking activity through a study of NTBF women business owners in Northern Ireland.

This paper focuses on new technology-based firms, which in the case of Northern Ireland, contribute around 70% of GDP (www.investni.com). Although exact figures are not available, the number of women business owners and new venturers within the technology sector in Northern Ireland is believed to be relatively low. However, at the global level, existing literature suggests that women have been gradually increasing their participation in this field, signalling a slow move away from the traditionally feminised retail and service industries (Brush et al., 2001). Overall, levels of female entrepreneurship in Northern Ireland are low (2.1%) in comparison to Europe and the US, with women being less than one quarter as likely to be involved in new venture creation (Hart, 2007). Hence, an understanding of female entrepreneurship, as well as the process of advancing business development through networking, is vital for encouraging female entrepreneurs towards new venture set-up and growth.

Current research on the efforts of female venturers to develop and manage their networks suggests differences in their approach to network development and participation in comparison to men (Buttner, 1993; Davis and Long, 1999). In order to gain insights into the reasons for such differences within the technology sector, this paper explores issues relating to the development and management of networks by female venturers. The findings of research undertaken among 18 female entrepreneurs who are at different stages in the development

of their technology-based enterprises are then presented. Finally, the implications of the research findings are discussed, and potential avenues for future research are suggested.

LITERATURE REVIEW

Female Business Venturing in the Technology Sector

Efforts by government agencies to encourage more women to engage in entrepreneurship, particularly new venturing, are seen as vital to enhancing levels of employment creation and economic growth (Reynolds et al., 2004). Levels of female engagement in enterprise, however, have traditionally been much lower than those of men who are three to four times more likely to start new ventures than women (O'Reilly and Hart, 2003). Entrepreneurial women are well-represented in some service sectors of the economy but are heavily underrepresented in technology-based sectors, despite the fact that increasing numbers of women are studying relevant subjects at university (Loscocco and Robinson, 1991; NFWBO, 1999; Mayer, 2006). Interestingly, although the number of women taking science, engineering and technology (SET) subjects to degree level is growing, women remain substantially outnumbered by men on such programmes (Kerr and Robinson Kurpius, 2004). This disparity is exacerbated by the fact that fewer female SET graduates go on to pursue careers in the field (www.set4women.gov.uk); this disadvantages women in many ways as they are not developing a presence in the sector, building effective networks or identifying entrepreneurial opportunities (Anna et al., 1999).

Moore and Buttner (1997: 13) define the female entrepreneur as 'a woman, who has initiated a business, is actively involved in managing it, owns at least fifty per cent and has been in operation one year or longer.' However, Holmquist (1997) suggests that in defining female entrepreneurs it is crucial that they are not treated as an homogeneous group. Furthermore, it should be recognised that female entrepreneurs, like their male counterparts, come in 'all sizes', from different backgrounds and with differing perspectives on enterprise creation and growth. Historically, the female contribution to business venturing has been largely excluded from small business research, with little attention afforded to female entrepreneurs until the beginning of the 1980s (Moore and Buttner, 1997; Walker and Webster, 2007). While, more recently, there has been increased attention focused on female entrepreneurship, including a greater recognition of women's credibility as capable business venturers, further understanding of the scope of that contribution and its future potential is required (Carter et al., 2001; Henry and Kennedy, 2003). This appears to be particularly true in the

context of female-led entrepreneurial new venturing and business growth within technology-based sectors (Winn, 2004). Given that entrepreneurship is ‘inherently, a networking activity’ (Dubini and Aldrich, 1991: 306), the development and management of quality entrepreneurial networks will clearly determine the success of any business venture, as Johannisson (1986: 20) explains: ‘the personal network of the entrepreneur should be regarded as his/her major asset.’ The following section considers the nature of female entrepreneurial networking within technology-based sectors.

