EXPLORING THE MOTIVATIONS AND PRE-ENTREPRENEURIAL CAREERS OF FEMALE, HIGH-TECHNOLOGY ENTREPRENEURS

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ABSTRACT

Women are a relatively untapped source of entrepreneurial potential within areas of the economy, such as high technology sectors which are seen as important for innovation, wealth and employment creation. The nature of the business environment and its growing acceptance of women in business have, to some extent, influenced the motivations of women to consider entrepreneurship as an alternative career path. Women are well-represented as entrepreneurs in some sectors of the economy; however, they remain heavily underrepresented in areas such as science, engineering and technology (SET).

Whilst many previous studies have been conducted amongst female entrepreneurs operating businesses in traditionally female sectors, such as retail and personal services (many of which are characterised as life-style businesses), little attention has been paid to investigating the motivations and pre-entrepreneurial careers of women establishing and developing ventures in high technology-based areas of the economy. The pre-entrepreneurial career is important in influencing the nature and extent of an entrepreneur’s social, human and financial capital, all of which play a vital role in shaping the start-up venture and have an impact on its subsequent growth.

In the context of the current recession, arguably, technology sectors have an even more important role to play. Given the under representation of women in the field, and their untapped potential, many governments are looking for ways to encourage more women to establish their own ventures. An enhanced understanding of the motivations and pre-entrepreneurial pathways of women in technology might help to identify ways in which to encourage more women to consider taking that career route. Research reported here addresses the gap in the literature by exploring the pre-entrepreneurial careers and start-up motivations of 18 female technology entrepreneurs in Northern Ireland, using data collected through an exploratory, qualitative, interview-based study. Implications for theory, policy and practice are explored.

INTRODUCTION

A sizeable amount of entrepreneurship research and, more specifically, research on female entrepreneurs has focused on motivations for entrepreneurial start-up. Indeed, a number of studies have attempted to establish a link between the motivations for start-up and the overall performance of female-owned firms (Carter and Cannon 1988, Cromie & Hayes 1988, Goffee & Scase 1985). Although such research provides a basis for understanding, little specific focus has been directed towards female entrepreneurs operating in male-dominated sectors such as those centred on the exploitation of technology-based opportunities. Prior research among female entrepreneurs highlights a number of push and pull motives for start-up with some being the same as those of male entrepreneurs, and others being acknowledge as more gender-specific (Rosa et al 1996), such as those which centre on aspects of flexibility required to establish an effective home and work-life balance (Goffee & Scase 1985, Losocco & Leicht 1993). Two factors which appear to influence most strongly the decision of women to follow an entrepreneurial career path and establish ventures of their own are their responsibilities to their family (known as the ‘sticky floor’ concept) and the influence of the ‘glass ceiling’ which blocks advancement to more senior positions (Welsh & Young 1984). Consequently, some studies have suggested that entrepreneurship, rather than being a choice, is a
last resort for many women who face gender discrimination in employment. This paper explores the motivation and pre-entrepreneurial backgrounds and experience of 18 female technology entrepreneurs in Northern Ireland who have established technology-based ventures rather than remain as employees.

HIGH-TECHNOLOGY ENTREPRENEURSHIP AND THE FEMALE ENTREPRENEUR

At a generic level the formation of a new firm is the culmination of entrepreneurial action on the part of one or more individuals working together; some firms result from venturing activity by local, indigenous entrepreneurs whilst others are created by those who move into a region. The majority of entrepreneurs have worked for other employers prior to starting their own firm which enables them to draw upon their prior work experience and capitalise upon social capital networks. The nature of the entrepreneur’s previous work experience (Chandler 1996, Shane 2000) and the types of opportunities to learn about the process of and the resources required for venture formation and growth may influence the initial decision to found the venture and breadth of experience on which they have to draw (Harrison et al. 2004).

The establishment of a high technology venture requires the entrepreneur to take into account a range of factors which influence the ease or difficulty of starting a new firm. The nature of the technology on which the firm is based exerts certain influences on the venture creation process (Oakey & Cooper 1991, Oakey 1995). These include variable barriers to entry into the market which will differ through time and vary between sectors (Oakey 1995). New sectors may be less competitive and the niche opportunities in newly emerging markets; provide suitable commercial opportunities of an appropriate scale for new firms. As markets develop entrepreneurs who wish to grow their ventures have the possibility of doing so within the context of the same market sector. In more mature sectors, dominated mainly by large firms, there may also be small niches which are unattractive to the larger incumbents which provide a suitable environment for the smaller, new entrant. Another option here is for small and larger firms to join forces, pool resources and collaborate, particularly where the specialist small firm complements the activities of the larger venture, permitting it to concentrate on its core business (Cooper 2001).

The length of the product development cycle is a key aspect which influences the emergence and growth of technology-based firms as it exerts strong pressures, particularly financial ones, on the start-up venture and its founder(s) (Oakey & Cooper 1989, Malecki 1981, Markusen 1985). To start a software company and take a product to market may require a period of several months, whereas it is likely to take several if not many years to get a biotechnology-based product to market. The skill of the entrepreneur lies in balancing resource needs, personal/team skills and how to use these assets to address the opportunity. Maximising access to and minimising ownership of resources is an important strategy for the start-up venture and here the use of personal and professional networks enables entrepreneurs to access resources not directly under their control. Networks which provide access to prospective customers, supplier, investors or technical specialists are frequently developed as a result of entrepreneurs setting up ventures in the same sector or a closely related sector to that in which they have worked previously (Cooper & Park 2008). In such situations entrepreneurs are able to build on previous connections and the reputation and credibility developed through experience and some form of a track record to leverage valuable resources.

