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SMEs, electronically-mediated working and data security: cause for concern?

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Abstract

Security of data is critical to the operations of firms. Without the ability to store, process and transmit data securely, operations may be compromised, with the potential for serious consequences to trading integrity. Thus the role that electronically-mediated working plays in business today and its dependency on data security is of critical interest, especially in light of the fact that much of this communication is based on the use of open networks (i.e. the Internet). This paper discusses findings from a 'WestFocus' survey on electronically-mediated working and telework amongst a sample of SMEs located in West London and adjacent counties in South-Eastern England in order to highlight the problems that such practice raises in terms of data security. Data collection involved a telephone survey undertaken in early 2006 of 378 firms classified into four industrial sectors ('Media', 'Logistics', 'Internet Services' and 'Food Processing'). After establishing how ICTs and the Internet are being exploited as business applications for small firms, data security practice is explored on the basis of sector and size with a focus on telework. The paper goes on to highlight areas of concern in terms of data security policy and training practice. Findings show some sector and size influences.

Keywords: data security, small firms, ICT adoption behaviour, electronically-mediated working, telework, security policy, security training, sector, firm size

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1 INTRODUCTION

One particular consideration that firms must account for whilst engaged in electronically-mediated working is the security of data. Any standard text will argue that a security system can only be as strong as its weakest link. In a field that is notoriously difficult to obtain authoritative data, the WestFocus research project 'ICT adoption and use by SMEs' reported on in this paper attempted to gain empirical evidence *inter alia* on the manner in which SMEs balance security considerations with networked working and trading.

Data security was defined in 1992 by NISS as the "protection of data from unauthorized (accidental or intentional) modification, destruction, or disclosure". McLeod and Schell (1997) maintain that data security requires three aspects to be maintained: integrity (i.e. providing an accurate representation of the physical reality that data represents); availability (i.e. allowing those authorised to have access to data); and confidentiality (i.e the protection of data and information from disclosure to unauthorised persons). Without the ability to store, process and transmit data securely, operations may be compromised for which there can be very detrimental consequences for trading. Thus the role that electronic communications play in business today and its dependency on data security is of critical interest. Much of this communication uses open network protocols on an Internet whose underpinning technology was originally designed for sharing data in research projects rather than for the purposes of e-commerce (Ratnasingham, 1998). Given typical assertions that to retain competitive edge firms must develop e-business processes that span more than one organisation (Nah *et al*., 2004), then firms so minded are obliged to exercise some level of oversight for data handling across electronically-enabled communications domains that extend beyond the internal. However apart from purely working with primary suppliers and customers in electronic alliance, firms are increasingly outsourcing tasks such as network support to 'third parties' (Gupta and Hammond, 2005) in electronic networks that may demand 'flexible workers' to have ubiquitous access (i.e. at any place and at any time using fixed and/or mobile modes) to both their own information systems and those of trading partners. With Spinellis *et al.* (1999) arguing that advanced technology has in many cases outpaced the development of 'control practice and employee knowledge', it is clear that the greater use of electronically-enabled communications may pose complex challenges for data security.

While much of the academic literature focuses on large firms, much less is evident on the experiences of SMEs in terms of ICT usage (Martin and Matlay, 2001; Dixon *et al.,* 2002) or on the emergence of networked trading which proponents such as Straub (2002) argue is becoming the dominant commercial paradigm. Clear and objective evidence on how small and medium-sized enterprises (SMEs) exploit ICTs and the Internet and the concommitant threats to data security need to be continually updated if policy makers, small firms and the technology providers that supply them are to work with the world as it really is, rather than as it may be portrayed on occasion by some technology providers. According to Simpson and Docherty (2004), distrust felt by owner/managers in the effectiveness of government-sponsored business support mechanisms conspires to add to a problem whereby small firms' ignorance of new technologies and systems makes them capable of their being exploited by technology providers. So in the absence of authoratative and objective voices informing small firms of market realities, unchecked commercial imperatives felt by organisations supplying the market with ICT-related tools may lead them to overstate threats in order to sell their wares, perhaps causing "firms (to) continue to choose technologies which may not be very effective for their environment" (Gupta and Hammond, 2005, p. 307). In findings from case studies of eight firms (of various sizes), Nathan *et al.* (2003) note poor ICT procurement practice whereby senior management purchase information systems that they do not fully comprehend, to then foist on an untrained staff which results in the sub-optimal use of those systems and what they call 'low-tech equilibrium'. Such a backdrop may do little to establish clarity for firms trying to work in a digital realm, and in all likelihood may conspire to confuse and hence to compromise data security policy and practice. Arguably, this constitutes a market failure.

There are over 4 million enterprises in the UK (DTI, 2003). The majority of these - nearly 3 million – are 'one-man-bands' (i.e they have no employees) leaving around 1.1 million which have employees. Further breakdown shows that 960,000 have between one and nine employees (constituting 'micro firms'), 160,600 have between 10 and 49 employees ('small firms'), 26,000 have between 50 and 249 employees ('medium-sized firms') and just over 6,000 have 250 employees and above ('large firms'). Thus SMEs – firms with between 0 and 249 employees - account for over 99 percent of all businesses in the UK, and thus have a significant role to play in the UK economy (Beaver, 2002). For the purposes of this study however, firms with no employees (i.e. single operators or 'one-man-bands') have been excluded. Exploration of sector and size differences will be undertaken therefore on the basis of firms with employees only.

The paper begins with a review of the literature, followed by an introduction of the WestFocus research project and methodology. Next research findings are set out, beginning with data on how ICTs and the Internet are being exploited by the SME sample in inter-firm trading. After setting out the general e-trading background for the sample as a whole, the discussion moves on to consider 'offsite working' or 'telework' with sector and firm size comparisons, followed by consideration of security policy and practice, again based on sector and size data. Then come concluding remarks.

2 LITERATURE REVIEW

There is a small but growing literature on e-business adoption taking a small firm perspective, some of which contains discussion on security risks. One focus whilst looking at adoption is on drivers, promoters or advantages of e-business (Poon and Swatman, 1999; Riemenscheider and McKinney, 2001; Shiels *et al*., 2003; Simpson and Docherty, 2004; Fillis *et al*., 2004; Stockdale and Standing, 2004 & 2006; MacGregor and Vrazalic, 2005) and barriers, hurdles or inhibitors (Riemenscheider and McKinney, 2001; Levy and Powell, 2003; Simpson and Docherty, 2004; Fillis *et al*., 2004; Stockdale and Standing, 2004 & 2006; Taylor and Murphy, 2004; MacGregor and Vrazalic, 2005). In a 2002 literature review of the area Dixon *et al.* (2002) identify common aspects found in relation to e-business adoption barriers for SMEs. Concerns for security and privacy is one such in a list that also contains a generalised lack of awareness of the potential of ICT, a lack of an IT skills base, concerns for high initial set-up costs, and a lack of staff to implement ICT. The general depth of discussion on security issues however in this literature is limited as noted in Appendix 1. Thus some authors spend a paragraph discussing the subject while others do little more than mention it. So while the subject of security is often raised in this literature, it lacks in-depth examination.

Researchers note the heterogeneity of SMEs (Martin and Matlay, 2001; Dixon et al., 2002; Taylor and Murphy, 2004), and sector and size examinations have been made of SME ICT and e-business adoption. Results are conflicting in places. Simpson and Docherty (2004) find sector to be a significant factor in e-business adoption and Martin and Matlay (2001) add that a micro-business focusing on business services is more likely to adopt ICT than a similar-sized manufacturing firm. Levy and Powell (2003) on the other hand find little evidence on the basis of sector for differential patterns in ICT adoption. Similarly, Van Beveren and Thompson (2002), MacGregor and Vrazalic (2005) and Levenburg (2005), argue that firm size is a significant factor in e-business adoption while Levy and Powell (2003) argue, in relation to ICT adoption, that size is not significant.

Another focus in this literature is on adoption models with a number being critical of stage models (which include the 'DTI Adoption Model') (Martin and Matlay, 2001; Levy and Powell, 2003; Fillis *et al*., 2004; Taylor and Murphy, 2004) on which UK business support has been based. These authors see stage models as prescriptive and ill-fitting of actual small firm adoption behavior. Simpson and Docherty (2004) are particularly critical of some business support mechanisms as delivered on the ground and based on the stage model paradigm; Levy and Powell (2003) argue for a 'contingent' approach in which adoption behavior is seen to be based more on apparent business need than on a linear and apparently seamless progression towards some vaguely-defined 'digital nirvana' where pervasive and integrated operations are transacted between and amongst firms. Ill-fitting policy can help contribute to distrust of government support agencies by small firms as Simpson and Docherty (2004) note with the potential effect of inhibiting small firms from seeking what should be 'disinterested' advice on critical issues such as data security. However MacGregor and Vrazalic (2005) find some taxonomies 'manufactured' (p. 511) and reflections of research design rather than reality on the ground. Citing Watson *et al.* (2000), Fillis *et al.* (2004) appear highly critical of the academic literature by warning of "the continued belief by many researchers in the sole value of formalised, structured, prescriptive ways of conceptualising business behavior despite the realities of non-linear, sometimes chaotic behavior" (p.350).

From an intra-firm 'distributed working' or 'telework' perspective, there is still however a paucity of in-depth academic research that looks into data security *per se* let alone one taking a small firm perspective. Aside from arguments on its efficacy, much writing on telework examines management issues raised by telework or, as for e-business, examines barriers inhibiting its adoption. So Lim and Teo (2000) in a commentary on ICT use in teleworking spend one paragraph discussing the risk of confidential data loss. Authors who take a more distinct focus on data security include Gupta and Hammond (2005) who examine IS security issues in small businesses. Echoing Spinellis *et al.* (1999) they go on to highlight resources as an issue for small firms where data security is concerned, and observe that 49% of organisations in the U.K see budget constraints as having some prime influence on 'computer security implementations'. They detail constraints felt by small firms in relation to security as: lack of staff with security expertise; lack of financial resources to hire expert help or to provide

training; lack of understanding of risks or being dismissive of them; inability to focus upon security due to other business priorities (Gupta and Hammond, 2005).

Authors directly examining telework and data security issues however are Sturgeon (1996) and Spinellis *et al*. (1999). Sturgeon identifies risks such as individual teleworkers handling sensitive data from home; Spinellis *et al.* who compare home office security threats with those of small firms examine the use of networked information systems (IS) within small businesses and home offices. They go on to argue that each shares a similar lack of technical expertise and resources by which to create and maintain a security posture adequate to apparent threat. Both studies argue for use of risk assessment procedures to minimise such threats. Amongst sometimes dated recommendations, Nilles (1998) argues for strong methods of user authentication and for network design principles that reflect a heterogeneity of access modes. Rikitake *et al.* (2001, 2002a, 2002b) examine data security issues raised by technologies such as WLANs, teleconferencing, P2P and VoIP in telework. They point, for example, to the risk of other family members using the same home PC and accessing, perhaps, Peer-to-Peer (P2P) networks which are known to be risky due to the possibility, they imply, of picking up computer viruses and other malware (2001). A US government-sponsored study (Kuhn *et al*., 2002) on telecommuting points to vulnerabilities in, amongst others, wireless networking, web browsers and printing software.

More typical of the literature are telework studies which have distinct foci other than security, but which note data security vulnerabilities as part of their examinations. Thus Clear and Dickson (2005) in a study on how management attitudes and levels of worker autonomy shape telework adoption in small firms discuss risks to data security in terms of its being a major disadvantage to the adoption of telework. Fulton *et al.* (2001) in a study on 'home-based e-work' that examines the blurring of home and work boundaries identify the shared use of home PCs as being a source of risk for data security. Tremblay (2002) explores work-life balance issues, but points to the dissatisfaction expressed by teleworkers of cumbersome security procedures. An Australian study (Standen and Sinclair-Jones, 2003) notes security issues raised by outsourcing and the development of a globalised service sector workforce. They go on to promote the use of 'ethical hackers' who can be employed to test network defences. Illegems and Verbeke (2003) argue that one of the factors militating against telework adoption is that it 'hinders the security of internal data' (p. 79) with two possible forms of unauthorised access defined: industrial espionage and intrusion by employees. They also argue that any form of telework implementation that leads to employees becoming self-employed freelancers will raise the level of risk to internal data as loyalty to their firm will diminish. Tran and Atkinson (2002) argue that privacy and security processes are required for multinational firms transferring data across international borders. Given the complexities of the issues inherent in the protection of data security, Lohmeyer *et al*. (2002) argue that IT departments should employ managed security providers (MSPs) to help them face security challenges online.

There are a number of guides offering advice on 'good practice' in relation to data security when working in a distributed and electronically-mediated manner and three are noted here. Huws and Podro (1995) argue that teleworkers should be trained to protect data security through anti-virus software, password use and taking back-ups of work-in-progress; if such training were not forthcoming, then teleworkers should not be held responsible for losses of data. The 'UK Online for Business' publication 'Working Anywhere' (2000) points out that safe data handling is dependant not just on technical measures and procedures but also on having reliable and vetted staff. Kuhn *et al.* (2002) argue that telecommuting staff working for US federal bodies should be given guidance on selecting appropriate technology, software packages and tools in order for best practice in data security to be followed.

However most of these authors are not reporting on small firms *per se*, and thus there is a hole in the literature given small businesses are not simply 'scaled-down versions' of large businesses (Quayle, 2004; MacGregor and Vrazalic, 2005). Numerous writers note that small firms face resource constraints not necessarily faced by large firms (Poon and Swatman, 1999; Levy and Powell, 2003; Simpson and Docherty, 2004; Fillis *et al*., 2004; Gupta and Hammond, 2005. Smith and Rupp (2002) (cited in Gupta and Hammond, 2005) note that that smaller organisations may place a more limited value on information and its security than larger ones. So though Walden (2005) echoes assertions by Schneier (2000, 2003) that data security issues are not properly understood or given adequate attention in many organisations – i.e. irrespective of size - for theory on SMEs to be relevant, consideration of their "motivations, constraints and uncertainties" (p. 18) must be made which are different in comparison to their larger cousins (Westhead aand Storey, 1996).

Questions of data security are raised amongst other aspects by differing modes of access (fixed versus wireless) and in terms of the variegation of devices (including PCs, personal digital assistants (PDAs) and mobile phones/cell phones) with writers such as Ghosh and Swaminatha (2001) arguing

that mobile commerce raises new security and privacy risks. Nevertheless, whatever the technologies and use of protocols that may protect data security whilst in transit across electronic networks, Gordon (2004) tempers any technology obsession by arguing that "If employees can walk out of the door of those organizations with reports, drawings, diskettes, files, and anything else in their pockets or briefcases (as they almost always can), then it's incorrect to say that telecommuting presents a new and different risk". Apart from deliberate intent by individuals to compromise the security of data, Lundegaard argues that "Disruptions of information systems are mostly a result of human error, ranging from system integration mistakes to accidental cutting of fibre optic cables, and natural disasters..." (Lundegaard, 1997). Whatever the source of risk, Reuvid (2004) argues that management controls and processes overseeing security are critical factors for firm survival. Thus Higgins (1999) observes, "a policy is the start of security management" (p. 217) and that "Effective security management … is based on the systematic concept, dissemination and operation of an information security policy". In the absence of such a policy, businesses may be seen as vulnerable, whether as the result of accident or malevolence. So a firm having a policy suggests that at least some appraisal has been made of potential security threats, however imperfect.