Networks and Female Entrepreneurial Networking in Technology-based Sectors

A network is defined by the interactive relationships or alliances that individuals have, or may seek to develop between them and others, in pursuit of some enterprise in which they have a particular interest. Participants or network members are known as ‘actors’; the ‘focal person’ is the central ‘actor’ in and ‘owner’ of his or her unique network of relationships (McGowan and Hampton, 2006). This idea of centrality is a key measure of quality within any network of relationships that the individual seeks to develop and manage. It defines the total number of steps from the focal person, where each of the many diverse contacts exist, plus the total number of those contacts that can be reached through their network. Other quality measures within the networking process include ‘density’, ‘reachability’ and ‘diversity’, all of which reflect the make-up, character and potential contribution of an individual’s network and help them to establish and grow their business (Knouse and Webb, 2001). The presence of these quality measures within a network will ultimately be manifested in the richness of the information that can be distilled, the speed with which such distillation occurs and the value of the advice and guidance available to the entrepreneurial decision-maker from its members. Information and confirmation are key benefits of utilising networked relationships. The implicit challenge for the focal entrepreneur, therefore, is to introduce these measures, in a balanced way, to their network of contacts. Network management is a dynamic activity, however; having too many strong ties in which there is too much density may compromise network quality. In contrast, too few weak ties may result in the focal entrepreneur becoming deprived of the information, insights and views from beyond the boundaries of the network of strong ties, as Granovetter (1982: 113) explains: ‘Weak ties provide people with access to information and resources beyond those available in their own social circles; but strong ties have greater motivation to be of assistance and are typically more easily available’. Similarly, Aldrich and Zimmer (1986: 19) note that ‘it is the weak ties who can expand the pool of customers; strong ties deliver redundant information’.

Similar to their male counterparts, female entrepreneurs need to be effective networkers when seeking to establish new ventures or grow their firms (Brush, 1997). While it has been suggested that few differences exist in the way male and female entrepreneurs utilise their networks (Starr and Yudkin, 1996), there is some agreement that female-dominated networks are limited by size, density, range and network tie strength, all of which are agreed network quality measures (Granovetter, 1982; Ibarra, 1993; Knouse and Webb, 2001). While one explanation for this suggests that, as women are relative new comers to business ownership, their networks have limited presence (Davis and Long, 1999), another claims that female entrepreneurs concentrate on building collaborative, inclusive relationships (Martin, 2001). Women entrepreneurs do not appear to identify strongly with the established business associations, clubs or networks that are, traditionally, much espoused by men. The literature also identifies particular elements of male entrepreneurs' networks that female entrepreneurs are unable to access such as the so-called 'old boy's network', 'fraternity contacts' and other formal and semi-formal social organisations (Gamba and Kleiner, 2001; Knouse and Webb, 2001; Linehan et al., 2001). Gaining meaningful access to such networks beyond mere 'tokenism' poses real challenges for women (Shaw et al., 2001) and is a significant networking barrier that women need to overcome (Linehan et al., 2001). Explanations offered as to why women have not entered into these quasi-formal, male-dominated networks include a lack of personal self-confidence, anxiety about discrimination, a perceived lack of competence relative to male members and concern about the amount of time and effort required to make progress within such networks (Smeltzer and Fann, 1989). In addition, there is often societal pressure placed upon women to take on domestic or caring roles, a consequence of which is to interrupt their career path in such a way as to break their ties with previous networks, thus impacting upon their capability to exploit their networking activities as a potential entrepreneurial resource (Marlow and Strange, 1994). Thus, an aspiring female entrepreneur may be at a clear disadvantage in the future when it comes to gaining knowledge and accessing scarce resources, factors that clearly influence the potential success of any business venture (Morgan and Hunt, 1994; Okanlawon, 1994).

Some research suggests that, unlike men who espouse more formal approaches to networking, women may receive similar support through the development of informal networks (Smeltzer and Fann, 1989). Men and women, it appears, have different priorities when establishing networks; women tend to seek social relationships while men tend to seek personal advantages (Buttner, 1993). Furthermore, women are more likely to want to build their networking activities around a deliberate strategy targeted at specific individuals

with whom they feel a degree of empathy and in whom they have a high degree of trust and confidence (Starr and Yudkin, 1996; Aldrich et al., 1997; Carter et al., 2001). Such differences are apparent in the role played by networks in venture development (Olm et al., 1988; Aldrich, 1989) and the ways in which women determine the quality of their networks (Ibarra, 1993; Knouse and Webb, 2001).