Thus, “the technical entrepreneur has to tolerate risk… has to generate support for a technology about which few people know, imparting his philosophy, spirit, vision and enthusiasm for his enterprise to all concerned with it. Surrounded by uncertainty, the financier is persuaded to place his money over a ‘black hole’ capable of swallowing thousands or millions of pounds with no guarantee of a return, and personnel are recruited, often from positions within other organisations. Thus, the technical entrepreneur is a risk taker required to persuade others to put their faith, finance and careers in his hands” (Cooper 2006a). Those to embark on the entrepreneurial journey need the skill and knowledge as well as persistence and determination to drive innovation and overcome whatever barriers and challenges which they will be confronted by.

The evidence is that while many opportunities exist in technology-related areas the majority of these are pursued by men so the female technology entrepreneur is a much rarer specimen than her male counterpart. Moore and Buttner (1997, 13) characterise 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.’ Historically, little attention was afforded to female entrepreneurs until the early 1980s (Moore & Buttner 1997, Walker & Webster 2007), since when a greater focus has recognised women’s credibility as capable business founders. There is still much work to be done in the domain (Carter at al. 2001, Henry & Kennedy 2003), which is particularly true in the context of female-led entrepreneurship and business growth within technology-based sectors (Winn 2004).
Government agencies are keen to encourage greater numbers of women to become entrepreneurs and are targeting start-ups which are seen as important components in employment creation and economic growth (Reynolds et al. 2004). The numbers of women engaged in enterprise have traditionally been much lower than those of men who are three to four times more likely to start new ventures (O’Reilly & Hart 2003). Entrepreneurial women are well-represented in some service sectors of the economy such as retail and personal services but remain heavily underrepresented in technology sectors, despite increasing numbers of women studying relevant degree subjects at university (Losocco & Robinson 1991, Mayer 2006, NFWBO 1999). A sizeable proportion of the women who do study SET subjects at degree level do not take up jobs in related sectors when they graduate; as a result they do not gain experience which would enable them to develop effective networks and be in a position to identify attractive SET opportunities (Anna et al. 2000).

**MOTIVATIONS FOR ENTREPRENEURSHIP AND THE IMPACT OF PRIOR EXPERIENCE**

Entrepreneurial Motivations

Cromie (1987) suggests that differences exist in the start-up motivations of male and female entrepreneurs, arising from the differences they attach to particular motivators. Change in the nature of the business environment and its greater acceptance of women in business has, partly, influenced the inclination of more women to pursue an entrepreneurial career. According to Orhan and Scott (2001) only a small proportion of entrepreneurial motivations are gender-based, with research pointing to motivations such as career advancement and flexibility to balance dual roles (Goffee & Scase 1985, Losocco & Leicht 1993). Some studies have attempted to establish a link between the motivations for start-up and the overall performance of female-owned firms (Carter & Cannon 1988, Cromie & Hayes 1988, Goffee & Scase 1985); indeed, this is an aspect of female entrepreneurship which has received considerable attention (Carter 2000a, b). Female entrepreneurship researchers have classified motivations into two categories: those which push women away from paid employment towards entrepreneurial careers and those which pull them towards business start-up (Alstete 2002, Brush 1990, Buttner & Moore 1997, Glancey et al. 1998). Orhan and Scott (2001), however, suggest that women are rarely motivated by just one factor and, instead, make decide to pursue entrepreneurship on the basis of a number of inter-related factors.

**Push factors:** At a general level ‘push’ factors are negative influences, such as redundancy, job insecurity, poor job prospects, and animosity in workplace, which push individuals away from paid employment or other activities towards an entrepreneurial career (Gilad & Levine 1986); however, Catley and Hamilton (1998) suggest that entrepreneurship, rather than being a choice, is a last resort for women who, because of their gender, face discrimination in employment (Deakins & Whittam 2000). Two factors, more than any others, appear to influence the uptake of entrepreneurship by women, their family responsibility (known as the ‘sticky floor’ concept) and the ‘glass ceiling’ which prevents them from rising through the ranks of many organisations. Research suggests that the necessity of earning a living and being able to ‘look after their children’, are push factors which commonly drive women into developing their own business (Alstete 2002, Orhan & Scott 2001) as entrepreneurship is viewed as making it possible to balance home and work-life situations (Carter & Anderson 2001). Some suggest that entrepreneurship is the only way in which women, with family and domestic commitments, can balance work and home-life roles (Cromie 1987, Fielden et al 2003). Several authors have highlighted the effect of the “glass ceiling” especially in the context of executive women who have been impeded from obtaining job progression to more senior positions (Carter & Cannon 1988, Welsh & Young 1984). Entrepreneurship is often considered an “easier way” to meet their personal need for achievement, success and self actualisation, than trying to move up a restricted corporate ladder (Moore & Buttner 1997) where organisational selection criteria, based on gender, age and level of experience, can influence the speed with which career movement is possible (Cromie & Hayes 1988). On a similar theme, Maclaran et al. (1997) use the term “glasshouse” to encapsulate the assumptions and misconceptions which constitute barriers to the advancement of women, restricted, contained and controlled by their environment and the status quo of male cultures.

**‘Pull’ factors:** At a general level ‘pull factors are positive influences, such as the need for independence, entrepreneurial drive, desire for wealth, social status and power (Alstete 2002, Orhan & Scott 2001), which attract individuals towards entrepreneurship to provide independence, fulfill ambition and realise other desirable outcomes. Some suggest that pull factors tend to be more dominant than push factors for
entrepreneurs (Keeble et al. 1992, Orhan & Scott 2001) as they are largely determined by choice (Orhan & Scott 2001) and entrepreneurial aspirations (Deakins & Whittam 2000). The central reason that both men and women start their own businesses is for independence, the challenge of business ownership and control (Brush & Hisrich 1988, Carter & Cannon 1992, Goffee & Scase 1985, Simpson 1991).

Evidence suggests that a sizeable number of women enter into entrepreneurship for flexibility and independence. They seek a greater balance between their working lives and their personal lives. According to McKay (2001), older women seek entrepreneurship for independence, as the perception of ‘working women’ has now changed. These women may have experienced intense pressure during their younger lives to give up work and put family needs first, supporting their husband’s career and/or bringing up a family, ahead of their own personal goals. Thus, entrepreneurship is a route via which they can gain recognition and reward. More recently research has considered that a growing number of women are motivated by professional freedom, self-direction and dynamic challenges (De Martino & Barbato 2003).