In sum, there are a limited number of studies taking a small firm perspective that focus on security issues raised by electronically-mediated working. As a whole the SME literature offers a sketchy view of security risks faced by small firms in a virtual domain. Amongst a growing volume of studies looking at ICT and e-Business adoption that account for SME experience, a number focus on the 'drivers' and 'barriers' to adoption and/or adoption models, sometimes with sector and firm size consideration. Often security is noted in taxonomies of barriers, but the depth of analysis is such that in many parts the subject appears more mentioned than discussed. A strong critique is made of stage models and in particular the ICT adoption model used by the DTI to underpin UK business support policy. Discussion on the impact of such policy on data security issues however is not very apparent in this literature. A number of writers argue for small firms to start to use risk management methods by which to face up to e-Business security challenges. Nevertheless a persistent reminder in this literature is that a small firm perspective requires consideration of resource constraints. So the literature individuating telework that examines data security is limited Thus other studies, some taking a small firm perspective and some not, need to be sought out for relevant analysis on data security issues within virtual domains.

3 METHODOLOGY

The research findings discussed in this paper are derived from a telephone survey of 378 firms located in a region bounded by West London boroughs and adjacent counties. This involved use of a structured questionnaire of 51 questions which collected data on a broad range of company activities related to ICT adoption and use, including ICT strategy, implementation, investment, training and security policy. As part of a collaborative effort by researchers from Royal Holloway, Kingston and Brunel universities, the target for this phase of a WestFocus project examining 'ICT adoption and use by SMEs' was for 400 completed interviews on the basis of 100 firms each from four industry sectors. These sectors are 'Media', 'Logistics', 'Internet Services', and 'Food Processing', all seen as making significant economic contributions to the study region. Listings of firms for the sectors were obtained from a commercial database provider, and these were sampled until the survey team obtained 100 interviews per sector. The telephone survey took between 20 to 30 minutes to complete, and was undertaken between January and March 2006. Upon completion of the survey, detailed examination of the data by the analysis team led to a certain number of interviews being removed to create a final sample of 378 interviews.

Univariate analysis using SPSS was undertaken of the WestFocus dataset by use of frequency distributions for the whole dataset and by use of cross-tabulations of data by sector and size and other variables. The Chi-square test is applied to these cross-tabulations, and the significance measure is displayed in footnotes. If the Chi-square test shows a lack of significance, then such data is ignored.

According to an European Commission (2002) definition, a Small and Medium-sized Enterprise (SME) has between zero and 249 employees, has a turnover of less than 50 million Euros, and is no more than 25% owned by a non-SME (not including banks or venture capitalists). Due to difficulties in establishing ownership patterns, and getting accurate turnover data, one limitation of the empirical work in this paper is that data has been gathered on firms on the basis of employee numbers only.

As can be seen in Table 1 which shows breakdown of the survey sample by size and sector, the sample is composed of 100 firms from the 'Logistics' and 'Food Processing' sectors, 90 firms from the 'Media' sector, and 88 firms from the 'Internet Services' sector, making 378 firms in the dataset as a whole. By size the sample is composed of 205 'micro firms' (1-9 employees), 140 'small firms' (10-49

employees) and 33 'medium-sized firms' (50-249 employees). The comparatively low number of medium-sized firms in the WestFocus sample overall and the relatively low number of 'Media' (3) and 'Internet Services' (5) firms in this size category act as research limitations. Apart from other considerations, any cell with frequency data lower than five invalidates the Chi-square significance test. Any data in cross-tabular analysis that fails this test is ignored. Thus findings shown in this paper are sometimes constrained to present only partial representations of size and sector data.

Table 1: Survey Sample Breakdown by Size and Sector

		Firm Size			
		Micro	**Small**	**Medium**	**Total**
Sector	**Media**	60	27	3	90
	Logistics	49	38	13	100
	Internet Services	49	34	5	88
	Food Processing	47	41	12	100
	Total	205	140	33	378

4 FINDINGS

The data examined in this section show various findings from the survey. Some of the data is shown on the basis of the whole sample, while other data is shown with breakdown by sector and size. The first findings examined are related to technology use, and this is followed by an examination of 'offsite working' and security policy and practice.

Table 2: Technology Use for Whole Sample

Technology	*%*
Email	99%
Internet	99%
Anti-virus software	96%
Firewall	93%
Own computer network (LAN/WAN)	86%
Broadband	84%
Company Website	84%
Wireless access	53%
Intranet	40%
Extranet/EDI	31%
Video/audio-conferencing	27%
Groupware	23%

Table 2 shows frequency data for a series of technologies and their use by the whole sample. Email (99%) and Internet (99%) use are practically ubiquitous, followed closely by anti-virus software (96%) and firewalls (93%). Own computer network (86%), use of broadband (84%) and company websites (also 84%) also have relatively high levels of adoption. Wireless access is used by 53% of firms, a notable level of adoption given the amount of time that such access has become available. 40% of the sample use intranets and 31% use extranet/EDI technology. Video/audio-conferencing (27%) and Groupware (23%) are the least pervasive technologies in the list.

Levels of use of anti-virus software and firewalls almost mirror email and Internet ubiquity, and taken together suggest that firms are aware of Internet-borne threats and thus take measures to protect themselves. While each of these firms can demonstrate apparent intention, whether their infrastructures are actually secure (to some nominal 99.9% level) is not clear. So a limitation of the data is that evidence that might contradict this picture such as whether firewalls are mis-configured and the level of currency of anti-virus software (i.e. how up-to-date it is) was not obtained as part of the survey. Additionally this data is obviously based at the level of the firm and does not account for practice by individual employees. That said, other technologies of note in terms of distributed working are video/audioconferencing – used by 27% of the sample – and groupware – used by 23%.

Table 3 shows frequency of response to the question, "Do you use the Internet to…?" (and individual options shown in the table) for the sample as a whole. According to these figures it is arguable that 'networked trading' is an established phenomenon in supply chains with customer-facing (downstream) use being more prevalent than supplier-facing (upstream) use. Figures for trading are 58% and 50% respectively in terms of customers and suppliers. A surprising finding is the relatively high level of the use of the Internet to make payments, with 61% of firms receiving payment from customers and 56% of firms making payment to suppliers. Notably 44% of firms use the Internet to work with other firms on collaborative ventures.

Table 3: Use of Internet for Trading Purposes

Trading Purpose	%
Receive payments from customers	61%
Trade with customers	58%
Make payments to suppliers	56%
Trade with suppliers	50%
Work with other firms on collaborative ventures	44%

As numerous commentators including Ratnasingham (1998) argue, trust is a vital element in the take-up of electronically-mediated trading. Allowing access by trading partners to a firm's systems requires, arguably, a high level of trust on the part of the 'provider' to the 'user' (Straub, 2002). Table 4 shows frequency of response to the question "Do you allow remote access to your systems / databases by customers / suppliers / joint venture partners?". Only 11% of the sample allow customers remote access with 6% allowing such access by suppliers and 5% doing so by joint venture partners. The figures are too low for meaningful statistical examination by size or sector. Thus the overwhelming majority of firms in the survey sample do not allow trading partners, whether customers, suppliers or joint venture partners, to have remote access to their systems. While these findings do not in themselves shed light on the issue of trust and any inherent data security risks whilst working in an electronic realm, or, for that matter, on the availability or otherwise of appropriate and cost-effective technology, this data does suggest that close electronic working across supply chains is still rare amongst SMEs.

Table 4: Remote Access to a firm's systems / databases by trading partner

Trading partner	%
Customers	11%
Suppliers	6%
Joint venture partners	5%

Attention now shifts to challenges faced by firms undertaking electronically-mediated trading. Table 5 shows frequency of response for the whole sample to the question "Have you experienced any of the following challenges in developing e-commerce for your business?" As surveyed firms could respond to more than one of the options offered, the data is not mutually exclusive. Of greatest relevance to the concept of 'distributed trading/working' are the responses 'Customers do not want to change' (19%), 'Suppliers are not ready for electronic business' (10%) and 'Difficulties with information sharing in collaborative ventures' (8%). For those promoting the greater use of electronically-mediated trading, such data must offer succour given the relatively low response rate for these challenges as a whole. From the data security perspective, the responses 'Security failures / problems' (6%) and 'Internet fraud' (8%) are most relevant. Though not identical in description, this latter finding chimes with the "Theft or fraud involving computers" finding from the DTI security breaches survey of 8% (DTI, 2006). Again such findings will offer succour to promoters of electronically-mediated trading. However, getting reliable statistics on security issues is difficult (Smith *et al*. 2002 cited in Walden, 2005), therefore figures on the subject should always be approached with caution.

Table 5: E-commerce challenges

E-commerce challenge	%
Customers do not want to change	19%
Difficulty in getting good technical advice from outside	15%
High costs to develop / maintain the web site	14%
Difficulty in hiring staff with appropriate IT skills	13%
Suppliers are not ready for electronic business	10%
High connection costs	8%
Difficulties with information sharing in collaborative ventures	8%
Internet fraud	8%
Security failures / problems	6%

Moving on to a sectoral examination of technology use, data failing the Chi-square 0.05% significance test was removed from consideration. Thus Internet, email, firewall and anti-virus software – all of near-ubiquitous use – are ignored for further analysis. Technologies explored in Table 6 therefore are 'Broadband' (84% adoption rate for the whole sample), 'Wireless Access' (53%) 'Intranet' (40%), 'Extranet/EDI' (31%) and 'Video/Audio-conferencing' (27%). Within the 84% overall adoption rate for Broadband, there is a high of 94% for 'Media' and a low of 81% for 'Food Processing'. This is the only case in which 'Internet Services' (84%) is not the lead adopting sector. So while 81% of the 'Internet Services' sample has wireless access, a notably high figure, the other three sectors show rates of 50% and less. This pattern of adoption is repeated for the three remaining technologies with 'Internet Services' firms running ahead of 'Media', 'Logistics' and 'Food Processing' at adoption rates that are significantly greater. So while 68% of the 'Internet Services' sample uses an intranet, the other three sectors' figures are 38% and less; while 50% of 'Internet Services' uses 'Extranet/EDI', the other three sectors' figures are 34% and less; and while 56% of 'Internet Services' uses 'Video/Audio-conferencing', the other three sectors' figures are 32% and less. Though the figures for the other three sectors are much more bunched, 'Logistics' is shown to be the least-adopting sector for four out of the five technologies. 'Media' appears to slightly lead 'Food Processing' in overall adoption rates for the five technologies which are not much greater than 'Logistics'.

While the data shown here does not show relative use of the technologies by firms in the sample, nevertheless they suggest that electronically-mediated working is practised to relatively high levels by the sample as a whole, and particularly by 'Internet Services'. Even if it may come as no surprise that this sector leads the pack given the nature of their business, it is still sobering to recall that the Internet as a business tool emerged little over 10 years ago.

Table 6: Technology Subset Use by Sector

Technology	**Media**	**Logistics**	**Internet Services**	**Food Processing**
Broadband	94%[1]	78%	84%	81%
Wireless access	48%	35%	81%	50%
Intranet	38%	36%	68%	28%
Extranet/EDI	21%	20%	50%	34%
Video/Audio conferencing	32%	14%	56%	16%

Having established some ICT adoption and use patterns for the sample as a whole and by sector, attention is now drawn to the firms' use of 'offsite working' and security policy and practice. While there are other measures that can be used to evaluate apparent preparedness in data security terms (e.g. policy noted in a staff handbook or employee contract or as part of an induction process), due to the necessity for economy in the survey, two questions were put that were adjudged to be more revealing in these terms. These are "Does your company have a written security policy for employee use of IT?" (referred to in Table 7 as 'Written security policy') and "Do your employees get training to make them aware of IT security issues?" (referred to in Table 7 as 'Security Training'). The other question "Do any of your company's personnel work offsite with access to your information systems (or

[1] Missing data for 1 firm

'telework')?" is referred to in Table 7 as 'Offsite working'. This latter question was so framed in order to avoid possible confusion over sole use of the term 'telework' which the author had experienced in previous research on the subject (Dickson and Clear, 2003). Arguably working offsite '….with access to your information systems' is a reasonable synonym for 'telework' in any event. For the sample as a whole, 51% responded in the affirmative to the question on 'Offsite working'. However when cross-tabulating with 'sector', for three of the four ('Media', 'Logistics' and 'Food Processing') the proportion of firms denying having 'offsite working' in these terms was greater than those having it, with responses of 45%, 37% and 43% respectively. Only 'Internet Services' had a greater proportion of 'offsite working' (82%) than not.

Table 7: 'Offsite working', 'Written security policy' and 'Security training' by Sector

	Sector			
	Media	**Logistics**	**Internet Services**	**Food Processing**
'Offsite working'[2]	45%	37%	82%	43%
Written security policy[3]	30%	32%	53%	45%
Security training[4]	46%	40%	79%	51%

In terms of security policy, as noted above, if management controls and processes are important for a firm's survival (Reuvid, 2004), then to manage data security some form of policy will be required (Higgins, 1999). Policies can be formal or informal, but in order to gather definitive data on the issue, a focus was placed on whether firms had a written and therefore formal security policy or not. With 40% of the whole sample answering 'yes' to this question, breakdown by sector shows that only 'Internet Services' (53%) had a greater proportion of those with a written security policy than not. This suggests that 'Internet Services' firms are generally more aware of the need for data security than the other sectors though 'Food Processing' (45%) is not far behind. However, that said, it may be surprising given the nature of their business that the proportion of 'Internet Services' firms having a formal policy is not even higher.

If having a written security policy demonstrates management commitment to data security in theoretical terms, then devoting time and effort to awareness training of staff on IT security issues may be seen as putting theory into practice to some extent. Across the whole sample, 53% answered 'yes' to the question on security training. 'Internet Services' and 'Food Processing' have a greater proportion providing such training than not, with the converse true for 'Media' and 'Logistics'. 'Internet Services' (79%) firms provide much more training than 'Food Processing' (51%), 'Media' (46%) and 'Logistics' (40%). All sectors show greater levels of 'security training' than 'Written security policy' use. However sector heterogeneity is shown elsewhere: figures for 'offsite working' are greater than 'written security policy' for 'Internet Services', 'Media' and 'Logistics' while for 'Food Processing' the opposite is true; figures for 'offsite working' and 'security training' are similar (+/- 1% and 3%) for the same three sectors with the least similar being for 'Food Processing' (where 'security training' exceeds 'offsite working' by 8%). So arguably the 'Food Processing' sector shows some different adoption behavior here from the other three.