The importance of developing and managing entrepreneurial networks within the context of technology-based ventures is clearly important. However, establishing and growing such networks often demands access to complex and diverse resources, both tangible and intangible, that can only be acquired by interacting with a wide range of individuals and organisations (Oakey, 1995; Cooper, 2000; Collinson and Gregson, 2003). Judicious use of networks can provide entrepreneurs with access to the individuals and organisations that are essential to providing such entrepreneurial resources. The nature of the technology community means that women who establish such ventures find themselves in a heavily male-dominated environment where most of those with whom they network are men. In the empirical section of this paper we present the results of a study conducted on female technology-based entrepreneurs, which explored how they built and developed their networks. Insights are provided into some of the key challenges faced by female entrepreneurs seeking to establish and grow their ventures in this male-dominated sector.

RESEARCH METHODOLOGY AND DESIGN

Research Approach

A qualitative methodology was adopted for this research. Semi-structured, in-depth interviews were conducted, with emphasis placed on the 'informal', and the discussion being exploratory in nature. Prior to data collection, a series of themes was developed to guide the researchers. The relative informality of the approach allowed participants to discuss their individual experiences in a manner that allowed details of their networking activities to emerge. Probing respondents to elaborate on their experiences occurred during the interviews only to develop the discussion, if appropriate, and to maintain a focus on the key themes.

Sample

Eighteen women participated in the research, representing nascent – pre-start (five), new ventures (five) and established (eight) businesses (see Table 1). This permitted the exploration of any changes in networking practice throughout the business lifecycle. Over the last 12 months, the nascent entrepreneurs in the sample

had been actively involved in some type of start-up activity for a new business that they would at least part own (Hart, 2007); here they are classified as being in the 'pre-start up' phase. Five women were defined as 'new venturers', operating for five years or less, with a limited market/product range (Carson and Cromie, 1991) in the second phase of development (Hart, 2007). The final eight women owned 'established companies', which they had been operating for more than five years. Further details on the female entrepreneurs and their businesses are provided in Table 1. All businesses were located in Northern Ireland and were within technology-based sectors. This was essentially a convenience sample that provided information-rich case studies considered as being particularly insightful with respect to the phenomena under research (Neuman, 1997).

[Table 1 near here]

Data Gathering

Semi-structured, in-depth interviews were conducted in a two-stage process over a twelve-month period. Each participant was interviewed for an average of one and a half hours during each phase. All interviews were recorded and transcribed. As a result of the inductive analysis of the interviews, core categories relevant to understanding the networks of these female entrepreneurs began to emerge. In stage 1, for example, key topics included the role and nature of female networking at different stages in the business lifecycle. Following analysis, primary data from the first stage of interviews were taken back to respondents so that the significance of networked relationships in the decision-making processes could be further examined. An important objective at this stage was to gain a deeper understanding of network ties and network quality. These second stage interviews developed issues emerging from stage 1, allowing a greater focus on the challenges of networking, the composition of female networks, and the benefits gained from enhancing network quality. Table 2 summaries these themes and illustrates the linkages between the discussions in the first stage of the research process and their confirmation and exploration in the second stage.

[Table 2 near here]

Data Analysis

Qualitative data are, by their very nature, chaotic and messy, and so require a methodical and systematic approach to analysis (Easterby-Smith et al., 1991, Miles and Huberman, 1994). To address such issues, Merriam (1988) suggests that qualitative data should be collected and analysed concurrently; this research reflected such an approach. Interviews were conducted in a series of three sets, each consisting of six companies. Once the first set of interviews were completed, they were transcribed verbatim and analysed before commencing with the next set. The considerable amount of actionable interview data led to the adoption of a rigorous structure for subsequent analysis facilitated by the use of NUD.IST (Dey, 1993; Richards and Richards, 1994; Catterall and MacLaran, 1996). The value of the research was further established by sourcing data from eighteen separate cases, in two separate data gathering exercises, over a period of twelve months. Data were also fed back to participants for comment, clarification, amplification, corroboration and amendment (Hirschman, 1986; Guba and Lincoln, 1994).