Some research has pointed to the possibility that women may not, in general, be motivated in the same way as men (Galloway et al. 2002). Despite evidence suggesting that women have strengths in business, some have questioned female motivations for entering into business, in particular their need for achievement and their risk-taking propensity: it is suggested that women are more motivated by the social contribution their business can make (Orhan & Scott 2001). Still and Timms (2000a, b) suggest that women’s objectives are to do something worthwhile, thus, taking a more client-focused approach compared with their male counterparts (Brush 1992). Minniti et al. (2005) propose that the likelihood of failure has a major impact on a woman’s decision whether to pursue entrepreneurial ambitions. With specific reference to Northern Ireland, the location of this research, the GEM report has acknowledged that fear of failure is a major obstacle to business creation (O’Reilly & Hart 2005). Yet research by Hisrich and Brush (1986) claims that a ‘fear of failure culture’ is not as important to women; however, what is important, is the opinion of society and family regarding their pursuit of an entrepreneurial career.

The importance of financial gain is often suggested as a motivating factor in deciding to move from paid employment (Baumol 1990) and that this will encourage some to accept the risk of giving up the security of a job in hope that it will pay off and reap financial benefits (Campbell 1992, Praag & Cramer 2001). Marlow (2002), however, suggests that this is not usually the case with female entrepreneurship as typically it is linked to low profit and growth aspirations. Rosa et al. (1996) suggests that women do not enter business for financial gain, but to pursue intrinsic goals such as independence and flexibility, to balance family and work commitments.

Typically, there are likely to be a range of push and pull factors operating together. According to Walker (2000) push factors are becoming more prominent motivators for female entrepreneurs, and what has been seen on other research is the way in which it is a push factor which typically pushes entrepreneurs over the proverbial ‘edge’, to pursue an idea to which they have been attracted for some time, but have lacked to trigger to turn latent entrepreneurial interest into actual entrepreneurial action. In doing so, the personal and professional background of the entrepreneur plays a pivotal role in shaping the business which emerges as a result of the different motivating forces. The following discussion explores the motivations of a group of female SET entrepreneurs and the relationship between their human and social capital at the point of starting their venture and the businesses they created.

**RESEARCH METHODOLOGY**

Entrepreneurship research lends itself to approaches which provide opportunities for discovery, exploration and theory building. Some suggest moving beyond conventional methods and adopting new approaches (Carson & Coviello 1995, Chell & Haworth 1992, Hofer & Bygrave 1992). Given the infancy of the research area and exploratory nature of the subject, a qualitative methodology was adopted for this study (Carson et al. 2001, Hill et al. 1999, Hirschman 1986, Miles & Huberman 1994). The paper draws on the findings from a sample comprised of 18 respondents, who were owner-managers of technology-based businesses operating in Northern Ireland (Table 1a and 1b). Over the previous 12 months, the five nascent entrepreneurs had been actively involved in starting their new business which they at least part owned (Hart 2007); they are classified as being in the ‘pre-start up’ phase. Five women were ‘new venturers’, who had been operating their businesses for five years or less, with a limited market/product range (Carson & Cromie 1991, Hart 2007). The final eight women owned and ran ‘established companies’, which had operated for over than five years. Table 1a provides further details of the SET-based business which the women operated in Northern Ireland. This study used a convenience sample which generated information-rich case studies which provided valuable insightful into the phenomena being studied (Neuman 1997).
Data were collected using a two-stage process with 12 months between interviews. Unstructured, in-depth interviews were undertaken, with an emphasis on “informal”, exploratory discussion as opposed to asking a series of specific and highly structured questions. Themes were identified to guide the interviewer and the relative informality of approach facilitated exploration of issues. The first round of interviews concentrated on business start-up while the second sought greater depth regarding the significance of motivations to pursue an entrepreneurial career. There was an emphasis on understanding issues associated with motivations either ‘push’ or ‘pull’ factors, as well as the pre-entrepreneurial background of these females to enter into a pre-dominantly male industrial sector. Insights into the reasons for start-up emerged as they spoke in their own words (Carson et al., 2001, O’Donnell & Cummins 1999). Data were analysed concurrently (Merriam 1988), as interviews were conducted in three sets, each comprising of six companies. Interviews at each stage in the primary research lasted an average of one and a half hours and were digitally recorded and transcribed.

Given the potentially messy and chaotic nature of qualitative data, a methodical and systematic approach to analysis was required (Easterby-Smith et al. 1991, Miles & Huberman 1994, Tesch 1990). Technology was used in the form of NUD.IST software to make the process of coding and analysis more efficient (Catterall & Maclaran 1996, Dey 1993). To generate confidence in the research findings once the data had been transcribed and analysed results were referred back to the interviewees for clarification, amplification, corroboration and amendment, if necessary (Guba & Lincoln 1994, Hirschman 1986).

**FINDINGS AND DISCUSSION**

When starting a new venture, the entrepreneur must identify a market opportunity and bring together the necessary human, financial, intellectual and physical resources. Their ability to spot a viable opportunity will be influenced by factors linked to their knowledge, skills and personal/professional motivations. To understand better how the female technology entrepreneur is shaped by her pre start-up experience and personal context, and the impact these have on her business, the discussion begins by exploring the personal context of the women in the research sample when they decided to start their firm. The discussion then explores their motivations for establishing their ventures and considers how their personal and professional backgrounds helped shape the firms which they created (Tables 1a and 1b).

**Personal Context at Start-up**

**Age:** The amount of experience and level of skills required to start a venture may differ between sectors and even within sectors, placing barriers in the path of the would-be entrepreneur. There are notable examples of successful, young entrepreneurs, including Gates and Branson; however, the majority of technology entrepreneurs establish their business after at least several years as employees (Cooper 2006b, Harrison et al. 2004).