Table 8: 'Offsite Working', 'Written security policy' and 'Security training' by Firm Size

	Size		
	Micro	**Small**	**Medium**
'Offsite working'[5]	42%	57%	84%
Written security policy[6]	26%	53%	74%
Security training[7]	46%	60%	64%

Table 8 shows cross-tabulations between frequency of response to the same three questions as noted above for Table 7 but on the basis of firm size. As noted, the overall number of 'medium-sized

[2] Missing: 11 ('Media': 2; 'Logistics': 1; 'Internet Services': 4; 'Food Processing': 4); Chi-square significance: .000
[3] Missing: 6 ('Media': 1; 'Logistics': 1; 'Internet Services': 2; 'Food Processing': 2); Chi-square significance: .004
[4] Missing: 7 ('Media': 1; 'Internet Services': 4; 'Food Processing': 2); Chi-square significance: .000
[5] Missing: 11 (Micro: 5; Small: 4; Medium: 2); Chi-square significance: .000
[6] Missing: 6 (Micro: 5; Small: 1); Chi-square significance: .000
[7] Missing: 7 (Micro: 5; Small: 2); Chi-square significance: .016

firms' in the whole sample (33) is much smaller than 'small firms' (140) and 'micro firms' (205). If we can accept this as a limitation, then there is an evident size effect in the data for the three questions. Responses to the question on 'offsite working' show affirmative figures of 42% for 'micro firms', 57% for 'small firms' and 84% for 'medium-sized firms'. Responses to the question on 'written security policy' show that 26% of 'micro firms', 53% of 'small firms' and 74% of 'medium firms' have written security policies. This finding chimes with DTI (2006) findings (commented on below) which found that "larger companies remain more likely to have a security policy" (p. 7) with 60% of UK businesses having no formal security policy (Walden, 2005). The final question on 'security training' shows that more 'small firms' and 'medium-sized firms' offer such training than not, with 'micro firms' showing the converse: 64% of 'medium-sized firms' and 60% of 'small firms' offer this training while only 46% of 'micro firms' do so. A 'switchover' is evident in this size data: higher rates of training is recorded than use of a formal security policy for 'micro' and 'small' firms but this is in the reverse for 'medium' firms.

Table 9: Training for Awareness of IT Security Issues v 'Offsite Working'

		'Offsite Working'?		
		Yes	**No**	**Total**
Training for awareness of IT security issues?[8]	**Yes**	32%	21%	53%
	No	19%	28%	47%
	Total	51%	49%	100%

At this point, consideration is turned to direct comparison between levels of training on IT security awareness and 'offsite working' (or 'telework') on the basis of the whole sample. Table 9 shows a cross-tabulation of frequency of response to the questions "Do any of your company's personnel work offsite with access to your information systems (or 'telework')?" and "Do your employees get training to make them aware of IT security issues?". Proportions shown are noted for a total sample of 364 responses[9]. The table shows that 51% of the total sample have 'offsite working' and 49% not with 53% of the total sample having training on IT security awareness and 47% not. Cross-tabulating these two variables shows that 32% of the sample have both 'offsite working' *and* training on IT security awareness while 19% have 'offsite working' *and no* security training. Put another way, 37% of the firms with 'offsite working' do not have security training.

Table 10: Written Security Policy v 'Offsite Working'

		'Offsite Working'?		
		Yes	**No**	**Total**
Written Security Policy?[10]	**Yes**	28%	12%	40%
	No	23%	36%	60%
	Total	51%	49%	100%

Table 10 shows a cross-tabulation of frequency of response to the questions "Do any of your company's personnel work offsite with access to your information systems (or 'telework')?" and "Does your firm have a written security policy for employee IT use?" 28% of the responses show firms with both 'offsite working' and a written security policy, but 23% of those firms having 'offsite working' do not have a written security policy. Put another way, 45% of the firms that have 'offsite working' have no formal security policy.

[8] Missing: 12; Chi-square significance: .000

[9] On a methodological note, from this point findings for total numbers of responses may differ with those cited in sections above. So whereas the number of those having 'offsite working' noted above is 367 (with missing data for 11 firms), and the equivalent number for 'training for awareness of IT security issues' is 371 (with missing data for 7 firms), the confluence of data for these two responses produces a total of 364. If data is missing for either question, then that case will be ignored for analysis purposes. Variability of totals for the same question between different cross-tabulations is explained by the fact that missing data can be mutually exclusive (i.e. where data is missing for one question only) or mutually inclusive (i.e. where data is missing for both questions).

[10] Missing: 13; Chi-square significance: .000

Now cross-tabulation of the data is attempted using three variables. However a lack of statistical significance reported by SPSS for the Chi-square test renders some cross-tabulations invalid. Cross-tabulating the training variable with formal policy and 'offsite working' variables is one such enquiry, so is ignored from further consideration. Therefore attention is drawn to use of a formal security policy and 'offsite working' by size and sector, though here too there are limitations. Failure of the Chi-square significance test is also the case for 'medium' firms so cross-tabulation of 'written security policy' and 'offsite working' data (as shown in Table 10) by firm is restricted to 'micro' (Table 11) and 'small' (Table 12) views. Table 11 shows that 42% of the total of 196 micro firms have 'offsite working' with 14% having a written security policy and 28% not. Table 12 shows that 57% of small firms have 'offsite working' with 39% having a written security policy and 18% not. This shows an apparent size effect: the smaller the firm the less likely they are to have 'offsite working' or a written security policy.

Table 11: Written Security Policy v 'Offsite Working' v Firm Size: Micro Firms

	Offsite Working'?			
		Yes	**No**	**Total**
Written Security Policy?[11]	**Yes**	14%	12%	26%
	No	28%	46%	74%
	Total	42%	58%	100%

Table 12: Written Security Policy v 'Offsite Working' v Firm Size: Small Firms

	Offsite Working'?			
		Yes	**No**	**Total**
Written Security Policy?[12]	**Yes**	39%	13%	52%
	No	18%	29%	48%
	Total	57%	43%	100%

To view sector influences, 'written security policy' and 'offsite working' data in Table 10 is further cross-tabulated by sector and results are shown in Tables 13 & 14. However data for the 'Internet Services' and 'Media' sectors failed the Ch-square test so only data for 'Logistics' and 'Food Processing' is shown. Table 13 shows that 38% of 'Logistics' firms have 'offsite working' with 21% having a 'written security policy' and 17% not. Table 14 shows that 42% of 'Food Processing' firms have 'offsite working' with 27% having a written security policy and 17% not. So while 'Food Processing' shows significantly more firms having 'offsite working' than 'Logistics', this is not the case for use of a 'written security policy' where 'Logistics' has a slightly higher rate of adoption than 'Food Processing'.

Table 13: Written Security Policy v 'Offsite Working' v Sector: Logistics

	Offsite Working'?			
		Yes	**No**	**Total**
Written Security Policy?[13]	**Yes**	21%	12%	33%
	No	17%	50%	67%
	Total	38%	62%	100%

Table 14: Written Security Policy v 'Offsite Working' v Sector: Food Processing

	Offsite Working'?			
		Yes	**No**	**Total**
Written Security Policy?[14]	**Yes**	27%	17%	45%
	No	15%	40%	55%
	Total	42%	58%	100%

[11] Missing: 9; Chi-square significance: .041
[12] Missing: 4; Chi-square significance: .000
[13] Missing: 2; Chi-square significance: .000
[14] Missing: 6; Chi-square significance: .001

5 DISCUSSION

To give some perspective to data in the whole WestFocus sample, some analysis from the bi-annual DTI Information Security Breaches Surveys of 2004 and 2006 is included in Table 15 which shows the level of threat faced by firms working in an electronic realm. The DTI data is based on a sample of 1,001 firms of all firm sizes (i.e. including large firms) so comparison with WestFocus SME data cannot be wholly valid. Nevertheless, given the paucity of empirical data on security risks faced by small firms, the DTI data acts as a benchmark here. The evidence from these surveys highlight a relatively variegated picture of some of the threats to data security: 'virus infection and disruptive software' and 'theft and fraud involving computers' have decreased in incidence after a hiatus in 2004; 'staff misuse of information systems', and 'unauthorized access by outsiders (including hacking attempts)' increased from 2002 to 2004 but have more-or-less plateaued after this; and 'systems failure or data corruption' have increased in incidence (given there is missing data for 2002).

Table 15: Type of Security breach suffered by UK businesses in 2002, 2004 & 2006 Surveys

Type of Breach	***2002***	***2004***	***2006***
Virus infection and disruptive software	41%	50%	35%
Staff misuse of information systems	11%	22%	21%
Unauthorised access by outsiders (including hacking attempts)	14%	17%	17%
Theft or fraud involving computers	6%	11%	8%
Systems failure or data corruption	N/A	27%	29%

Source: Compilation from DTI Information Security Breaches Surveys 2004 and 2006

The DTI typology does not yield exact equivalents for WestFocus data, but two comparisons are made here as a means of exploring the data. A WestFocus rate of 8% for 'Internet fraud' is exactly the same as the 2006 DTI figure for 'Theft or fraud involving computers'. However 'Security failures / problems' at 6% in WestFocus data is significantly different from the 2006 DTI figure for the nearest equivalent term 'Systems failure or data corruption' of 29%. Whatever the quality of these comparisons, and with caution extended to the value of self-revealed data on sensitive issues such as data security, the WestFocus figures do not make a case for overbearing levels of risk faced by small firms trading online. Certainly the high levels of electronically-mediated trading evident in the WestFocus data - which chime with general year-on-year volume growth in electronically-mediated trading as a whole (Fulford and Doherty, 2003) – can be set favourably against the relatively low figures for security incidents.

Further comparison between the two sets of data can be made in terms of 'security policy' and 'security training'. A figure of 40% is shared by WestFocus 'written security policy' data and the DTI 'formally defined and documented information security policy' data (2006). However, given that the 'large firms' component for the DTI finding is noted as 73%, the true figure for SME security policy in the DTI data must be lower than 40%. In terms of training WestFocus data shows a figure of 53% for the 'training for awareness of IT security issues' while DTI figures show that 35% of the sample overall undertake 'training and presentations' as one means by which firms 'make their staff aware of their obligations regarding security issues' (DTI, 2006). Further, a DTI figure of 40% for large firms implies that the figure for SMEs in the DTI sample must be lower than 35%. Accepting the inherent limitations of both of these comparisons, this analysis again reflects favourably on the WestFocus sample.

From a technological perspective, the use of Internet-related technologies found in this study shows that a basic electronic communications infrastructure (composed of Internet, email, firewalls and anti-virus software) is in place for the WestFocus sample as a whole. While the almost ubiquitous use of these technologies makes sector and firm size considerations irrelevant, sector influence is evident for a subset of other technologies examined ('wireless access', 'intranet', 'extranet/EDI' and 'video/audio conferencing') which have lower general levels of take up in comparison with the 'basic infrastructure' technologies. Greatest adoption rates – by some margin – are for 'Internet Services', with a notable high of 81% for 'wireless access'. 'Broadband' bucks the adoption-by-sector trend in that 'Media' firms are its greatest adopters, but this can be tempered by the very high levels of its adoption overall. At the level of the whole sample, the relatively high levels of Internet use for commercial purposes (such as receiving payment from customers) suggest that 'networked trading' may be entrenched in places. If sector adoption behavior established for ICT holds true for commercial

uses, then assertions made by Nah *et al.* (2004) - that firms need to develop e-business processes spanning more than one organisation in order to maintain a competitive edge – would appear most keenly matched, unsurprisingly perhaps, by the 'Internet Services' sector. Some way behind in terms of technology adoption come 'Media' and 'Food Processing', with 'Logistics' as the slight laggard. The WestFocus data does not identify high relative levels of e-commerce challenges for firms in the sample as a whole. To what extent use of a such an infrastructure guarantees secure distributed working and electronically-mediated trading for firms is by definition difficult to measure, even if some general perspective on security threat has been garnered. Nevertheless the comparatively low levels of remote access accorded by the whole sample to trading partners suggests that the majority of SMEs are not ready for and/or do not have the high levels of trust necessary for the kind of integrated trading along their supply chains propounded by writers such as Straub (2002). Certainly DTI figures add a threatening backdrop in that firms that allow remote access are twice as likely to have their networks penetrated (2006).

Mirroring work on e-commerce adoption (Martin and Matlay, 2001; Simpson and Docherty, 2004), evidence was found for differences in 'offsite working' (i.e. teleworking) on the basis of sector, and for data security practices on the basis of both sector and size. In terms of sector, 'Internet Services' demonstrated greatest attention to data security risks in terms of written security policies and provision of training for IT security awareness. As with levels of technology adoption, overall the other sectors ('Food Processing', 'Media' and 'Logistics') come some way behind in these terms. A common adoption pattern for these three sectors shows that 'security training' levels were slightly greater than 'offsite working' with 'written security policy' trailing somewhat. 'Internet Services' had a slightly higher level of 'offsite working' than 'security training' to buck the trend, but the much higher levels of technology adoption and use of 'offsite working', 'written security policy' and 'security training' mark the sector out as different to the rest. Nevertheless in all four sectors, use of a formal security policy came in third place. However additional sector level data for 'Logistics' and 'Food Processing' points to further differences in behavior with 'Food Processing' firms enjoying higher levels of 'offsite working' though lower levels of formal security policy. Suggestions that 'Food Processing' firms are more promiscuous than 'Logistics' firms in security terms should be tempered however with evidence that 'Food Processing' as a sector has more awareness training on security issues for employees than 'Logistics'.

In regard to size, generally the larger the firm, the greater the levels of written security policies and training in evidence, which chimes with work on e-commerce adoption (MacGregor and Vrazalic, 2005; Levenburg, 2005; Van Beveren and Thompson, 2002). In the WestFocus data, different behavior is apparent between 'written security policy' and 'security training' by firm size. So while response rates for 'micro' and 'small' firms show higher response rates for security training than formal security policy, the converse is true for 'medium' firms where response rates for formal security policy exceed those for security training. In the absence of additional analysis using the training variable, direct comparison between 'offsite working' and 'written security policy' for 'micro' and 'small' firms shows higher proportionate use of policy by 'small' firms than 'micro' firms.