RESEARCH FINDINGS

The findings from this study are reported under the following themes: the role of networks for female entrepreneurs, the nature of female networks, composition of female networks within three phases of business development, the benefits of developing and managing network quality, and the challenges of networking for female entrepreneurs in NTBFs.

The Role of Female Networking in NTBFs

Our analysis revealed that networking was of key importance to how these female entrepreneurs did business throughout the different stages of the business lifecycle. For example, while the pre-start entrepreneurs highlighted networking as a valuable means of gaining information to help establish the validity of the business idea, the new venture entrepreneurs suggested that networking prevented isolation and provided support in the early stages.

For the more established female entrepreneurs, the role of networking was in gaining further business by promoting the company and developing a sound reputation. This research indicated that networks at this stage were crucial for saving time by providing information for decision-making purposes and for confirming the

correctness of decisions being made. A typical comment to reflect this came from ER, one of the established entrepreneurs interviewed:

'I have connections with the X (formal network)...you'd have individuals in the business you might have talked to ...one of the nice things about having somebody else's view is that you can toss ideas around when you have a decision to make.'

Female Networking Activities

The results from this study suggested that different types of networks existed depending on the firm's particular stage of development. For example, networking at the venture start-up stage was mainly through personal contacts. These were with people known to the female entrepreneur who were already in business and/or had knowledge of the relevant industry sector. These relationships tended to be informal and, while mainly used for advice, were also a valuable source of signposting to other valuable contacts. Similarly, within new ventures, the consensus was that personal informal networks were vital for doing business. Personal networks were primarily made up of family and friends, who were relied upon to provide much-needed, moral support in the early stages.

In the early years of venture start-up, most of the female entrepreneurs were also involved in formal or semi-formal networking activities. Our research highlighted how crucial it was for the female entrepreneur to tell 'her story' and gain other peoples' views and opinions. Of particular interest was the way that such experiences reinforced and highlighted the importance of networking in the future development of the business. In this regard, GM's comment was typical:

'I know that if I want to grow the business, then I will have to get to know more people who can help me.'

The owners of the established firms appeared to have acquired a higher level of sophistication in the way in which they managed their networks. For example, their networking activities appeared to have both informal and formal dimensions. Indeed, within the more established enterprises, the building of relationships and networking activities with both customers and suppliers was seen to be of critical importance, as LP stated:

'Well, I would ask anybody we know...other contractors or, if we have a good relationship with the customer, ... we look at our customer database. You know, there is any number of contacts within the company who could help us ...'

For this group, formal networks included the development of relationships with network brokers. These were seen as useful, within limits, and utilised as and when required. AA illustrated the need for access to information from the formal network:

'I now can afford to buy in expert advice if I need it, from accountants, lawyers and consultants, for certain aspects of the business'.

Another critical element for the established venturers in our study was the ability to extend their own network by accessing those of their internal staff members. These entrepreneurs clearly valued the potential offered via their 'internal team'. AA summed up the group's sentiments:

'I tend to rely on the knowledge and expertise of my team and their contacts...the company is much bigger than me now ... but they [her team] are vital for my firm's success, and I include them in gathering the information I need to make good decisions.'

Network Composition

For those in the pre-start up stage, our study revealed that the 'gender' of their network contacts appeared to be largely male-dominated. PT's comment supported this view: *'The contacts I have in this business tend to be males, that's just the way it is'*. However, within some of the early new ventures, it emerged that the all-female networks were also important. Involvement in such networks was crucial for the female entrepreneur to express her views openly, in a non-judgemental environment, which was seen as both encouraging and as aiding confidence-building. BJ's comment reflected this view:

'Being part of a women's group allows me to develop my confidence, people will say, thank God only women are here'.

Reinforcing this view, one of the new venturers (GM) commented upon her negative experience of dealing with men, which persuaded her to build informal networks with mainly female entrepreneurs/advisors:

'Because it was all women, it was fantastic... A lot of them had been in the same situation... walking into a male environment and feeling maybe belittled... they give you encouragement, you know. Not that its like 'girl power'....; now that I have got to know X (female advisor) I know if there is anything I need or anything she could help me with or give me advice on, then I could just phone her.'