The average age of the women at start-up was 32.5 years (Table 1a), the youngest was 23 and the oldest 47. Only two of the women were in their 40s. Interestingly, four of the five nascent entrepreneurs were under 30 years of age and so may have been encouraged to become entrepreneurs at a relatively early age by the changing culture towards women in business. A study of technology entrepreneurs in the United Kingdom (UK), who happened to be men, revealed a mean of 35 years at start-up and a range of 20 to 55, with a little under a third of entrepreneurs in their 40s (Cooper 2006b) so these findings suggest that this sample of women represent quite early entrants into the entrepreneurship space. This raises a question as to whether some of the women were pushed into entrepreneurship by barriers in their career path, an issue explored later in the discussion. It is important to note that MR had begun her entrepreneurial career at a younger age than that indicated in Table 1a as she had three businesses prior to this start-up.

**Marital status and family:** The work of Cohen, (1997), Johnson and Storey, (1993) and Goffee and Scase, (1985) suggest that there is no dominant trend for female entrepreneurs to be married. The majority of women in the sample were married (12) and one was a widow (Table 1a). The majority of these 13 women (11) had children, with numbers ranging from one to seven. While seven of the participants had no children, four of these women were nascent entrepreneurs and were four of the youngest in the study. It is clear from this research that many of the women had started their business once they were married and some had children. For some of the respondents the fact that they were married had made business start-up possible because their husband’s income reduced some of the financial risk. Indeed, Table 1a indicates that majority of female entrepreneurs had two full-time incomes in the household. A typical comment by nascent entrepreneur QG supported this view: “I have a husband! It would be a huge financial risk, but I
am fortunate that I am not the breadwinner in the house, so we could survive. God forbid that anything should happen but it wouldn’t be the end of the world if it didn’t work out, though it is a risk”. HH, who ran an established firm, noted: “From a money point of view… I had two young boys, I was married, we’d a mortgage, and my husband was just a newly trained teacher so he certainly wasn’t the huge breadwinner…but we had another income and I thought well, if things don’t work out by September I will always get another job”. Of the eleven entrepreneurs with children, only one woman (AA) set-up her business prior to having a family, seven decided to set-up after the birth their children and three combined having their family and setting up their own venture.

Table 1a: Characteristics of the female entrepreneur (FE) and her business

<table>
<thead>
<tr>
<th>FE</th>
<th>Age of FE at start-up</th>
<th>Marital status and (no. of children)</th>
<th>Highest level of education</th>
<th>Sector</th>
<th>Business activity</th>
<th>Age of firm in years</th>
<th>No. of employees</th>
</tr>
</thead>
<tbody>
<tr>
<td>AA</td>
<td>29</td>
<td>Married (2)</td>
<td>HND - Computers and Business</td>
<td>Technology</td>
<td>Computer Software Design (P)</td>
<td>12</td>
<td>20</td>
</tr>
<tr>
<td>BJ</td>
<td>36.5</td>
<td>Married (1)</td>
<td>UG - Computer Science</td>
<td>Technology</td>
<td>E-commerce Solutions (S)</td>
<td>2.5</td>
<td>3</td>
</tr>
<tr>
<td>CK</td>
<td>30</td>
<td>Married (4)</td>
<td>UG - Business Studies</td>
<td>Technology</td>
<td>Computer Software Design (P)</td>
<td>5</td>
<td>18</td>
</tr>
<tr>
<td>DR</td>
<td>29</td>
<td>Married (7)</td>
<td>UG - Politics</td>
<td>Technology</td>
<td>Data Cabling Provider (S)</td>
<td>15</td>
<td>17</td>
</tr>
<tr>
<td>ER</td>
<td>42</td>
<td>Single (0)</td>
<td>UG - Computer Science</td>
<td>Technology</td>
<td>Software Developer (P)</td>
<td>12</td>
<td>6</td>
</tr>
<tr>
<td>FS</td>
<td>32.5</td>
<td>Married (0)</td>
<td>UG - Archaeology</td>
<td>Technology</td>
<td>Software Developer (P)</td>
<td>4.5</td>
<td>14</td>
</tr>
<tr>
<td>GM</td>
<td>30</td>
<td>Married (4)</td>
<td>O-Levels (GCSEs)</td>
<td>Technology</td>
<td>Data Management (S)</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>HH</td>
<td>34</td>
<td>Married (3)</td>
<td>UG - Electrical &amp; Electronic Engineering</td>
<td>Technology</td>
<td>Software Developer (P)</td>
<td>14</td>
<td>6</td>
</tr>
<tr>
<td>JC</td>
<td>36</td>
<td>Married (2)</td>
<td>PG - MBA</td>
<td>Technology</td>
<td>Software Developer (P)</td>
<td>4</td>
<td>15</td>
</tr>
<tr>
<td>JB</td>
<td>23</td>
<td>Single (0)</td>
<td>UG - Bio-medical Science</td>
<td>Science</td>
<td>Clinical Analysis (S)</td>
<td>15</td>
<td>12</td>
</tr>
<tr>
<td>KM</td>
<td>37</td>
<td>Married (2)</td>
<td>UG degree – Nursing</td>
<td>Science</td>
<td>Clinical Analysis (S)</td>
<td>8</td>
<td>26</td>
</tr>
<tr>
<td>LP</td>
<td>33</td>
<td>Married (1)</td>
<td>UG - Electrical &amp; Electronic Engineering</td>
<td>Technology</td>
<td>Software Developer (P)</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>MR</td>
<td>47</td>
<td>Widowed (1)</td>
<td>UG - Art and Design</td>
<td>Engineering</td>
<td>Bespoke Components (P)</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>NS</td>
<td>39</td>
<td>Married (2)</td>
<td>UG - Occupational Therapy</td>
<td>Science</td>
<td>Design Clinical Devices (P)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>OH</td>
<td>26</td>
<td>Co-Habit (0)</td>
<td>PG - Electrical and Mechanical Engineering</td>
<td>Engineering</td>
<td>Electro Magnetic Component (P)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>PT</td>
<td>27</td>
<td>Single (0)</td>
<td>PhD - Bio-medical Science</td>
<td>Science</td>
<td>Design Microbiological Devices (P)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>QG</td>
<td>28</td>
<td>Married (0)</td>
<td>PhD - Bio-medical Engineering</td>
<td>Science</td>
<td>Design Medical Devices (P)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>RC</td>
<td>26</td>
<td>Single (0)</td>
<td>PG - Electrical and Mechanical Engineering</td>
<td>Engineering</td>
<td>Design Electrical Engineering (P)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>32.5</td>
<td>AVERAGE</td>
<td></td>
<td></td>
<td></td>
<td>6</td>
<td>9</td>
</tr>
</tbody>
</table>