There is a trade-off between the apparent robustness of measures taken to protect data security and the ability to trade or work with information systems. Obviously a security interface that is overly robust can stymie attempts to work remotely. As Nilles (1998) argues, tongue-in-cheek, "sensitive company information is easiest to protect from outside intruders if it is kept securely locked in the company's vaulted, main office computers with no access allowed from the outside" (p. 83). In a networked electronic world of course such a stance would be untenable, with telework by definition impossible. The ability to telework at its simplest functional level requires a PC, a telephone line, an ISP (internet service provider) account and an email agent. Then, where electronic communication is restricted to email use only between remote worker and colleagues at a central location, arguably the level of controls required to handle data safely would be relatively minimal, all things considered; similarly the ability to interrupt workflow when systems are offline may be relatively minimal. If on the other hand such 'offsite working' required direct access to a firm's systems by a mobile worker exploiting wireless technology, then additional controls may be required to provide a similar level of apparent data security. Such additional controls may bring in their train some greater potential to interrupt workflow. Thus drawing the balance between the robustness of a firm's security system and an ability to work or trade whilst offsite requires management consideration.

In a dynamic and fast-moving marketplace, wireless communications, for example, is noted as one technology posing threats to secure teleworking (Rikitake, 2002a). Adoption of 'wireless access' does not by definition imply 'remote' or 'offsite access' necessarily as wireless technologies such as Bluetooth are designed for short-distance transmissions amongst local devices and a teleworker is notionally some 'non-local' distance away from co-workers. Nevertheless it is possible to conjecture

scenarios in which teleworkers in the sample firms access systems remotely using wireless means. If critical and sensitive data were to be handled in these scenarios, then the 2006 DTI survey (whose limitations as a comparator for this study are noted above) might raise questions in data security terms when it observes that 60% of firms that allow remote access, and 40% of firms that allow staff to connect via public wireless (WiFi) hotspots), do not encrypt their transmissions. While technological solutions should be seen only as part of meeting challenges to data security, encryption, where desired, implies more complex data handling processes and working practices for firms, and hence higher costs. Given observations on resource constraints faced by small firms (Poon and Swatman, 1999; Levy and Powell, 2003; Simpson and Docherty, 2004; Fillis *et al*., 2004; Gupta and Hammond, 2005) the ability for firms to accommodate users whether 'onsite' or 'offsite' using fixed and mobile (wireless) modes and perhaps via a multiplicity of devices (e.g. PC, mobile phone) in an apparently secure extended electronic network may be beyond the level of skills, knowledge and financial resources that some smaller firms in the WestFocus sample possess. The fact that technology adoption patterns by the WestFocus sample as a whole are generally higher than relative levels of 'written security policy' use and 'awareness training for IT security issues', added to apparent resource constraints, may indicate that claims by Spinellis *et al.* (1999) that advanced technology outpaces the development of 'control practice and employee knowledge' have validity. Given that smaller firms are less likely to have a formal security policy than their larger equivalents, then it is possible to speculate further that smaller firms are more likely to have unsafe handling practices than larger firms.

If technology providers fail to meet the needs of firms as Nathan *et al.* (2003) imply, then there is a role for government agencies to step into the market gap to help ensure firms handle data securely safely. Martin amd Matlay (2001) however assert that 'there is an acute lack of engagement on behalf of small business owner/managers who are largely suspicious of government interference in industry'. Thus traditional business support mechanisms through which small firms can learn about security policy formation and safe data handling practice may fall short as a desired policy goal, as Simpson and Docherty (2004) intimate. The 'cat-and-mouse' struggles between those responsible for system security and those intent on exploiting security flaws, whether with criminal intent or otherwise, supports the case advocated by Standen and Sinclair-Jones (2003) for the use of 'ethical hackers' (i.e. trusted individuals and agencies who seek to test the security of systems in order to reveal security flaws to a target firm) by which firms can check their security posture. This is not a simple task given the variegation of devices and loci noted by which to access firms' systems, and the 'motivations, constraints and uncertainties' (Westhead and Storey, 1996: p.18) experienced by small firms that includes 'non-linear (and) sometimes chaotic behavior' (Fillis *et al.* 2004). Thus, amongst other enquiries, such an initiative would require answers to the following questions:

a) Can small firms afford such support, and if so, can they then be persuaded to make such an investment (especially those firms that may be in great need of such an offering but which show little inclination to seek out business support interventions)?

b) How can small firms be sure of the *bona fides* of such individuals and agencies?

c) How can small firms be persuaded that such individuals and agencies themselves are secure?

Given the existing legal and administrative burdens already felt by SMEs struggling to survive in an increasingly competitive marketplace, there may be little apparent enthusiasm for yet another state-sponsored instrument. Thus there may be a role for policy makers working with stakeholders to facilitate the development of an appropriate mechanism. Use of some form of licensed 'honest broker' that enjoyed a level of independence from government would likely be required.

6 CONCLUSION

This paper attempts to help fill a gap in the academic literature on data security issues in relation to electronically-mediated working by SMEs. Based on a telephone survey of 378 firms in West London and surrounding counties in early 2006 and managed by a WestFocus project team composed of researchers from Royal Holloway, Kingston and Brunel universities, this analysis attempts to explore technology adoption and threats to data security on the basis of the whole sample, and where possible on the basis of four industry sectors ('Media', 'Logistics', 'Internet Services' and 'Food Processing') and three firm sizes ('Micro', 'Small', and 'Medium') of SME. The small firms literature shows that data security is a subject mainly examined in combination with some other issue(s), and that there are few studies dedicated to security issues raised by telework *per se*. General findings on Internet-related technologies show that the basic infrastructure for secure distributed working and electronically-mediated trading is in place for the sample as a whole, even if the quality (or otherwise) of such an infrastructure cannot be ascertained.

Mirroring work on e-commerce adoption, evidence was found for differences in 'offsite working' on the basis of sector, and for data security practices on the basis of both sector and size. In terms of sector, 'Internet Services' demonstrated greatest attention to data security risks in terms of written security policies and provision of training for IT security awareness. Overall the other three sectors ('Food Processing', 'Media' and 'Logistics') came some way behind in these terms. Further sector behavior shows that 'Food Processing' firms appear to display different adoption behavior from the other sectors in regard to the relative balance between 'offsite working', use of a formal security policy and security training for employees. In terms of size, generally the smaller the firm, the lower the levels of written security policies and training in evidence, which chimes with work on e-commerce adoption. An apparent market failure allied with small firms' distrust of state-sponsored business support mechanisms begs for new approaches in the promotion of data security. Use of 'ethical hackers' by 'honest brokers' may be one approach deserving policy attention therefore. Nevertheless, whatever the relative merits and demerits of such a proposal, if teleworking and mobile working in general are to flourish amongst small firms, then greater research effort needs to be devoted to data security issues in the virtual domain that takes a small firm perspective.

APPENDIX 1: Selected review of studies examining ICT adoption that highlights the relative level of discussion on security issues

Author(s)	Description	Empirical Data	Security
Clear and Dickson (2005)	UK study examining how adoption of telework is influenced more by management attitudes, levels of worker autonomy and employment flexibility than technology provision	303 SME survey; 58 face-to-face interviews	Data security discussed only in terms of its being 'a major disadvantage to the adoption of telework'
Dixon *et al*. (2002)	Literature review providing a critique of research into ICT use by SMEs; examines UK policy and ICT targets; highlights UK regional and international differences in ICT adoption; maintains that influences of sector, age and firm size on ICT adoption is under-researched	Reviews papers that use empirical data but no primary empirical data	'Security/privacy issues' noted as one of a number of barriers to ICT adoption
Fillis *et al*. (2004)	UK study that examines factors promoting and inhibiting adoption of e-business; critiques stage models of adoption; findings show that sector has an important influence on e-business development	21 SMEs; 18 face-to-face interviews; 3 phone interviews	'Security issues' mentioned as a possible impediment to future business development
Gupta and Hammond (2005)	US study examining information systems (including Internet technologies) security issues for 'small businesses'	138 small business survey using US definition of SME (1-499 employees) though only 6 responses > 200	Identifies security risks as perceived by small business owners, security incidents experienced by the sample and measures taken to guard against security threats; findings raised doubts about the effectiveness of security measures
Levenburg (2005)	US study examining how small firms use a range of 'e-business' tools in their supply chains; finds more extensive use of ICT tools in the supply chains of 'small' and 'medium-sized' firms rather than in 'micro' firms, though when a 'micro' firm adopts 'e-SCM', 'benefits are more pronounced'; finds that 'micro' firms show different use behavior from 'small' and 'medium' firms	395 SME survey	No mention of security
Levy and Powell (2003)	UK study that critiques stage adoption models; argues for an alternative 'transporter' model which recognises the fact that at adoption behavior is contingent on perceived	12 SME case studies	Brief discussion that highlights the experience felt by one firm whose customers failed to use their web site due to a perceived security risk

	business need; highlights owner attitude as instrumental in adoption decisions; identifies sector adoption behavior of firms		
MacGregor & Vrazalic (2005)	Examines e-commerce adoption barriers amongst small firms in regions in Sweden and Australia; uses statistical methods by which to derive two fundamental factors affecting adoption: either firms find e-commerce 'too difficult,' or 'unsuitable' for their business, or both	477 small firms survey	'Security' seen as a barrier but its discussion is limited; discussed mostly in terms of its being a statistically-divergent artifact for Australian and Swedish adoption practice in the two factor model
Martin and Matlay (2001)	UK study that critiques government policy based on use of the DTI five-stage ICT adoption model (developed by Cisco); seen as deficient due to its 'one-size-fits-all' underpinning that is based on wholly linear progression and that ignores key influences such as sector, size, ethnicity, gender, human & financial resources, customer base and internationalisation	No empirical data	'Security systems' mentioned as part of a discussion on business support requirements for small firms
Poon and Swatman (1999)	Australian study that examines the benefits of 'small business Internet commerce'; strong interest in email detected in firms but almost no integration between firms' Internet use and internal systems found; highlights some sector influences	23 small firms	No mention of 'security'
Quayle (2002)	UK study that examines levels of awareness about e-commerce and levels of e-commerce adoption amongst SMEs	298 small firms survey	Mentions security in the literature review as one of a number of 'hurdles' to e-commerce adoption
Riemenschneider and McKinney (2002)	Brief article reporting on a US study examining advantages and disadvantages of e-commerce adoption by adopting and non-adopting firms	27 telephone interviews and 184 firm survey	'Lack of security regarding important information' seen as one of four reported disadvantages, and a predominant concern for non-adopters
Shiels *et al.* (2003)	UK study examining ICT adoption in firms in four sectors using an 'ICT Exploitation and Integration Model' which posits four levels of ICT sophistication: 'technical integration', 'operational integration', 'inter-organisational integration' and 'strategic integration'.	24 SME case studies	Mentions network security and security of back-ups in discussion of 'technical integration'
Simpson and Docherty (2004)	UK study examining barriers and drivers for e-commerce adoption; critical of UK business support mechanisms; argues SME distrust of government business support may allow third party vendors to exploit SME ignorance	Small number (undefined) of interviews with owner-managers	Security concerns noted as one of a number of barriers to e-commerce adoption
Spinellis *et al.* (1999)	Conceptual study that examines security requirements for the 'small enterprise' and 'home-office environments'; argues for use of risk analysis methodologies and uses two scenarios as exemplars by which to illustrate security threats; makes a series of recommendations for potential solutions to threats.	No empirical data	Focuses on security issues related to 'small enterprises' and home offices and notes that these can suffer serious security problems as they typically lack the technical expertise to create and maintain a suitable level of security. Finds that SMES and home offices face similar levels of risk.

Stockdale and Standing (2004)	Australian study that identifies SME benefits and barriers to e-commerce	No empirical data	Security not mentioned
Stockdale and Standing (2006)	Australian study examining drivers and barriers for e-commerce adoption; draws up a typology of SME adopters	Combination of secondary case study data and 'interactions' with stakeholders	'Security and worries about fraud' noted in a brief discussion on security issues
Sturgeon (1996)	US study that examines drivers for telework and the security threats and risks that it poses for firms (i.e. it does not focus on small firms *per se*), especially in terms of sensitive data. Written before wireless modes of communication became common though measures to manage risks appear valid still	Uses small number of anonymised case studies to highlight vulnerabilities	Focuses on threats to data security raised by telework under a taxonomy that includes 'disclosure', 'interruption', 'modification', 'destruction' and 'removal'; argues for risk assessment; recommends various types of measure to manage threats
Taylor and Murphy (2004)	UK study that critiques DTI adoption model echoing Martin and Matlay (2001) and argues for the use of the PITs model (Foley and Ram, 2002); discusses barriers to adoption and tries to identify factors that promote 'successful adoption of e-business technologies'	Discusses empirical data provided by other researchers	As a barrier to entry into the digital economy, notes there are perceptions of unresolved security and privacy issues which most acutely identifies online payment and which discourage small firm adoption of 'this technology' and e-business
Van Beveren and Thomson (2002)	Brief paper reporting on an Australian study that highlights firm size as a factor that influences e-commerce adoption	179 SME survey of manufacturers	No mention of 'security'

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TQM and firms performance: An EFQM excellence model research based survey

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Abstract

The purpose of this article is to develop an instrument for measuring TQM implementation following the European Foundation for Quality Management Excellence Model and to provide empirical evidence on the relationship between management practices and measures of business performance in the model. To this end, the study employs survey data collected from Spanish manufacturing and service firms. Confirmatory factor analysis is used to test the psychometric properties of the measurement scales and the hypothesized relationships between total quality management practices and organizational performance are examined using structural equation modeling. The findings of the research indicate that the adoption of the TQM practices suggested in the EFQM Excellence Model allows firms to outperform their competitors in the results criteria included in the Model. Therefore, this paper provides a valuable benchmarking data for firms as it substantiates the EFQM Enabler's contribution to the attainment of competitive advantage.

Keywords: total quality management, business performance, competitive advantage, EFQM excellence model, Spain

1 INTRODUCTION

Since the 1980s, when the total quality management (TQM) concept was firstly defined (Deming, 1986, Crosby, 1979, Juran, 1986), practitioners and researchers alike have broadly defended the positive effects of TQM practices on firms' overall effectiveness and performance. However, although TQM has been clearly conceptualized around basic principles such as consumer focus, continuous improvement and human resource management, there has been a lack of consensus regarding its primary constructs, which prevents comparison across studies and generalizations from the empirical evidence. The 90s mark the starting point of empirical research on critical factors in TQM, although different studies have yielded different sets of TQM factors (Saraph *et al*., 1989; Flynn *et al*., 1994; Powell, 1995; Ahire *et al*., 1996; Black and Porter, 1996; Zhang *et al*., 2000; Antony *et al*., 2002). As a result, there is no single measurement instrument to evaluate TQM implementation.