While the female entrepreneurs in the later stages of new venture development expressed more critical views regarding the value of all-female networks, the more established female entrepreneurs appeared to be even less impressed with the idea of 'women only' networks. The following views reflect this: *'It just wouldn't do much for me in getting business'* (ER), and, *'It just doesn't speak to my level of business or my industry ... I loathe to be treated differently because I'm female ...'*

However, for the most part, the female-led established businesses in our study had managed to develop key contacts, including both men and women; having previously worked in the industry they had sought to build and develop their network of contacts prior to setting up their own venture.

For the established female entrepreneurs, networks were inclusive; anyone who could contribute to their decision-making could and would be 'tapped' for information and resources because of their knowledge and expertise, regardless of their gender. This comment by DR characterises this particular view:

'I would ask questions from anyone I knew who would have the knowledge in that particular area ... regardless of whether they were male or female. Really, it is amazing who you meet ... and you can come away thinking to yourself, yes, that's the answer to that question.'

An exception to this pattern was MR, who, despite being an established entrepreneurs for nine years and having run three previous businesses, had focussed on all-female networking when she returned and set-up in Northern Ireland. The fear of isolation and a lack of confidence appeared to be at the root of this decision, as she explained:

'I was really quite isolated when I came back here because I didn't know anyone ... they still looked at me as an outside person even though I belonged here originally ... the network meant that I got to know lots more like-thinking people ... it gives me a more feminine feel because I'm working with what I call the 'manly things in life' ... and just the general, you know, sort of comradeship.'

Benefits from Developing and Managing Network Quality

Our study highlighted that the female owner-managers of the established firms had actually become sophisticated and effective networkers. These individuals had spent time building and developing their network of contacts over a relatively long period of time. Consequently, they gained a number of benefits from having a wider, more diverse network. Regular contact with a few core network members who had the appropriate industry links appeared to allow these women to gain better and more current business information/guidance when required, even from their weak ties. The following comment from AA reflected this trend:

'I may have met X [network member] through the network, but it just so happened that someone in the network that we both knew brought us together. X [as a network broker] knew that Y [another network member] had a need, and knew that I could service that need. So, I suppose that is the advantage of the network - that even if you don't know someone, then someone knows you both and can see how you can assist each other and introduces you.'

Similarly, KM acknowledged the importance of maintaining a wide, varied network that enabled her to receive and give support:

'I'm a good one for maintaining networks and I maintain a wide range of links with people - not my inner circle, where you have your base group. That is one of the things I learned from X [university mentor] about having your network and then your 'further-out' people. So if someone asked me about something, I generally know someone who would know, or can put them in touch with somebody who could help.'

Women in the new venture group appeared, to a greater or lesser extent, to have some understanding of the need to deliberately develop their network of contacts to assist in their decision making process. Even those involved in networking activities within all-female networks also appreciated the importance of extending their contacts in order to gain further networking benefits; they recognised the potential limitations of their same gender networks and the need to build greater diversity to achieve enhanced benefits.

Challenges of Networking

Our exploratory study suggests that female entrepreneurs are influenced by a number of networking challenges. For example, all of the participants in the study recognised that their family commitments impacted negatively on the time they had available to network outside of work and to focus on the development of their business. However, despite this, it was clear that the women recognised that they had deliberately chosen to set-up and develop businesses in a high growth environment. Central to this was their personal drive for achievement and success.

In a few of the early new venture firms, confidence was noted as a challenge in pursuing access to mixed gender, formal networks. At this stage in the development of the business, the female entrepreneurs seemed to experience some uncertainty and a lack of confidence, coupled with a perception that men may actually be unhelpful or restrict their network access. However, the issue of not being able to gain access to business networks was challenged by the established female entrepreneurs in the study, who suggested that 'being female' had actually 'played to their advantage' in gaining access to an organisation or industry body that might otherwise have been difficult to enter, as commented by AA:

'Oh, in lots of different ways being female has become an advantage; if you are the only woman in the room, as is often the case, you might only be there to make up the numbers...'