Source: Developed by profiling the interviewees

Motivations for Venture Start-up

It was evident that most of the women had given up the security of a good, well-paid job, in order to start their venture. LP discussed how she had realised that if she wanted to build a successful business she had to sacrifice other things in her life. The extent of this ‘sacrifice’ was clear from AA’s comment: “...they (previous company) offered me a directorship and all sorts of things and I was really quite young then… I’d had a successful career…I was earning a big salary and had all my perks…but I decided I’d had enough”.
‘Push Factors’: The ‘push’ factors identified in this study appear to confirm that some of the women moved into entrepreneurship because of a lack of job prospects, the ‘glass ceiling’ effect and necessity. The lack of suitable job prospects in Northern Ireland was identified mainly by women who had set up their firms more than five years earlier. These women pointed to a lack of scope for them to be employed in quality, high-powered positions which were challenging, given the level of skills and knowledge they had gained. They had responded to both the metaphorical ‘glass ceiling’ which they perceived restricted their career path in the SET domain, and also the nature of the Northern Irish employment market for women in SET. For example, AA commented, “I knew I had acquired a lot of skills...and to be honest with you I couldn’t see a job in this region that would allow me to progress” and MR noted, “I came back here and all I was really qualified to do was to be a designer...but women in that business in Northern Ireland were not part of the scene nine years ago”. The impact of the ‘glass ceiling’ was illustrated by ER whose experience had pushed her into entrepreneurship: “I was working for a company where three companies were actually going to merge into one, there were too many managers...and the chap who became MD...he was elderly, old school and he didn’t like women managers...he made three senior managers redundant and two of them were the only senior women managers he had...and I was one of them”.

The necessity to ‘earn a living’ also emerged as a dominant ‘push’ factor, due to redundancy and the ‘need to survive’. Redundancy not only acted as a motivator to become an entrepreneur, but it was also the means by which the start-up became possible. ER sat tight in her job and kept quiet about the ‘glass ceiling’ which she had encountered because she knew that her redundancy package was critical to the start-up of her venture. Also, for BJ, ‘voluntary severance’ was what ‘pushed’ her towards entrepreneurship. Similarly, GM also set-up her business venture using her redundancy payment. The majority of women became entrepreneurs out of necessity, to survive. GM explained, “We just had to do it because we needed to pay our mortgage”. Similarly DR claimed that she and her husband were, “…accidental business people, we just had to put cornflakes on the table because I didn’t work”.

Necessity to survive is acknowledged in the entrepreneurship literature, but its relevance is sometimes questioned in the case of female entrepreneurs in general, as a result of the assumption that they are not the ‘sole breadwinner’. This implies an, arguably, somewhat dated view of women as subservient and supported, which this research suggests is not generally the case today, when many women are equally responsible for supporting and providing for the home. It also tends to overlook women do not have partners, which is the case with a number of women in this sample. It is relevant to mention here, also, that some of the women had been able to take the entrepreneurial step because of their husband’s income acting as a safety net, so the picture is not ‘cut and dried’ across this group of SET entrepreneurs.

In contrast to the findings of female entrepreneurship research cited earlier only two of the women in this study pointed to having set-up in business because of their role as primary carer for their children. GM reflected on what had motivated her, “We thought...I would have more of a structured life, nine to five and come home. With four children, four boys, I thought this could give me more time to be with the boys”. BJ looked for similar personal benefits, “The reason we wanted our own business, was for me – a strong part of that was for me and my daughter...she had been at nursery since she was four months old. I dropped her off every day at a quarter to eight and picked her up at a quarter to six...at this stage she was primary one...I felt there had to be more to life and I had to spend more time with her”. For this minority of women who sought an improved work-life balance the reality, however, was that their businesses had taken off and had come to dominate family life, as GM reflected, “...in some ways in gives me less time with the boys ... we wanted to be our own bosses but we thought we would have more time to ourselves ... but at the moment we don’t have”.

‘Pull Factors’: The literature suggests the two core reasons for women in general to enter entrepreneurship are social contribution (Orhan and Scott 2001) and independence (McKay 2001). While push factors had been important motivators for start-up many of the interviewees cited pull factors which included social contribution, independence, recognition of an opportunity in the market, self-fulfilment and wealth. Thus, this research supports the importance of these factors and identifies additional key pull factors. In the wider entrepreneurship literature recognition of an opportunity, self fulfilment and wealth are pull factors primarily believed to motivate male entrepreneurs, but are here they are seen to influence these female SET entrepreneurs.

Taking the more traditional female motivators first, a common theme to emerge among some women, especially those in the science-based firms who had set-up ventures to ‘do good’, was a desire to contribute something to society which would impact positively on peoples’ lives. Here, NS’s comment was
typical, “What’s so special is, it’s going to make such a difference to the quality of life for people who are so physically disabled and for me that’s really, really important”.