Furthermore, evidence concerning the impact of TQM on business performance is also based on a wide range of indicators that differ across studies and are in some cases contradictory, especially regarding financial performance, which is measured in terms of ROA –return on assets- or ROI –return on investment. Some research has found a positive effect of TQM on the latter (Easton and Jarrell, 1998; Hendricks and Singhal, 2001a,b); whereas other research reports a negative incidence of TQM on these measures (Chapman *et al*., 1997). In some cases, TQM's repercussion on these financial outcomes is even deemed inexistent (Adam, 1994; Powell, 1995; York and Miree, 2004). The different methodological and conceptual approaches used by researchers may have led to conflicting results but, in response to this controversial evidence, a new body of research is examining a contingent approach to the TQM-performance relationship. This approach assumes that the effects of TQM on business results are mediated by both non-controllable environmental factors, such as market competitiveness, uncertainty or complexity (Fuentes, 2003; Chong and Rundus, 2004), and by internal factors, such as how long TQM has been implemented, or the firms' size, diversification or capital intensity (Terziovski and Samson, 1999; Hendricks and Singhal, 2001a; Brah *et al*., 2002; Lloréns *et al*., 2003; Taylor and Wright, 2003).

Obtaining sound evidence of TQM's impact on performance in different contexts should be as much a priority as addressing the potential moderators of this link. TQM is one of the most complex activities that any company can involve itself in; it requires implementing a new way of managing business and a new working culture which not only affect the whole organizational process and all employees but also demand the allocation of significant organizational resources. Firms therefore need to be fully convinced of the trade-offs provided by TQM, particularly if time elapses before the desired results are felt, or if substantial organization stress has to be overcome in the short term to adopt the necessary organizational change (Brah *et al*., 2002). However, most research undertaken so far relates to companies operating in developed countries, mainly USA, UK and Australia (Sila and Ebramhimpour, 2002), although some researchers have focused on developing economies such as India (Motwani *et al*., 1997, Rao *et al*., 1997), Saudi Arabia (Curry and Kadasah, 2002) and Palestine (Baidoun, 2004).

To reinforce the benefits of TQM it is also advisable to facilitate comparison across studies by avoiding differing conceptualizations and TQM-related measures. Accordingly, it has recently become a common practice to link research to the criteria of well-known Quality Award models (Woon, 2000; Rahman, 2001; Prajogo and Sohal, 2004). Quality Awards provide a useful assessment framework against which organisations can evaluate their quality management practices and their end business results, and constitute a common benchmark or standard criteria for firms operating under their area of influence. We advocate the use of these models as a TQM benchmark in their respective geographical area of influence (i.e. countries), as they offer firms several advantages, including the immediate chance to assess their closest competitors' TQM practices and the outcomes that may be expected. Consequently, the aim of this study is to develop an instrument to measure TQM implementation based on Quality Award applicable to the Spanish firms under study, i.e., the European Foundation for Quality Management (EFQM) Excellence Model, as well as to provide empirical evidence on the relationship between management practices and measures of business performance in the model.

The body of literature that analyzes the relationship between quality management and organizational performance resorting to quantitative data analysis, and adopting a comprehensive analysis of the EFQM quality practices and outcomes, is limited. The list becomes even shorter if we seek this analysis based on causal relationships and referred to business organizations (Bou-Llusar *et al*., 2005; Eskildsen and Dahlgaard, 2000). Given that this model represents the European standard to be achieved by firms involved in the TQM adventure, this study seeks to fill a gap in the literature by employing structural equations modelling (SEM) to test the criteria relationships. Our end purpose is to substantiate TQM's contribution to the attainment of competitive advantage, that is, the

outperformance of competition as measured by the results criteria included in the EFQM Excellence Model.

The paper is structured as follows. We firstly review the TQM literature and the EFQM Excellence Model and describe the opportunities derived from the use of this framework as a guide to developing a TQM measurement instrument. The next section covers the methodology followed in the research, including details of how the measure instrument was constructed, the sample obtained and the research method employed. Thirdly, we address the evaluation of the scale's psychometric properties: namely, its reliability, validity of content, convergent validity and discriminant validity. Finally the causal model is tested, providing evidence on TQM outcomes.

2 LITERATURE REVIEW

TQM measurement

The literature's failure to provide a single, systems approach to TQM implementation is illustrated by Sila and Ebramhimpour (2002), who undertake a useful revision of the TQM survey-based research published in English between 1989 and 2000 - a total of 347 articles - and identify up to 25 TQM factors *most commonly* extracted from the 76 empirical studies that adopted an integrated or holistic view of TQM. They also offer a variety of reasons that may justify the appearance of different sets of TQM factors, mainly:

1) Differences in the conceptual approaches taken by researchers.

2) Differences in the empirical methodology followed: some studies use confirmatory factor analysis to verify the underlying factors of TQM (Wilson and Collier, 2000; Kaynak, 2003; Fuentes *et al*., 2004), although most research basically employs factor analysis (FA).

3) Differences between countries' business, socio-political and socioeconomic environments (i.e. culture, education levels, information technology, government regulations, level of industrialization) that would prevent straightforward transferability and applicability of TQM concepts, principles, and practices (Sila and Ebramhimpour, 2002). This raises the question of the universal applicability of TQM (universalism), which has recently received the attention of several scholars (Newman and Nollen, 1996; Roney, 1997; Rungtusanatham *et al*., 2005). In short, further research is still needed to determine whether TQM management practices and principles can transcend organizational and national boundaries or whether this concept can be subject to different interpretations in different environments.

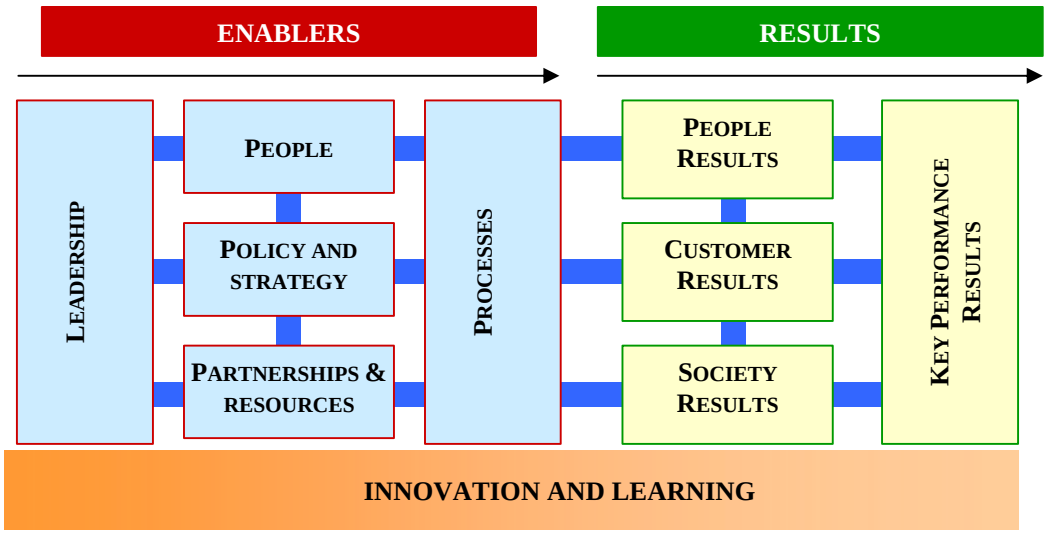
In efforts to measure TQM world-wide, several Quality Awards have been used to guide research into TQM. These awards synthesize the common understanding of TQM practices for the firms operating under their area of influence. The most popular of them has been the Malcolm Baldrige National Quality Award (MBNQA) in USA (Black and Porter, 1996; Rao *et al*., 1999; Samson and Terziovsky, 1999; Wilson and Collier, 2000; Pannirselvam and Ferguson, 2001; Prajogo and Sohal, 2004); although the Australian Business Excellence framework (ABE) (Rahman, 2001) and the Singapore Quality Award (Quazi and Padibjo, 1998; Woon, 2000) have also inspired several studies. This research is based in the EFQM Excellence Model, which is described in the following section together with a justification of its applicability to identifying TQM constructs.

The EFQM Model

The EFQM Excellence Model was introduced at the beginning of 1992 as the framework for assessing organisations for the European Quality Award. It is now the most widely used organisational framework in Europe (Eskildsen and Dahlgaard, 2000) and has become the basis for the majority of national and regional Quality Awards. The EFQM Excellence Model is a non-prescriptive framework based on 9 criteria as shown in Figure 1. Five of these are "*Enablers'* (leadership, people, policy strategy, partnership & resources, and processes) and four are 'Results' (people results, customer results, impact on society results and business results). The 'Enabler' criteria cover what an organisation does. The 'Results' criteria cover what an organisation achieves. 'Results' are brought about by 'Enablers', and 'Enablers' are improved using feedback from 'Results'. The Model, which acknowledges that there are many approaches to achieving sustainable excellence in all aspects of performance, is based on the premise that:

> Excellent results with respect to Performance, Customers, People and Society are achieved through Leadership driving Policy and Strategy that is delivered through People, Partnerships and Resources, and Processes (EFQM, 2002).

Figure 1: EFQM Excellence Model



The EFQM Excellence Model is a practical tool that offers several advantages from the empirical research perspective, as do other Quality Awards:

- The model is regularly revised and updated, incorporating the contributions of EFQM consultants. Therefore, the set of constructs underlying the model is not limited to a single researcher's view of TQM, which also guarantees its comprehensiveness, dynamism and tracking of the latest developments in TQM.
- It provides an extensive set of sub-criteria to detail the exact meaning of each criterion. This facilitates the items' identification in the scale development.
- Additionally, award models are intended to be instruments for comparing an organisation with its competitors in order to achieve and/or maintain competitive advantage. When survey data based on these models is provided to the firms, the self-assessment of TQM implementation and the identification of areas for improvement in relation to the firm's closest competitors is substantially facilitated, which increases the practical implications of the research. The EFQM Excellence Model has obvious prestige among European firms as a sound quality standard and there is an ever-increasing number of firms involved in the recognition process to achieve the European Quality Award (EQA) (EFQM, 2006). As this happens, the benchmarking utility of the model increases.
- In the case of the EFQM Excellence Model, the increasing convergence of European markets dissipates any concern regarding the universalism issue. Therefore, empirical evidence relative to the effects on performance of TQM practices according to this model acquires great relevance for all firms competing in the European Union.

Previous research based on the EFQM Excellence Model has been devoted, in many cases, to conceptual developments or reflections on the application of the EFQM model (Cragg, 2005; Martín-Castilla, 2002; Rusjan, 2005; Westlund, 2001; Wongrassamee *et al.*, 2003). Thus, researchers have addressed, for example, the problems associated with the self-assessment methodology used by the EFQM Excellence Model (Samuelson and Nilsson, 2002; Li and Yang, 2003), or the usefulness of the EFQM model to identify organizations' most representative resources and capabilities, that is, their basis for competitive advantage according to the resource-based view of the firm theory (Castresana and Fernandez-Ortiz, 2005). Several papers have also been dedicated to case studies specially within the education (Farrar, 2000; Hides, *et al.*, 2004; Tarí, 2006) and health care sectors (Jackson, 2000; Jackson and Bircher, 2002; Moeller *et al.*, 2000; Stewart, 2003). The literature also provides several research papers on the EFQM Excellence Model (i.e., papers based on quantitative research and that resort to multivariable analysis techniques), although these have not always adopted a holistic view of quality practices (Eskildsen and Dahlgaard, 2000; McCarthy and Greatbanks, 2006; Osseo-Asare *et al.*, 2005). Among the research papers that analyze the full set of relevant dimensions in the EFQM Excellence Model (Bou-Llusar *et al.*, 2005; Calvo-Mora *et al.*, 2005; Eskildsen *et al.*, 2001; Moller and Sonntag, 2001) the employment of methodologies that allow evaluating causal relationships between

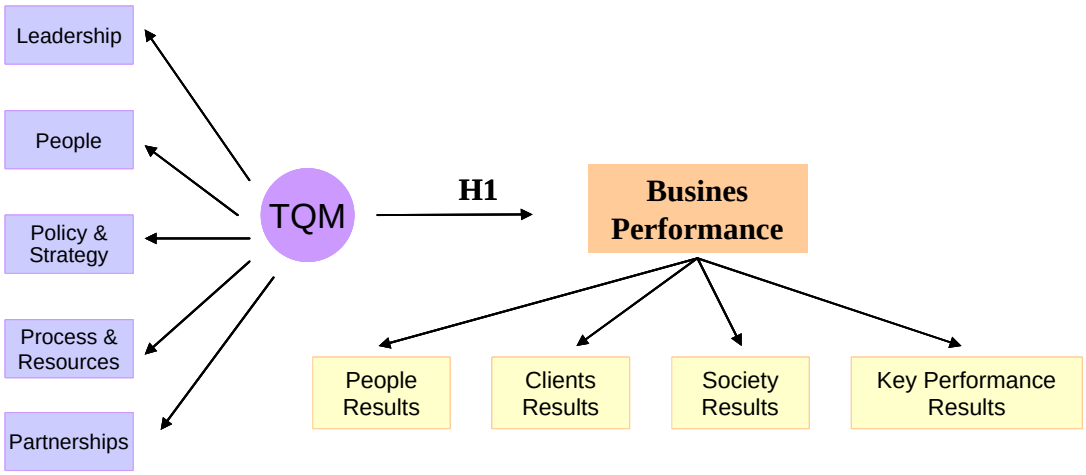
Enablers and Results, namely Structural Equations Modeling (SEM), is more scarce (Bou-Llusar *et al*., 2005).

In this context, our empirical work seeks to validate the nine criteria of the EFQM Excellence Model as constructs. To this end the paper provides an exhaustive analysis of the psychometric properties of the scales employed. The scale validation effort is important to assure the quality of the measure instruments or their ability to provide a sound and accurate measure of the concepts in the research model. The research also aims to determine the impact of the Enabler criteria on the Results predicted in the EFQM Model using SEM, that is, evaluating the notion of causality. Therefore, we give the "Results" constructs a separate status in our study as the dependent variables influenced by the TQM practices followed by organizations. This same approach has been followed by Samson and Terziovski (1999), who relate their investigation to the MBNQA criteria, and by Rahman (2001) who conceptualizes TQM using the Australian Business Excellence (ABE) framework as a guide. Thus, the following hypothesis is formulated:

H1: TQM practices according to the EFQM Excellence Model directly and positively influence organizational performance in the Results criteria shown in the Model.

Among the outcomes of TQM practices, the Key Performance Results category includes a wide variety of different types of performance indicators. In this study, we have selected those most consistently incorporated into previous research (Kaynak, 2003), namely financial performance, supplier support, process efficiency and cost reductions. The model to be tested is shown in Figure 2.