There was a consensus amongst established venturers that while men in formal networking clubs were receptive to female involvement, it was often other women members were not so supportive. As MR noted:

'There is one lady who is in charge of it [the network] and she is the most 'I hate other females' type of person I have ever encountered; she has publicly humiliated me twice at their functions. It is the most unusual behaviour... It was dreadful...but there is enough room for everyone!'

DISCUSSION

Early entrepreneurial research assumed a 'male' realm of activity (Carter, 2000a, 2000b; Beaver, 2002; Bruni et al., 2004), with a lack of recognition or analysis of aspects that might be unique or particularly pertinent to the female entrepreneur (Boden and Nucci, 2000; Da Cunha and De Cunha, 2002; Ruminska-Zimny, 2002; Mattis, 2004). Hence, this study sought to explore the role, nature, composition and challenges of networking by NTBF female entrepreneurs at different stages of business development.

Networking clearly plays a central role for the female entrepreneur in sharing information, validating and confirming decision-making, as well as signposting to additional support and resources. For the women in our study, networking had an informal dimension at all stages in the business lifecycle and was symbolised by a chat with a friend, someone else in business, or a member of the family, where the purpose was simply to 'bounce ideas off someone else'; indeed, this reflected the women's strengths as natural communicators (Ibarra, 1993; Knouse and Webb, 2001). In the early stages, the women's personal networks were important in validating the business idea, however, as the firm matured, the women sought to develop formal and semi-formal, industry-focused networks to gain further benefits, particularly in relation to decision-making and reputation building. It appears that, as a woman establishes her business, she tends to rely extensively, if not exclusively, on networks that include only other women. Reinforcing the findings of previous studies, our research suggests that the all-female informal networks provided critical support to the early stage venture owners by way of ending feelings of isolation and boosting confidence (Smeltzer and Fann, 1989). However,

over the longer-term, women come to view such networks as holding less worth in assisting them to develop and grow their business.

Within the more established enterprises, the women in our study often suggested that their gender was an irrelevancy in defining their profile as an entrepreneur; it was their relative success in establishing and growing their business that was the real measure of who they were. They perceived their relationships with male colleagues through this particular lens, placing an increasing level of importance on contributions from other network members with whom they had developed long-term relationships over a significant period of time. In many cases, such individuals were often well known to the women, usually prior to their starting the venture, perhaps as previous work colleagues. This finding supports the argument that women are more likely to build their networking activities around a deliberate strategy targeted at specific individuals with whom they feel empathy and in whom they have a high degree of trust and confidence (Starr and Yudkin, 1996; Aldrich et al., 1997; Carter et al., 2001). Our study suggests that gender effects the drive for, and the success of, female entrepreneurial ambitions; women are inherently good at networking, which means that they seek intrinsically to develop inclusive, reciprocal, collaborative, social relationships through their networking activities (Buttner, 1993; Martin, 2001).

The finding of our exploratory study also offer insights into how female entrepreneurs develop and maintain their network quality, and so derive benefits from their contacts (Carter, 2000; Shaw et al., 2001). Networking benefits arising from enhanced quality were reflected in our study by the diverse nature of the female entrepreneurs' contacts, the degree to which network members knew one another and the extent to which these contacts gave them access to other key people. Thus, our research suggests that enhanced quality and network benefits evolve in line with business development; for example, the women in our sample who had successfully established their business over a longer period of time were particularly adept at developing and managing diverse networks which included both sexes. The ability to develop and utilise networks in an increasingly strategic way is a powerful tool for female entrepreneurs to draw on in order to manage opportunities, deal with threats and gain access to key resources.