For women whose businesses operated in a more commercial setting, the main reason for start-up was different. Wealth and personal gain was more important, and the potential to become ‘rich’ was a strong motivating factor for risking the security of a current job. However, in many instances this was combined with additional reasons such as job dissatisfaction and the spotting of an opportunity in the market. Reflecting this position KM stated, “I have to be very honest...I wanted to make a whole lot of money because I could see from where I was working, that I was working exceptionally hard for someone else for not an adequate reward...so that was my prime motivation”. On a related note, JB commented, “I think I realised at some point, it had always been my idea to build up and sell out... make some money because I put very, very little in cash terms into the business to start with”. Thus, although the literature suggests that financial gain is not a prime motivator for female entrepreneurs (Rosa et al. 1996) this research suggests that some women in this study were motivated by monetary gain. In addition, these women did seek intrinsic goals such as independence (Rosa et al. 1996) along with the challenge of business ownership and control (Carter & Cannon 1992, Simpson 1991, Brush & Hisrich 1988, Goffee & Scase 1985).

This level of independence meant a certain amount of flexibility. Both AA and ER were led to entrepreneurship, for a level of flexibility. However, this was not for family responsibility but for a flexible lifestyle, as ER’s reflection highlighted, “One of the reasons for going out on my own was that I only wanted to work three days a week, I wanted a bit of time off to myself”. A related factor was the desire for self-fulfilment, and the need to achieve (Hirsch & Peters 1986). The quest for self-fulfilment and achievement are reflected in IC’s typical comment, “I’d been out trekking around the world for about 12 years...to bring back the experience that I was building up in an Irish setting...back to this sort of little microcosm of X (town established in), was pretty useful and I just found it really fulfilling...”.

Building on comments early about opportunity spotting, some of the women were motivated by opportunities they recognised in the marketplace. As NS observed, “The idea came from a real situation that I worked in and I could see the potential”. DR commented that her husband had been working in the market, getting experience when she realised it had potential. She remarked: “We had no notion of starting a business...we were at a crossroads wondering what we would do next...but we were not thinking in terms of starting our own business...it was more a case of here’s a job I can do...and it dawned on me that there was great potential there if there was a bit of structure”.

Knowledge and Prior Experience

**Education:** Education is important in the development of entrepreneurial human capital as it has an impact on the individual’s knowledge, skills and attitudes. The establishment of a technology-based venture requires different types of knowledge, associated with both the business/market and technology dimensions of the enterprise. The women in this study were, generally, highly educated; all but two of them held at least an undergraduate degree and four has postgraduate degrees, two of these a PhD (Table 1a). Of the two women who did not have a degree one had a vocationally-oriented HND in Computing and Business which provided a good background for her software design business and the other, who left school with O levels post-16, ran a data management business. Most of the women educated to degree level held degrees which were either directly related to their business or an aspect of the degree was related to the venture’s SET focus. While the numbers of women now studying for SET degrees is increasing HH reflected on her university experience some years earlier: “I graduated in 1977...at that stage, I was the only one (female) in my year for three years, while I was at Queen’s”. These findings contrast with those of Cooper’s study of technology entrepreneurs (2006b) which revealed that more than 50% of the male founders did not hold degree, but around two-thirds had worked in a related sector prior to start-up. One interpretation of this could be that to gain credibility in a male-dominate field, women have to be equally if not more qualified than their male counterparts to gain an employment position and then to go on to found a business and compete against men in a similar field.

**Prior work experience:** Education is important because it lays the foundations of an individual’s career, but for the would-be entrepreneur the experience which they acquire post secondary or tertiary education is also important because it influences the potential to develop further technical know-how and also business/market awareness. From analysis of Table 1b it is evident that the vast majority of these women worked in sectors which enabled them to develop both technical and business capability. The findings align
with those of Mukhtar et al. (1998) which pointed to the role of prior industry experience in the development and survival of technology-based ventures.

Table 1b Characteristics of the female entrepreneur (FE) and her business (continued)

<table>
<thead>
<tr>
<th>FE</th>
<th>Sector employed in pre start-up</th>
<th>Position in firm where employed</th>
<th>Lone (L) or team (T) start (current)</th>
<th>Skills of team - Similar/different from FE</th>
</tr>
</thead>
<tbody>
<tr>
<td>AA</td>
<td>IT</td>
<td>Member of Senior Mgt Team</td>
<td>L (L)</td>
<td>-</td>
</tr>
<tr>
<td>BJ</td>
<td>Banking</td>
<td>Business Account Manager</td>
<td>T (T)</td>
<td>Different</td>
</tr>
<tr>
<td>CK</td>
<td>Electronics</td>
<td>General Manager in the family business</td>
<td>T (T)</td>
<td>Different</td>
</tr>
<tr>
<td>DR</td>
<td>Telecommunications</td>
<td>Sales Executive</td>
<td>T (T)</td>
<td>Different</td>
</tr>
<tr>
<td>ER</td>
<td>Software</td>
<td>Senior Manager</td>
<td>L (T)</td>
<td>-</td>
</tr>
<tr>
<td>FS</td>
<td>IT</td>
<td>IT Consultant</td>
<td>T (T)</td>
<td>Similar</td>
</tr>
<tr>
<td>GM</td>
<td>Care worker</td>
<td>-</td>
<td>T (T)</td>
<td>Different</td>
</tr>
<tr>
<td>HH</td>
<td>IT Consultancy</td>
<td>Senior Consultant</td>
<td>L (L)</td>
<td>-</td>
</tr>
<tr>
<td>IC</td>
<td>Telecommunications</td>
<td>Business Development Manager</td>
<td>T (T)</td>
<td>Different</td>
</tr>
<tr>
<td>JB</td>
<td>Bio-medical Science</td>
<td>Microbiologist</td>
<td>L (T)</td>
<td>-</td>
</tr>
<tr>
<td>KM</td>
<td>Clinical Analysis</td>
<td>Clinical Manager</td>
<td>T (T)</td>
<td>Different</td>
</tr>
<tr>
<td>LP</td>
<td>Education</td>
<td>IT Manager</td>
<td>T (T)</td>
<td>Different</td>
</tr>
<tr>
<td>MR</td>
<td>Self employed in Catering Business</td>
<td>Owner/Manager</td>
<td>L (L)</td>
<td>-</td>
</tr>
<tr>
<td>NS</td>
<td>Occupational Therapy</td>
<td>Occupational Therapist</td>
<td>T</td>
<td>Different</td>
</tr>
<tr>
<td>OH</td>
<td>Engineering</td>
<td>Engineer</td>
<td>T</td>
<td>Similar</td>
</tr>
<tr>
<td>PT</td>
<td>Bio-medical Science Research</td>
<td>Research Associate</td>
<td>T</td>
<td>Different</td>
</tr>
<tr>
<td>QG</td>
<td>Bio-medical Research</td>
<td>Research Associate</td>
<td>T</td>
<td>Different</td>
</tr>
<tr>
<td>RC</td>
<td>Engineering</td>
<td>Engineer</td>
<td>T</td>
<td>Similar</td>
</tr>
</tbody>
</table>