Figure 2: Research Model



3 RESEARCH METHODOLOGY

Instrument development

There are several sub-criteria under each EFQM criterion that describe aspects of the criterion in more detail. These sub-criteria were used as a guide, as was previous empirical research on factors critical to TQM based on a holistic approach to this concept (Saraph et al., 1989, Flynn et al. (1994), Anderson et al. (1995), Badri et al., (1995), Powell (1995), Ahire et al. (1996), Black and Porter (1996), Ahire and O'Shaughnessy (1998), Grandolz and Gershon (1998), Quazi and Padibjo (1998), Anderson and Sohal (1999), Samson and Terkiovski (1999), Zhang et al. (2000), Antony et al. (2002) and Brah et al. (2002)). Many critical factors obtained in previous research not only show a clear correspondence with the EFQM criteria, but also the items that comprise have come through a validation process, which fully justifies using them in this study. A review of the literature and the EFQM Excellence Model provided over one hundred items from amongst the nine criteria. The different statements were evaluated to avoid duplications and the list was reduced to 81 items. The process entailed careful monitoring to ensure comprehensive coverage of the TQM concept. With statements for all the nine criteria completed, the questionnaire was pilot-tested using six respondents from the regional Quality Club Managerial Board. All the informants were the CEOs of each firm and their corresponding

companies were not included in the random sample. The researchers undertook personal interviews of an average length of 90 minutes to carefully review the questionnaire. The interviewees have considerable managerial experience to examine the questions and they provided a valuable opinion about their readability, adequacy to the TQM measurement and correct understanding. As a result, several items were rewritten to facilitate their interpretation, to avoid confusion and thus prevent research bias. The items finally employed are listed and classified according to their main dimensions as shown in Appendix 1. Following Ahire and O'Shaughnessy (1998), a seven-point Likert scale was used for all items to ensure higher statistical variability among survey responses. Thus, for each TQM Enabler criterion, respondents evaluated how well the different statements described their companies practices on a scale from 1 ("strongly disagree") to 7 ("strongly agree"). In order to isolate TQM effects on performance and avoid confusion with other exogenous or endogenous factors, respondents were asked to evaluate the extent to which the sole contribution of these practices had led to the achievement of each of the performance indicators (1="not at all"; 7="a great deal"). That is, respondents are asked to indicate to what extent their firm's quality practices allow to achieve the evaluated variables of performance. This procedure does not "invoke" causality but rather avoids the TQM-performance relationship to be interfered either by uncontrollable variables or other organizational processes that can affect performance. In addition, performance was evaluated against the firms' main competitors to introduce an explicit reference to the attainment of competitive advantages (Weerawardena, 2003a and b; Chong and Rundus 2004; Prajogo and Sohal, 2006). The reference to the major competitor in the industry allows both minimising the industry effect and decreasing the response's subjectivity establishing a point of reference to make the comparison (Kraft, 1990); likewise, this fact allows assessing the achievement of competitive advantages in the matter in the period under consideration (Grant, 1991). The research seeks to establish whether the TQM practices suggested in the EFQM Excellence Model allows firms to outperform their competitors and can be considered a feasible path towards building competitive advantage. Therefore, in most cases performance was evaluated by the firms' CEOs, and the respondents selected their firm's main competitor according to their perceptual judgements. Total quality oriented firms can be presumed to have a strong market orientation which provides them with a reasonable knowledge of their clients and competitors' operations (Yam *et al*., 2005).

While perceptual judgements have a potential for self-reporting bias, prior research has also shown that perceived performance can be a reasonable substitute for objective measures and that managers prefer to avoid offering precise quantitative data (Taylor and Wright, 2003; Fuentes *et al*., 2004)

Sample and research method

Data for empirical testing and validating the TQM scale was obtained by means of a mail survey. The research population consisted of all the ISO 9000 registered firms in the Principality of Asturias, a total of 451 organizations according to the data provided by the Regional Quality Club. Certified firms were selected to guarantee a certain interest in quality management practices as well as familiarity with the issues addressed in the questionnaire (Curry and Kadasah, 2002). Similarly, ISO 9000 implementation may be seen as a stepping-stone towards TQM (Antony *et al*., 2002). The questionnaire was mailed to the General Manager or Managing Director of each organization to ensure a good knowledge of the firms' TQM practices and outcomes in relation to their competence. Thus, it is essential to guarantee that the survey's respondents do possess the knowledge required to answer the questions appropriately (Agus, 2000; Taylor and Wright, 2003; Weerawardena, 2003b). The questionnaire delivery included a cover letter and a pre-paid return envelope. The covering letter outlined the objectives and importance of the study, was signed by the President of the Regional Quality Club and included an assurance of confidentiality. The study was conducted between January and March of 2005. Telephone calls were made three weeks after the start to follow-up the study and another copy of the questionnaire was sent to several organizations when required. A final response rate of 20.6% was obtained, representing 93 firms from a range of manufacturing and service sectors. The proportion of respondents was equally distributed between manufacturing and non-manufacturing sectors (41.8 % and 58.2% respectively). The majority of the respondents (78.5%) were senior managers (General Manager or Managing Director), so they had the knowledge to answer the questions appropriately. Approximately, 8.4% of the firms had less than 10 employees, 44.6% had between 10 and 49 employees, 37% employed between 50 and 249 workers, and 10% had more than 250 employees.

4 PSYCHOMETRIC PROPERTIES OF MEASUREMENT SCALES

The psychometric properties of the measurement scales were assessed in accordance with accepted practices (Gerbing and Anderson, 1988) and included the establishment of content validity, reliability, convergent validity, discriminant validity and criterion-related validity. The scales validation involved both exploratory and confirmatory factor analysis using SPSS12.0 and EQS6.0 software respectively.

Reliability - stage one

The reliability of an instrument assesses its ability to yield the same results on repeated trials. Internal consistency is one of the methods that can be used for assessing reliability (Nunnally, 1978). It indicates how well the different items of a scale measure the same concept and it is generally measured by means of a reliability coefficient such as Cronbach's coefficient alpha. Cronbach's alpha was calculated separately for each of the constructs, with item-to-total scale correlations being plotting. Generally, reliability coefficients of 0.70 or more are considered good and it is advisable to eliminate those items that diminish the coefficient value. The results in Table 1 show that the values of Cronbach's alpha derived for the constructs ranged between 0.773 and 0.951, indicating a high reliability of the scales. Ten items were deleted after the reliability analysis shown in italics in Appendix 1.

At this point in our research we had still not checked for possible item overlap across the dimensions of both TQM practices and results. We therefore undertook a principal components analysis with varimax rotation for each set of Enabler and Result variables. A factor loading of 0.50 was used as the cut-off point. The results show that the statements corresponding to the same dimension load on a single factor, with the only exception of some items relating to resources management from the Partnership and Resources criterion (Part&res5 to Part&res8). These items load on the Processes factor. This fact is not conceptually surprising, given that resources management involves the development of certain organizational processes. For this reason, a new factor, labelled Processes and Resources, is considered in further CFA, while the partnership and resources criterion is subsequently referred to as Partnership. Additionally, it is noteworthy that none of the variables failed to meet the cut-off point considered; nor were there cross loads among factors.

Validity

Validity refers to the degree to which a measure accurately represents what it is intended to measure. Three different types of validity are generally considered: content validity, convergent and discriminant validity, and criterion-related validity (Nunnally, 1978).

Content validity

Content validity represents the extent to which a specific content domain is reflected by an empirical measure. Unlike the other validity analyses, content validity is not evaluated numerically. Researchers must ensure that the survey addresses all issues relevant to the content domain under study in order to guarantee content validity. The scales for measuring TQM practices and outcomes in this research are guided by the EFQM Excellence Model criteria. Quality Award models are viewed as comprehensive by many researchers and practitioners and have been used in previous research to derive empirical constructs (Samson and Terziovski, 1999; Woon, 2000; Rahman, 2001). The development of the items was also reinforced by an extensive review of the literature and detailed evaluations by academics and practitioners alike. It is therefore argued that the TQM constructs can be considered to have content validity.

Convergent validity

Convergent validity refers to the degree to which a measure converges on a same model with the remaining measures forming part of the same concept. Thus, a strong condition of convergent validity is that all scale items load significantly on their hypothesised latent variable and have a loading of 0.6 or better (Anderson and Gerbing, 1988). A single-factor confirmatory factor analysis was carried out when feasible, given that CFA needs at least four items per latent variable to obtain degrees of freedom. When this condition was not achieved, the corresponding construct was allowed to correlate to another construct to obtain the factor loadings. Consequently, a single factor model was performed for Leadership, People, and Policy and Strategy, whereas the Processes and Resources construct correlated to that of Partnership, represented by two items. As three categories of outcomes within Key Performance Results -financial, suppliers and costs- are also estimated by less than four items, we ran a

model so that all the Key Performance Constructs could correlate. For the same reason, Results on Society correlate with the results for People and Clients. Table 1 shows the results of these analyses, which prove the convergent validity of each scale. The great majority of the items used proved to achieve convergent validity in their respective scales, although four items were deleted after this analysis (see items in bold type in Appendix 1).

Table 1: Construct validity and reliability

FACTOR Item	Loadings	T-Value	Composite Reliability	AVE	Cronbach's Alpha	Goodness of Fit
LEADERSHIP (LEAD)						
Leader2	0.86	7.816	0.946	0.716	0.945	***S-B*** c^2
Leader3	0.87	9.304				***(14)=27.8937***
Leader4	0.88	10.931				P=0.01470
Leader8	0.77	7.713				BBNNFI=0.922
Leader10	0.84	10.156				CFI=0.959
Leader11	0.87	12.065				IFI=0.960
Leader12	0.83	10.458				GFI=0.888
						SRMR=0.034
PEOPLE (PEOP)						
People1	0.82	13.702	0.951	0.611	0.934	***S-B*** c^2
People2	0.78	9.788				***(35)=42.7784***
People3	0.80	8.675				P=0.17182
People4	0.76	9.831				BBNNFI=0.928
People5	0.87	10.966				CFI=0.986
People6	0.83	12.829				IFI=0.986
People7	0.72	8.381				GFI=0.837
People8	0.65	7.104				SRMR=0.052
People9	0.75	7.877				
People10	0.77	11.058				
POLICY AND STRATEGY (P&S)						
Polest1	0.85	10.432	0.938	0.685	0.936	***S-B*** c^2
Polest2	0.88	9.650				***(14)=22.0982***
Polest3	0.73	8.008				P=0.07662
Polest4	0.83	9.972				BBNNFI=0.943
Polest5	0.87	12.289				CFI=0.978
Polest6	0.74	9.638				IFI=0.978
Polest7	0.88	11.163				GFI=0.923
						SRMR=0.030
PROCESSES AND RESOURCES (P&R)						
Process1	0.70	7.275	0.971	0.615	0.951	***S-B*** c^2
Process2	0.86	9.132				***(89)=133.7315***
Process5	0.74	8.407				P=0.00153
Process6	0.75	8.500				BBNNFI=0.909
Process7	0.82	8.144				CFI=0.923
Process8	0.71	7.398				IFI=0.925
Process9	0.77	8.137				GFI=0.813
Process10	0.91	9.191				SRMR=0.050
Process11	0.83	10.239				
Part&res5	0.72	7.855				
Part&res6	0.75	5.955				
Part&res7	0.78	7.788				
Part&res8	0.75	7.069				
PARTNERSHIPS (PART)						
Part&res1	0.95	8.754	0.807	0.682	0.773	
Part&res2	0.68	7.955				

KEY PERFORMANCE RESULTS (KPERF)						
Financial (FINR)						
Financialr1	0.92	10.672	0.939	0.837	0.939	
Financialr2	0.97	13.851				
Financialr3	0.85	10.100				
Suppliers (SUPPLR)						
Supplr1	0.86	8.332	0.909	0.770	0.905	***S-B*** c^2
Supplr2	0.92	11.325				***(84)=116.4094***
Supplr3	0.85	8.910				P=0.01112
Processes (PROCR)						BBNNFI=0.952
Procr1	0.78	8.581	0.932	0.696	0.930	CFI=0.961
Procr2	0.83	8.547				IFI=0.962
Procr3	0.89	10.512				GFI=0.743
Procr4	0.84	8.061				SRMR=0.061
Procr5	0.82	8.073				
Procr6	0.84	10.409				
Costs (COSTR)						
Costr1	0.81	8.499	0.839	0.636	0.802	
Costr3	0.75	8.557				
Costr4	0.83	10.257				
CUSTOMER RESULTS (CUSTR)						
Custr1	0.89	9.160	0.917	0.689	0.914	
Custr2	0.90	7.150				
Custr3	0.79	8.470				
Custr4	0.76	6.930				
Custr5	0.80	5.628				***S-B*** c^2
SOCIETY RESULTS (SOCR)						***(51)=84.9838***
Socr1	0.91	8.485	0.928	0.865	0.925	P=0.00198
Socr2	0.95	9.287				BBNNFI=0.889
PEOPLE RESULTS (PEOPR)						CFI=0.914
Peopr2	0.78	9.270	0.915	0.687	0.905	IFI=0.917
Peopr4	0.63	7.363				GFI=0.858
Peopr5	0.89	10.369				SRMR=0.053
Peopr6	0.92	9.707				
Peopr7	0.89	8.421				

Reliability - stage two

By using the actual loadings from the confirmatory results, an additional internal consistency measure can be obtained as a test of reliability: composite reliability (Fornell and Larcker, 1981). Composite reliability is a measure of the average variance shared between a construct and its measures; it does not assume, like Cronbach's alpha, that all the loadings are equal to 1; nor is it influenced by the number of attributes associated with each construct. Another measure suggested by Fornell and Larcker (1981) to examine the shared variance among a set of observed variables measuring an underlying construct is the average variance extracted (AVE), which is also calculated when evaluating the reliability of the scales, although, as Fornell and Larcker (1981) note, AVE is an even more conservative measure than composite reliability. In general, composite reliabilities of at least 0.7 and average variances extracted of at least 0.5 are considered desirable (Hair *et al.* , 1999). Therefore, construct reliability was again evaluated using estimated model parameters (e.g., composite reliability, average variance extracted).

As Table 1 shows, each construct manifests a composite reliability greater than the recommended threshold value of 0.7. The AVEs range between 0,611 and 0,837, above the recommended 0.50 level.

Discriminant validity.

Discriminant validity is ensured when the measurement items posited to reflect a construct differ from those that are not believed to make up the construct. This is particularly important when constructs are highly correlated and similar in nature. An alternative test of discriminant validity is to

determine whether the correlation between constructs is significantly less than one. In practice, this requires that the 95 percent confidence interval for each pair-wise correlation (i.e., plus or minus two standard errors) does not contain the value 1 (Anderson and Gerbing, 1988). This would prove that the correlation between the dimensions is significantly far from 1, and therefore that the dimensions represent different concepts.