A further characteristic of female entrepreneurs' networking activity revealed by our study was that, as their enterprises grew, the female venturers came to value their internal networks as a means of expanding their

reach. However, the women involved in early new venturing appeared to be considerably less sophisticated at injecting real quality into their networking efforts, preferring, at least initially, to rely on networks made up exclusively of other women. Most of these women recognised the need to take positive action to enhance the quality of their networking activities, to develop competencies as networkers, to increase networking benefits and, consequently, to develop their venture successfully over the longer-term. This finding highlights the evolution in female entrepreneurial networks during the different stages of the business lifecycle, for example, female networks only appear to suffer from problems arising from network size and quality in the early stages of business development. With regard to the established female venturers, however, the fact that they were involved in mixed gender networking and were dismissive of all-female networks clearly illustrates their awareness of the need to develop quality within their networks (Granovetter, 1982; Ibarra, 1993; Knouse and Webb, 2001).

At odds with the popular view, the findings from this exploratory study suggest that few barriers exist to entering the more formal networks that are traditionally dominated by men; indeed, female representation was welcomed in such networks. Furthermore, if formal networks are considered male strongholds (Hisrich and Brush, 1986; Carter, 1993; Gundry et al., 2002), and the NTBF sector is predominately male, one might have assumed that the women in our study would have experienced greater difficulty in gaining access. The female entrepreneurs in the later stages of the business lifecycle considered these mixed gender industry networks as crucial to business development and growth, a finding which contrasted with the new business venturers whose need for confidence and support drew them to all-female networks in the short-term. Further findings derived from studying the new venturers emphasised the challenges expressed in other studies as to why women have not entered into these quasi-formal 'male'-dominated networks, highlighting issues such as personal self-confidence and a perceived lack of competence relative to male members.

Interestingly, while the findings of this study did not confirm that family responsibilities reduced the amount of time available to female entrepreneurs for networking, most of the women acknowledged the societal pressure on them to undertake domestic and caring roles (Morgan and Hunt, 1994; Okanlawon, 1994). While the women interviewed were fully aware of the time and effort involved in running a NTBF (Smeltzer and Fann, 1989), they were not deterred from networking for growth, particularly in the later stages of business development, as they began to recognise the potential longer term benefits for their family. Essentially, the

loss of 'family quality time' had to be set against the business benefits derived from networking activities (Linehan et al., 2001; Martin, 2001).

Our study also illustrates differences in the roles played by networks in venture development (Olm et al., 1988; Aldrich, 1989), and the ways in which women determine and build quality in their networks (Ibarra, 1993; Knouse and Webb, 2001). However, as our study highlights, central to this is the particular stage of business development reached by the female entrepreneur.

CONCLUSION

Traditionally, entrepreneurship has been stereotyped as a masculine domain (Heilman, 2001; Powell et al., 2002; Marlow and Carter, 2004), with the skills and attributes that women bring to business often viewed as being of less value (Marlow, 2002). Recent government publications in the UK, however, suggest that women are a significant, yet relatively untapped, source of entrepreneurial potential (Harding et al., 2004; Hart, 2007), pointing to the importance of expending greater efforts to enhance levels of female entrepreneurial activity. With this in mind, it might be beneficial for politicians and academics to focus more attention on areas of the economy where gender stereotypical attitudes persist (Wilkinson, 2001) and where there is scope to enhance levels of participation by female entrepreneurs to build high-value and sustainable businesses. In this regard, supporting women entrepreneurs within the technology sector should be a particular priority, given the nature of the labour market and the positive impact of technology and knowledge-based entrepreneurial venturing on economic prosperity. A better understanding of issues surrounding the activities of female entrepreneurs would also help identify ways in which others might be encouraged to engage in new venturing.

While this exploratory study was constrained by a number of limitations, including the use of a convenience sample that comprised a limited number of cases from a single geographical location, it has helped to address some of the perceived gaps in the literature regarding female entrepreneurial networking for new-technology venture start-up and growth. At the policy level, for example, our findings suggest that women who restrict themselves to same gender networks may be limiting the potential for their firms to develop into robust technology ventures. While it is recognised that female-only networks have a valuable role to play at certain stages of the business life cycle, reaching beyond these groups is clearly a priority for many female entrepreneurs who understand the need to participate in more diverse networks to increase the long-term viability of their firms.