Source: Developed by profiling the interviewees

More than half of the women worked in sectors where women had been in the minority (Table 1b) so many of these women had become accustomed to working in male-dominated environments. HH noted: “I would have been one of the few girls employed, certainly within engineering at that stage”. ER’s experience highlighted just how rare women were in the software sector where she worked prior to starting her own software development business, “I was working in an office with about twenty-five men in it and I was the only woman and you just have to learn...not to expect anything extra and to work hard”.

Despite the predominance of men in these sectors the gender issue did not appear to have had much effect on these women’s decision to start and grow a business within these sectors. Indeed, the majority of these women had never considered their gender to be an issue or believed it had had an impact on their entrepreneurial experience. However, this may be because by studying for a degree in largely ‘male-dominated’ subject areas and pursing prior careers in ‘male-dominated’ sectors they had already confronted and challenged gender stereotypes. These findings contrast with those of Beaver (2002), Brush (1992) and Hisrich and Brush (1984), but support results of US work which found that women are increasingly breaking with traditional perceptions and are gaining recognition in areas such as high technology (Langowitz & Morgan 2003).

Experience in a relevant field prior to start-up provides would-be entrepreneurs with the chance to identify opportunities and understand better the commercial context within which their business will operate (Cooper & Park 2008). These women entrepreneurs were generally at an advantage when it came...
to spotting businesses opportunities as most had a fairly thorough understanding of the market within which they were to operate their new venture, developed through years of experience (Table 1b). ER reflected: “I'd been working for 20 years in computers before I went out on my own. Quite often a couple of years working for someone else in the same area can be very helpful. To go out and start a business straight from university is very difficult”. FS recalled how she had identified a suitable opportunity, “I was working in data base consultancy for ten years and I was having a lot of difficulty in sourcing certain tools and software...and basically I knew how to do it so I did and set up on my own”. 

Given their age at start-up these women had worked for at least one employer and consequently had benefitted from, in many cases, a fairly sustained period of pre-entrepreneurial employment experience on which they were able to capitalise: others, including GQ and PT were quite recent graduates. Drawing on multiple sources of learning, NS talked of how she had developed a piece of technology to meet an indentified need: “I knew from my experience of disability and working in paediatrics, and my experience of learning difficulties, I could see a range of clinical scenarios that this (device) could be applicable to”. Some of the women had used some of their period of pre start-up employment very strategically. For example, AA returned to Northern Ireland after a period working away with the intention of starting her own business: “I decided I would take it (the job) despite it being a third of the salary I had in London, because it would give me an opportunity to a) keep my hand in and learn some new skills because I hadn’t been involved in all aspects of IT, and b) it would give me a chance to see what was going on and to meet people and develop my networks in NI...so it would be a learning year, I could do the job fairly easily and I could also find out what was going on”. For those with a predominantly a technical background, largely as a result of their education, working for someone else prior to starting their firm helped them develop skills which proved invaluable when starting their own business. By working for a larger company ER developed knowledge and skills in, “Man-management, people management, personnel management, budgeting, financial control in general and a bit of marketing...’cause in a small organisation, you have to do it all!” The financial side of the business often poses a challenge to the start-up entrepreneur: HH reflected, “I didn’t do any formal accounts training in X (previous employer) but I built up such a knowledge of balance sheets and profit and losses, in an informal way that set me up very well with a lot of business background...which I wouldn’t have had if I had left and set up directly on my own”. Entrepreneurs from a technical domain often find it hard to secure the first customer and experience difficult in closing sales, without which any business will ultimately fail. DR was grateful for her pre-start experience which had also enabled her to envision her venture beyond start-up, showing a potential path to help grow her business: “It taught me a lot about the art of selling, you know making calls, getting stuff across, making appointments and, actually closing a sale. Very raw but I was able to see a larger business structure and processes”. MR was the only women with prior start-up experience. She reflected, “Before I set up this business I had three businesses so my past experience certainly helped in getting this business going day-to-day”. 

Team development and expertise: While the focus of this research is on the female entrepreneur, in 13 of the 18 cases the women had started their venture with others, and of the five who started on their own two had been joined by team members subsequently, bringing complementary skills and experience (Table 1b). In only two of the 13 team starts did the fellow team members have the same skills and as the female entrepreneur; in the majority of cases the background and experience of the women were complemented by their fellow founders who added a different dimension to the skills and experience portfolio. The dominance of team start-ups in technology-based firm research has been noted in a number of studies, and there is evidence that team-based start-up perform better than lone starts (Cooper 2006b, Oakley 1995). Two women, who started ventures with a partner, identified their distinctive competences and division of labour. BJ noted “…because X (partner) and I have very different skill sets it works very well together, he’s PCs to his ears but that’s not necessarily what I’m about – yes I understand and I do them, but I’m more into the customer relationship side of things”, while DR indicated, “…it is me that runs the firm here, X (husband) has the technical expertise. That is the most potent business you get developing when the partnership is working and both partners have different skill sets”. Interesting, in both of these example the partner is male and takes the technical lead while the female entrepreneur leads the management/customer side of the business.