Because we could not include all the criteria in a single model without violating the ratio of sample size to number of parameters (Jöreskog and Sörbom, 1995), we divided the set of scales into various sub-models grouping related constructs to obtain correlations. This approach is well established in the literature (Bentler and Chou 1987; Doney and Cannon 1997; Atuahene-Gima and Li, 2002).

The first set of correlations was obtained from the model run with the four categories of Key Performance Results (see Table 1). Once the discriminant validity of these dimensions had been established, as shown in Table 2, we tested their convergence on a single factor to ensure the unidimensionality of the Key Performance Results (see Table 3). Thus, as the single-factor model has an acceptable fit, the construct is deemed unidimensional (Payan and McFarland, 2005). Accordingly, another CFA was run to obtain the correlations amongst the measures of Results on Clients, Society, People and Key Performance Results (see Table 4).

TABLE 2. Discriminant validity of Key Performance Results

Construct	Covariance	Confidence Intervals of covariance coefficients
FINR-SUPPLR	0.614	(0.488-0.740)
FINR-PROCR	0.671	(0.515-0.827)
FINR-COSTR	0.702	(0.546-0.858)
SUPPLR-PROCR	0.758	(0.650-0.866)
SUPPLR-COSTR	0.727	(0.569-0.885)
PROCR-COSTR	0.750	(0.758-0.842)

Table 3: Unidimensionality of the Key Performance Results

Item	Loadings	T-Value	Composite Reliability	AVE	Cronbach's Alpha	Goodness of Fit
FINR SUPPLR PROCR COSTR	0.73 0.78 0.90 0.82	7.795 8.191 10.793 8.632	0.883	0.656	0.877	***S-B c^2 (2)=0.0799*** P=0.96083 BBNNFI=1.042 CFI=1.000 IFI=1.014 GFI=0.999 SRMR=0.004

Table 4: Discriminant validity of the Results criteria

Construct	Covariance	Confidence Intervals of covariance coefficients
CUSTR-SOCR	0.575	(0.367-0.783)
CUSTR-PEOPR	0.826	(0.730-0.922)
CUSTR-KPERF	0.864	(0.772-0.956)
SOCR-PEOPR	0.509	(0.257-0.761)
SOCR-KPERF	0.581	(0.383-0.779)
PEOPR-KPERF	0.745	(0.613-0.877)

Goodness-of-fit statistics	***S-B c^2 (98)=153.8193*** P=0.00027	BBNNFI=0.886 CFI=0.907 IFI=0.911	GFI=0.811	SRMR=0.057

A second CFA model included the correlations of each of the TQM Enablers with the Clients, People, Society and Key Performance results. In order to increase sample size relative to the parameter estimates, we used single-scale score indicators to measure the Enablers' latent constructs. Thus, the actual level of the constructs was represented by the median of the measurement items that survived the scales validation process. The measurement error terms for each of these constructs were fixed at (1-composite reliability coefficient) times the variance of each scale score in the final model to determine the extent to which measurement error affected the observed pattern of relationships (MacKenzie *et al*., 1998).

Table 5: Discriminant validity of research model constructs

Construct	Covariance	Confidence Intervals of covariance coefficients
LEAD-PEOP	0.711	(0.737-0.845)
LEAD-P&S	0.775	(0.649-0.901)
LEAD-P&R	0.715	(0.597-0.833)
LEAD-PART	0.469	(0.297-0.641)
LEAD-CUSTR	0.570	(0.360-0.780)
LEAD-SOCR	0.465	(0.217-0.713)
LEAD-PEOPR	0.610	(0.398-0.822)
LEAD-KPERF	0.582	(0.364-0.800)
PEOP-P&S	0.701	(0.559-0.843)
PEOP-P&R	0.573	(0.415-0.731)
PEOP-PART	0.398	(0.116-0.680)
PEOP-CUSTR	0.468	(0.270-0.666)
PEOP-SOCR	0.429	(0.227-0.631)
PEOP-PEOPR	0.548	(0.358-0.738)
PEOP-KPERF	0.543	(0.351-0.735)
P&S-P&R	0.748	(0.626-0.870)
P&S-PART	0.467	(0.153-0.781)
P&S-CUSTR	0.608	(0.434-0.782)
P&S-SOCR	0.411	(0.139-0.683)
P&S-PEOPR	0.502	(0.248-0.756)
P&S-KPERF	0.530	(0.310-0.750)
P&R-PART	0.580	(0.356-0.804)
P&R-CUSTR	0.750	(0.772-0.828)
P&R-SOCR	0.508	(0.288-0.728)
P&R-PEOPR	0.657	(0.511-0.803)
P&R-KPERF	0.711	(0.585-0.837)
PART-CUSTR	0.422	(0.170-0.674)
PART-SOCR	0.240	(-0.074-0.554)
PART-PEOPR	0.392	(0.152-0.632)
PART-KPERF	0.340	(0.052-0.628)
CUSTR-SOCR	0.557	(0.371-0.743)

CUSTR-PEOPR	0.713	(0.725-0.801)		
CUSTR-KPERF	0.759	(0.769-0.849)		
SOCR-PEOPR	0.474	(0.224-0.724)		
SOCR-KPERF	0.554	(0.360-0.748)		
PEOPR-KPERF	0.727	(0.601-0.853)		
Goodness-of-fit statistics	***S-B c^2 (163)=253.7822*** P=0.00001	BBNNFI=0.971 CFI=0.978 IFI=0.979	GFI=0.769	SRMR=0.116

The results obtained (see Table 5) show that there is discriminant validity between all the dimensions considered. The highest correlation between dimensions was 0,859 (between the Clients Results and the Key Performance Results scales). The associated confidence interval was 0.77 to 0.95. Hence discriminant validity was supported for all pairs of dimensions. Again, once the discriminant validity of the Enablers' constructs had been proven, their convergence on a single factor was tested to confirm the existence of a single dimension underlying these practices, the actual firms' level of adoption of TQM. The convergence of all the dimensions of business performance considered in the EFQM Model was similarly evaluated. The empirical evidence obtained in both cases is shown in Table 6, this evidence allows considering a single factor to represent the TQM practices and the TQM results in the research model, thus both TQM practices and the TQM results are deemed unidimensional constructs.

Table 6: Unidimensionality of the TQM's Enablers and Results

FACTOR **Item**	**Loadings**	**T-Value**	**Composite Reliability**	**AVE**	**Cronbach's Alpha**
TQM'S ENABLERS Leadership People Policy and Strategy Processes and Resources Partnerships	 0.92 0.86 0.87 0.84 0.60	 11.295 11.220 10.160 7.554 5.461	**0.912**	**0.678**	**0.900**
Goodness-of-fit statistics	***S-B c^2 (5)=11.3805*** P=0.04434		BBNNFI=0.922 CFI=0.961 IFI=0.962	GFI=0.926	SRMR=0.041
RESULTS Customer Results Society Results People Results Key Performance Results	 0.91 0.59 0.81 0.81	 7.370 5.012 7.690 9.767	**0.866**	**0.622**	**0.841**
Goodness-of-fit statistics	***S-B c^2 (2)=0.9739*** P=0.61451		BBNNFI=1.037 CFI=1.000 IFI=1.012	GFI=0.993	SRMR=0.017

Criterion-related validity

Criterion-related validity is concerned with the extent to which an instrument is related to an independent measure of the relevant criterion. Thus, a set of quality-management constructs has criterion-relation validity if the collective measure of the constructs is highly and positively correlated with a measure of performance. Although predictive validity can be assessed in this way, it can also be tested in the measurement model if the latter contains the construct of interest and a construct that it should predict (Garver and Mentzer, 1999).

Therefore, criterion-related validity of the five TQM Enablers was initially evaluated by examining the multiple correlation coefficients computed for the five measures and the results of the EFQM programme. The multiple correlation coefficients obtained were in all cases above 0.5 ($p < 0.001$), providing strong evidence of criterion-related validity. The analysis of the proposed SEM model will provide further evidence on this topic.

6 RESEARCH MODEL TESTING

Our model suggests that there is a latent factor, designed as TQM that represents the quality practices developed by the firms following the EFQM framework. This latent factor achieves higher values if all the Enablers are performed, that is, if a global orientation is adopted in the application of the EFQM Model. Thus, total quality is evaluated by the various Enablers of the EFQM framework and conceived as a primary influence on organizations' performance. Business performance is also represented by a latent construct which embodies the overall performance according to all the Model's results indicators. The SEM results of the relationship between TQM practices and performance show a strong correlation between these variables (ß=0.81; p=0.001) and the structural model explains the 65.0 percent of the variation in business results. The goodness-of-fit statistics used to assess the fit of the data to the hypothesized model are the same as those used to test the measurement models: (*S-B* c^2 *(26)=43.6689;* P=0.01640; BBNNFI=0.921; CFI=0.943; IFI=0.945; GFI=0.860; SRMR=0.050). These indices also reveal a good fit of the model to the data. Consequently, the hypothesis formulated (H1) is confirmed. This brings about an important practical implication of the study: the balanced adoption of the TQM practices represented by the Enabler constructs leads to substantially better organizational performance in relation to a firm's main competitors.

7 CONCLUSIONS, LIMITATIONS AND FUTURE RESEARCH

As implementing and developing TQM requires major organisational commitment and effort, there is a need for clear evidence that TQM really has a positive impact on performance. Similarly, results should be susceptible to comparison and useful for firms attempting to achieve total quality. This research uses the EFQM Excellence Model as a guide to measure total quality practices. Its main objectives are to provide empirical evidence on the outcomes that may be expected by firms willing to adopt TQM according to this Model, and to develop and describe a specific measurement instrument to this end. To adequately develop an instrument for measuring the TQM implementation it is devoted a great effort to justify the appropriateness of the scales. This has been made using stringent criteria and combining exploratory and confirmatory analysis. Additionally, the scales are facilitated to allow either undertaking a straightforward replication of the study, or the future development by researchers of comparisons among studies with similar purposes. The excellent works of Eskildsen and Dahlgaard (2000) and Bou-Llusar *et al*. (2005), although resort to SEM to analyze the proposed relationships, do not focus on the former aspects -detailed scales and validity and reliability analysis.

The paper also contributes to TQM literature by proving the positive causal relationship between the EFQM's Enablers and firms' Results. Additionally, the use of a Quality Award as a point of reference to measure TQM practices, and the inclusion of all the EFQM Model's expected outcomes, is a valuable benchmarking data for firms, particularly in the European context. Thus, as the similarities of European regional markets increase, and environmental conditions become smoother, the direct, general applicability of the TQM concept represented by the EFQM Model will grow, obviating any concerns about universalism. Moreover, the EFQM Excellence Model constitutes an unquestionable benchmark in TQM for European firms, and is receiving an ever-growing number of applications for recognition at its different levels (Committed to Excellence, Recognised for Excellence, and the EFQM Excellence Award). We can therefore conclude that: a) adopting the EFQM Excellence Model contributes to firms outperforming competition, i.e., the achievement of competitive advantage; b) there is no concern regarding its universal usability within the European context; and c) it represents the next step to be taken by all European firms committed to quality management in order to surpass the Quality Assurance stage.

The results reported, however, must be treated with caution. The research constitutes a cross-sectional snapshot based on 93 firms operating in the north of Spain. We can neither trace the progress of the companies in our study nor estimate the potential lags between TQM adoption and the outcomes achieved by the firms. A longitudinal study would be necessary to overcome such limitations. Moreover, sample size is far below the number of cases reported in other research, which has led in this case to a more complex data analysis. It would be advisable to replicate the study in broader contexts to confirm the underlying factors identified in this case. The study also suffers from a common limitation in quantitative research: the use of subjective measures for the variables considered. However, it is widely reported in the literature that this procedure increases the response rate as well as that there is a high correlation between subjective and objective data on performance (Venkatraman and Ramanujan, 1986). The use of self-reported data may induce social desirability bias, although the assurance of anonymity can reduce such bias when responses concern sensitive topics (Hair et al., 1999). Finally, although some items have been deleted in the validation process, it must be borne in mind that the different items employed to approximate the underlying constructs "overlap" to some extent to try to

capture the underlying constructs measure. Thus, items are expected to be correlated (measures should possess internal consistency reliability) so that dropping some items of the measurement model does not necessarily alter the meaning of the construct (Jarvis *et al.*, 2003). In this respect, four items pertaining to the organization's external orientation (customers, stakeholders and community) are deleted in the Leadership factor. This can be considered a problem since customer satisfaction is basic to TQM. However, several items concerning the anticipation and management of organizational change survive, which involve a careful monitoring of the environment, and a clear intention to meet the market needs.

This research acknowledges the multidimensional nature of TQM. However, future research should consider the interactions not only between specific TQM practices themselves but also between these practices and the different sets of performance variables if we are to obtain a better understanding of quality management. The correlations between the EFQM Excellence Model's constructs indicate that the different activities and outcomes are not independent. Eskildsen and Dahlgaard (2000) illustrate the relationships between the Enabler criteria and People Results within a European service firm. Calvo-Mora *et al.* (2005) replicate this research using a sample of 111 Spanish university centres, assuming the same interactions as the aforementioned study between the Enablers, and including the interactions between the four types of results of the Model (People, Students, Centre and Society). However, in the latter study, Process Management is the only Enabler shown to have a direct impact on performance variables, whereas Eskildsen and Dahlgaard (2000) confirm that it is the People Enabler which directly affects the People Results. In this line, and based on business organizations, the study of Bou-Llusar *et al.* (2005) uses canonical correlations to explore the associations between the EFQM criteria, although indirectly infers the causal relationship between Enablers and Results. In short, this is still a recent line of investigation and more empirical support from different settings is required. This evidence will also enable better understanding of which TQM practices may have a more positive effect on different types of performance. Finally, we believe that the role of firms' competitive environments as an antecedent of the adoption TQM practices, or as a moderator of the TQM-performance relationship, also deserves future research. It is necessary to develop a deeper understanding of the type of environments that favour the TQM adoption, or that could made the TQM a more valuable resource to obtain, if the TQM-performance relationships is positively moderated.