The limited number of 'high-flying' women in technology ventures also reinforces the opinion that it is men, not women, who typically engage in entrepreneurship (Marlow, 2002). Thus, greater profiling in the media of successful female entrepreneurs is urgently needed to encourage more women to engage in technology-based venturing, particularly those who are reticent with regard to building networks to support the development and growth of their business. In the longer-term, this should lead to a shift in gender balance within the technology sector. Ultimately, women's participation in the world of business and the image of the successful entrepreneur must change with the times (Fagenson and Marcus, 1991). Within the technology sector this need is even more pressing if greater acceptance of 'successful' female entrepreneurs is to be achieved. In the meantime, the notion of female subordination and the de-valuation of feminine activities continue to impact negatively upon the nature and level of female entrepreneurs' human and social capital.

With regard to future research, studies that focus on strategies for enhancing the quality of female entrepreneurs' networks, particularly in sectors that are traditionally male-dominated, are now required. Further research is also needed into the dynamics of female networking activity, including how internal networks can supplement external networks during key decision-making processes. Furthermore, research which compares male and female technology entrepreneurs would also help to highlight the extent to which the women in our study, particularly those in the more established businesses, exhibited networking behaviour reminiscent of their male counterparts.

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Table 1: Demographic characteristics of the female entrepreneurial firms in the study

Firm	Sector type	Product/Service	Business Activities	No. of employees	Formal Network Membership -mixed (M) or single sex (S- Female: S-Male)	Lone (L) or team (T) start (currently)	Age at time of set-up (years)	Time in business (years)	Marital status and no. of Children
AA	Technology	Product	Computer Software Design	20	Yes (M)	L (L)	29	12	Married (2)
BJ	Technology	Service	E-commerce Solutions Provider	3	Yes (S-F)	T (T)	36.5	2.5	Married (1)
CK	Technology	Product	Computer Software Design	18	Yes (M)	T (T)	30	5	Married (4)
DR	Technology	Service	Data Cabling Provider	17	Yes (M)	T (T)	29	15	Married (7)
ER	Technology	Product	Software Developer	6	Yes (M)	L (T)	42	12	Single (0)
FS	Technology	Product	Software Developer	14	Yes (M)	T (T)	32.5	4.5	Married (0)
GM	Technology	Service	Data Management	5	Yes (S-F)	T (T)	30	3	Married (4)
HH	Technology	Product	Software Developer	6	Yes (M)	L (L)	34	14	Married (3)
IC	Technology	Product	Software Developer	15	Yes (M)	T (T)	36	4	Married (2)
JB	Science	Service	Clinical Analysis	12	Yes (M)	L (T)	23	15	Single (0)
KM	Science	Service	Clinical Analysis	26	Yes (M)	T (T)	37	8	Married (2)
LP	Technology	Product	Software Developer	20	Yes (M)	T (T)	33	10	Married (1)
MR	Engineering	Product	Bespoke Components Manufacturer	3	Yes (S-F)	L (L)	47	9	Widowed (1)
NS	Science	Product	Design Clinical Devices	0	Yes (M)	T	39	0	Married (2)
OH	Engineering	Product	Electro Magnetic Component Manufacturer	0	No	T	26	0	Co-Habit (0)
PT	Science	Product	Design Microbiological Devices	0	No	T	27	0	Single (0)
QG	Science	Product	Design Medical Devices	0	No	T	28	0	Married (0)
RC	Engineering	Product	Design Electrical Engineering Devices	0	No	T	26	0	Single (0)
	AVERAGE			9			32.5	6	

Source: Developed by profiling the interviewees

Table 2: Analysis codes and the linkages between the first and second stage interviews

Generic themes from the literature	Analysis codes from the first stage interviews	Analysis codes which emerged from the second stage interviews
Female entrepreneurial networking:	Role of female networking	Challenges in networking for female Entrepreneurs
Importance of networking	Nature of female networking - formal vs. informal	Composition of female entrepreneurial networks
Networking lifecycle issues	Changes in the nature of networking between pre-start, new venture and established female firms	Network quality: characteristics and dimensions of female networks towards gaining network benefits

Source: Developed as a result of the researchers' literature and empirical research

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