Reputation and networks: An added benefit of starting a venture in the same field is “reputational capital” (Slatter 1992), which in the case of a women entering a proverbial ’man’s world’ was of even greater
value. Reputation and good professional relationships helped to cultivate important networks which the
women had utilised as they started and grew their businesses. Some, including QG, learned from their
contacts about what start-up involved: “We did speak to a few people, like accountants and other people
we knew. We did get outside advice and X (a contact from pre-entrepreneurial employment), has his own
spin-out company and was able to give us some information about what we would have to consider if we
were to establish a company. We did, therefore, take advice from certain people, with X being the key
person, and also other people I used to work with”. Relationships developed prior to start-up also were
actual and potential sounding boards for possible business developments, as AA highlighted, “There is
nobody that I have worked with, prior to setting up, that I would feel I couldn’t lift the phone to and ask
them or tell them what I’m doing and trust them enough to sort of confide in them, to see what they think”.
The scope to call on the connections of those already in business was also valuable as ER noted, “Because
you would hope that they (network members/contacts from previous employment) would have come across
who it was that you were talking about and advise you”.

CONCLUSIONS

In the absence of a detailed understanding of the female technology entrepreneur, this paper has sought to
extend our knowledge of the types of women who have been attracted by an entrepreneurial career in the
male-dominated SET arena in Northern Ireland, a part of the United Kingdom (UK) where rates of female
engagement in venturing, let alone technology venturing, are around a third lower than the rest of the UK
(Hart 2007). It also focused on their motivations for pursuing such a career path. The above findings have
shed some light on the career development paths which this group of entrepreneurial women have taken to
start-up. The path to entrepreneurship of some of these women could be described as fairly pioneering.
They enrolled in SET degree programmes when women were rare on such courses; they worked in male-
dominated SET career roles when there were very few women in technical positions in the workplace, and
they established their own firms at a time when, and in a socio-cultural context where, female
entrepreneurship was not common. The fact that four of the most recent entrepreneurs were among the
youngest in the sample suggests that perhaps the environment for entrepreneurship might be becoming
more accepting of female entrepreneurs who are relatively new to the sector. The flow of women into SET
entrepreneurship is still constrained by the relatively low numbers who have studied for degrees which
help open up the potential of an entrepreneurial career path. The fact that more women are now pursuing
degree in these fields does mean that there are more potential female entrepreneurs being produced by our
universities, only time will tell how many women decide to pursue that career path.

An important finding for our understanding of the female entrepreneur is the strikingly high level of
educational attainment evident amongst the women in the sample, whether they were the younger or older
women in the sample. These findings show a much higher level of attainment than some other studies of
male technology entrepreneurs and as was suggested earlier, they raise the question as to why this might be
the case. It could be that in order to secure employment in technical roles, which lay the foundation for an
entrepreneurial career, women need to demonstrate higher levels of achievement than male candidates. It
could also be that highly intelligent and talented women find that they are not able to advance to positions
to which they aspire with employment, and therefore have little option other than to leave employment, as
was suggested was the case by a number of the interviewees.

In common with other studies of SET entrepreneurs, prior work experience proved vital in helping
these women prepare to start their own ventures, whether it was the knowledge gained, the skills developed
or the networks which they were able to cultivate, there was widespread agreement and evidence of the
importance of this phase of these women’s careers. Those who start a business very soon after leaving
university lack the depth of experience gained through the entrepreneurial apprenticeship. Many university
SET degrees now include some element of enterprise education or business planning so this will help to fill
some of the knowledge gaps, and degrees with work placements help to provide a window into the
workplace (Lucas et al. 2009). It was evident that even the women with more professional experience prior
to start-up tended to form a start-up team, which is in line with findings of previous research.

Previous work on the motivations of female entrepreneurs for opting to start their own firms have
highlighted push and pull motives, and some of these were evident in this sample of women, with both
types of factors often operating together. Necessity emerged as a key factor, with purely opportunity driven
firms in the minority. There has been an increasing focus on the importance of the search for work-life
balance as more women seek to pursue career paths which do not put the happiness of their family life in
jeopardy. Even though many of the women had children only a small minority cited work-life balance as a
motivating force, and for those who did, what was clear was that running an SET business did not permit time for the family in the way which had been envisaged – the image was illusory. This points to the challenge of running a professional business which needs to deliver to tight deadlines and requirements: some types of firm might be able to put things off until tomorrow, most SET firms do not fall into that category. Interestingly, quite a number of the women mentioned financial motivations, which is a finding more typical of male entrepreneurs. This is an area where these SET women were more like their male counterparts than female entrepreneurs in general.

It would be interesting to undertake a similarly study in ten years time to find out what the profile of the female SET entrepreneur looks like then. It would appear that the age at which some women are seeking to set up their first firm is reducing, and while this is positive it is important to understand more about how the clash of commercial workplace experience might have an impact on the development of their enterprise. There may be a role for universities and enterprise agencies to provide business support and training in aspects which the younger entrepreneur may lack. Also, linking young entrepreneur to mentors may help the younger entrepreneur along the entrepreneurial pathway. Some of these women were pioneers in SET fields when they were very much swimming against the tide of convention, when there were few role models for them to look to for inspiration and a sense of what could be achieved by a woman in a predominantly man’s world. Some of them represented valuable role models for the current and next generation of entrepreneurial women, and have important lessons which they can share. Given the increasing number of successful female entrepreneurs there is scope to use these women as mentors or more broadly to profile their cases as role models to encourage those who are considering entrepreneurship. While some of these women became entrepreneurs out of necessity they have demonstrated their abilities to develop and build successful ventures and in so doing have the potential to inspire more women to look at entrepreneurship as a positive rather than negative career response.

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