Appendix 1: Research Scales

TOTAL QUALITY MANAGEMENT

LEADERSHIP	
Long-term customer satisfaction is laid down as the organization's mission and basic principle	*Leader1*
Organizational leaders take on the responsibility for developing quality oriented management systems	Leader2
Leaders personally assess the application and progress of total quality principles	Leader3
Leaders allocate resources for continuous improvement of the management system	Leader4
Leaders interact with customers and keep in mind their contributions when designing goods and services	*Leader5*
Leaders always bear in mind stakeholder groups	*Leader6*
Leaders activities seek to provide value for the community and protect the environment.	*Leader7*
Leaders listen and support employees and encourage them to take part in deciding and managing total quality policies and plans.	Leader8
Leaders acknowledge and reward employees' contributions to bettering quality.	Leader9
Leaders pre-empt change needed in the organization and pinpoint the factors that lead to a need for change.	Leader10
Leaders provide a plan detailing the different stages of change, and secure the investment, resources and support needed to achieve change.	Leader11
Leaders measure and review the effectiveness of organizational change and share the knowledge that is obtained.	Leader12
PEOPLE	
In human resource planning, the employee is considered an 'internal customer' who participates in policy, strategies and organizational structure.	People1
Employees know that quality is their responsibility, and they are encouraged to meet customers' and the organization's objectives.	People2
Continuous improvement is consistently fostered and facilitated	People3
Employees are given tailor-made preparation for their jobs and are qualified to solve quality problems.	People4
Staff is continuously trained in the principles of quality, team work and job-specific skills.	People5
Employees are actively involved in quality-related activities and the success of the company, and many of their suggestions are implemented	People6
Employees are responsible for quality and end results of the product/service. They can take decisions independently.	People7
There are quality circles and/or interdepartmental teams to improve quality.	People8
The company has effective two-way communication links with its employees.	People9

The pay and promotion systems acknowledge efforts to improve quality.	People10
Pay and acknowledgement systems are based on quality-related objectives and on company results.	**People11**
Employees receive the right occupational health and safety training at work.	*People12*
POLICY AND STRATEGY	
The company draws up strategic action plans (used to regularly review and to establish the organization's short-term and long-term objectives and to pre-empt competitive situations). Their 'gold standard' is a commitment to quality.	Polest1
Strategic plans and related policies always consider customers' needs, suppliers' capacities and the needs of any other stakeholders in the company's activities.	Polest2
Detailed information about such things as competitors' actions, other market agents' behavior, legal and environmental issues, etc is collected to help formulate strategy.	Polest3
Information from all the company's processes is analyzed when strategy is defined.	Polest4
Progress towards achieving strategic objectives is regularly assessed.	Polest5
SWOT analysis is regularly used to review and update business strategy.	Polest6
Resources are allocated to achieve strategic objectives.	Polest7
PROCESSES	
Processes are designed ensuring that skills and capacities are right for company needs.	Process1
All processes, procedures and products are assessed regularly in an attempt to bring in change and improvement.	Process2
New products and/or services are designed thoroughly and meticulously before being manufactured and marketed so as to ensure that clients' present and future expectations are met.	**Process3**
Quality-related criteria predominate over speed and cost when developing new products.	*Process4*
The different company departments liaise during the development of new products/services.	Process5
We regularly ask our clients what they want from our products now and in the future.	Process6
Our clients' needs are passed on and are understood at all levels.	Process7
Clients leave is thoroughly analyzed.	Process8
We use clients' complaints and grievances to improve our products.	Process9
Present relationships with clients are analyzed and regular attempts are made to improve them.	Process10
We strive to increase our level of commitment towards our client via policies designed to encourage customer loyalty, guarantees, etc.	Process11
PARTNERSHIPS AND RESOURCES	
We have close, long-term relationships with our supplies designed to resolve quality-related problems.	Part&res1
Our suppliers help to improve our products and/or services and also provide technical assistance.	Part&res2
The company is prepared to form alliances with partners and collaborator in the market in an attempt to achieve competitive advantage.	*Part&res3*
Work is organized around reducing and optimizing physical, economic and financial resources.	*Part&res4*
Our company makes ongoing efforts to keep their facilities clean and in order.	Part&res5
The company coordinates its strategies and it technological equipment, machinery and know-how.	Part&res6
Our company strives to improve operational efficiency by efficient use of technology.	Part&res7
Our company creates databases and files with the information it has in order to analyze and learn.	Part&res8
There is updated quality-related data available to all members of the company.	*Part&res9*
CLIENTS' RESULTS	
Improved satisfaction of our clients.	Custr1
Improved communication with our clients.	Custr2
A reduction in the number of customer complaints and grievances.	Custr3
Client consolidation, returning clients and loyal clients	Custr4
Improved client perception of the company.	Custr5
PEOPLE RESULTS	
Enhanced communication between employees	**Peoprs1**
Improved satisfaction of the employees	Peoprs2
Improved Absenteeism	*Peoprs3*
Less staff turnover	Peoprs4
Improved ability of staff to react to changing customer requirements.	Peoprs5
Improved ability of staff to inform and advise clients about products and services.	Peoprs6
Improved skills of employees.	Peoprs7
SOCIETY RESULTS	
Improved social image.	Socr1
Improved view of the company as a responsible member of the community that, when possible, creates employment, implements equal rights policies, concerns itself with accident and environmental damage protection, and encourages and sponsors activities that are beneficial to society as a whole.	Socr2
KEY PERFORMANCE RESULTS	
Increased sales	Financialr1
Increased market share	Financialr2
Increased profit	Financialr3
Improved quality of suppliers' goods.	Supplr1
Better relationships with suppliers.	Supplr2
Improved delivery deadlines from suppliers.	Supplr3
Improved process efficiency (faulty parts per total production).	Procr1
Enhanced knowledge of the best way to handle processes.	Procr2
Improved manufacturing time and customer delivery times.	Procr3
More process flexibility.	Procr4

More process productivity.	Procr5
Improved delivery times of customer orders.	Procr6
Lower percentage of faulty products and/or sub-standard service provision.	Costr1
Quality of products/ services compared to competitors.	**Costr2**
Less waste products	Costr3
Lower costs of quality management	Costr4

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Biting the hand that feeds: Social identity and resistance in restaurant teams

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Abstract

The aim of this paper is to engage with, and develop the literature on teamwork and employee resistance by examining the use of teamwork as a means of work organisation and as a distinctive forum for employee resistance. We emphasise how employees, at times of heightened conflict, first of all re-evaluate their group memberships and group loyalties (including membership of teams and other competing groups and sub-groups), and second, take action in line with the groups most suitable to helping them attain beneficial outcomes. Drawing on an ethnographical mode of inquiry, we explored what turned out to be an incompatible application of teamworking to counter the typically busy and chaotic nature of front-line hotel restaurant employment. The resistance that emerged varied from individual forms of resistance and misbehaviour to overt collective forms involving the joined up efforts of team members and team leaders. Subsequent analysis confirmed the value of using a social identity approach as a means to explain workplace behaviour. However, additional work is required in considering a broader range of research methods and team-related variables in order to verify these insights and develop knowledge on teams and resistance.

Keywords: social identity approach, labour process, resistance, teamwork, ethnography, hotel and catering

1 INTRODUCTION

Groups and teams have been a major focal point of psychological and sociological theory and research. An understanding of groups is necessary for almost every analysis of social behaviour, including, leadership, majority-minority relations, status, role differentiation and socialisation (Levine and Moreland, 1998). Furthermore, small groups provide important contexts within which other behaviour occurs e.g. attraction, aggression and altruism (Geen 1998; Batson 1998). At a functional level, people spend much of their lives in collectives of some kind; e.g. families, school classes and sports teams, and these groups provide members with vital material and psychological resources.

Yet, the formal use of teams within organisations is a relatively recent phenomenon. Traditional work arrangements attempted to remove the power of the informal team and preferred a more individualised form of work organisation. Indeed, Cohen, Ledford and Spreitzer (1996) reported that nearly half of US organisations used self-managed work teams for at least some proportion of their workforce. Similarly, within the UK, the 1998 Workplace Employee Relations Survey (WERS) indicates that 65 per cent of workplaces report that they use some form of teamwork (Cully, Woodland, O'Reilly and Dix, 1999) and a review undertaken by the Institute of Work Psychology found team based working operating within 70 per cent of the organisations examined (Waterson, Clegg and Axtell, 1997).

The expansion in interest in teamwork has been seen as a response to increased competitive pressures, specifically as a mechanism for improving flexibility, responsiveness and quality (Lloyd and Newell 2000). Groups and teams have been at the core of programmes to reform routine work within manufacturing – partly as a response to Human Relations theory in the 1930s, sociotechnical systems theory in the 1950s and Japanization and lean production in the 1980s. Indeed, managerialist and psychological accounts view teamwork as the answer to all organisational ills, as it not only enhances productivity, flexibility and efficiency, but also improves employee satisfaction, motivation and commitment to the organisation (e.g. Jackson, Sprigg and Parker, 2000; Wall and Jackson, 1995). Moreover, organisations such as call centres, where the work is organised in a manner that would not logically adapt to teamwork are, nevertheless adopting teams and teamwork (van den Broek, Callaghan and Thompson, 2004). This has in part led to more critical writers viewing teamworking as the latest in a succession of management fads or as covert mechanism by which management intensify their control over labour (e.g. Barker, 1993; Sinclair, 1992).

Accordingly, one of the mainstays of the labour process debate, the countering of managerial control by resistance behaviour (Edwards, 1986) has only been given limited analysis at a team level (e.g. Bacon and Blyton, 2005; Barker, 1993; McKinlay and Taylor, 1996a and 1996b). The very nature of the team system, which cultivates patterns of commonality and mutual support, provides the ideal domain for employees to contextualised and reinterpret managerial interventions. In one sense the team is providing employees with organisational resources that can be used to develop resistance behaviour (Vallas, 2003).

We suggest that in order to further detail resistance within teams it is of value to take account of, at least some of the principles of the social identity approach (Haslam, 2004). Social identity theory (SIT) purposely examines the methods by which collections of individuals interpret and behave towards their own group and other important groups (Tyler and Blader, 2001; Turner and Oakes, 1997; van Knippenberg and van Schie, 2000). Importantly, SIT not only recognises that dimensions of identity derive from self-enhancement strategies, but also from the groups that we belong to and the significance that we place on those groups. Indeed, the emphasis of SIT is on the processes through which groups chose to what extent they wish to share beliefs regarding their self-definitions, i.e. SIT is likely to aid our understating on how the relationship within the group and between the group and the organisation or management body will impact on resistance behaviour.

As such, the main aim of this article is to demonstrate that by using a social identity approach we can begin to explain how the processes within teams and between the team and the organisation lead to resistance behaviour. We draw on empirical evidence from a detailed ethnographic study of the restaurant in Hotelcorp – a branch of a large hotel chain, to illustrate and further explain the relationships between team identity and resistance. We start by looking at some of the existing work on resistance and specifically resistance within teams. Our following discussion concerns the social identity approach. However, the social identity approach is considerable (see Haslam, 2004 for a review) and only some dimensions are relevant to the current discussion. Following a summary of the social identity approach, we present our research methods and then examine the interplay between identity and resistance for the teams within our sample. We conclude this paper with a more detailed

evaluation of how this work contributes to existing theorising within the area and make suggestions for further study.

2 TEAMWORK AND EMPLOYEE RESISTANCE

Edwards and Scullion (1982) refer to resistance as overt action taken to express recognition of conflict. As such, resistance equates first and foremost with attempts to subvert management demands. The basis for understanding resistance, however, is far more contentious. Despite having some noteworthy strengths and many supporters at both management and governmental level; both a unitary and a pluralist approach are viewed as being inadequate analyses for the basis of industrial conflict (Edwards, 1986). Moreover, whilst the Marxist perspective emphasises the central importance of the division between those who own the means of production and those who merely have their labour to sell, many Marxist concepts have often proven to be somewhat blunt instruments for analysts seeking to understand the nature of employment relations within different work contexts (Blyton and Turnbull, 2004). Indeed, a further dilemma is put forward by Foucauldian writers (e.g. Jermier, Knights and Nord, 1994) who believe that the most prevalent way of analysing resistance - a reactive process where agents embedded in power relations actively oppose initiatives by other agents - is associated with an overly simplistic view of who resists and how and why they do so. This is despite the fact that actual accounts of resistance can rarely be found in such studies (Ackroyd and Thompson, 1999).

This work is not for the purpose of taking sides in the orthodox versus Foucauldian labour process debate – in particular, the rather adversarial debates over 'subjectivity' or 'self-identity'. In actuality, we are responding to an inherent problem in labour process theory outlined by Thompson (1989). That is the limited focus within existing work on the role of individual and social identity within the conceptual structure for explaining the labour process. Following Thompson (1989) and Thompson and McHugh (2002), we make the case for (and ultimately wish to demonstrate) the use of a critical psychology to inform our understandings of the labour process. Namely, how resistance is engendered as much by the indeterminate social identity of employees as it is by the subjectivity associated with dominating forms of work organisation.

However, for this particular analysis of team-related resistance, we correspond with the materialist approach advocated by Edwards (1986). This is because an analysis based on Edward's position, where an omnipresent 'structured antagonism' leads to the subjection of workers to the authority of management and the need to plan production with the needs of a capitalist market, is likely to be accepted in principle by people committed to the capitalist system, yet at the same time allow us to develop genuinely objective concepts of resistance.

Indeed, many of the first accounts of teams as a potential source of resistance centred very much on Edward's materialist approach and established that resistance could actually flourish in what many believed to be inhospitable circumstances. For example, McKinlay and Taylor (1996a and 1996b) gave detailed accounts of informal team-based peer review processes and how tacit trading of scoring team members were said to nullify its disciplinary content. There were also chronicles of other ways in which teams gradually withdrew from their disciplinary role, 'silent strikes', and, a three-week go-slow. Moreover, Palmer (1996) reported on young employees who turned out to be far less malleable than initially imagined to be by management. This was evidenced in poor attendance and high turnover that persisted despite threats of disciplinary action. As a result, management was forced into making formal and informal concessions to their lowest level and least skilled workers. However, not all reports of team activity pointed towards spirited expressions of conflict and unplanned management accommodation. For instance, Delbridge (1995) suggested that whilst worker resistance and 'misbehaviour' may persist in such circumstances, it would be in ways that are increasingly fragmentary and marginal. Similarly, Knights and McCabe (1998 and 2000) outlined arguably weak and typically individual forms of team-based resistance. These included call operatives 'mouthing words' as a means to have a rest and engaging in fiddles to avoid being disciplined.

Other research on team based resistance has focused on more detailed accounts of the process. For instance, Griffiths (1998) suggest that team-based resistance (mostly in the form of humour) can be attributed to leadership styles. More specifically, humour allowed team members to put pressure on the team leader to listen more carefully to their concerns. What is more, a series of articles lead by Kirkman (i.e. Kirkman and Shapiro, 1997; Kirkman, Jones and Shapiro, 2000; Kirkman and Shapiro, 2001) suggested 'cultural values' were a problematic reality when implementing teams as a new form of work organisation. In effect, enduring cultural values were said to seriously conflict with the main objectives of self-managed work teams - setting goals, self-monitoring, self-evaluation, self-reward and

self-punishment. It was also suggested that low levels of trust, low tolerance of change, or even a disdain for making sacrifices for others were key determinates in team-based resistance.

Recent work has started to move towards more detailed explanations of the micro-social processes that lead to resistance in teams, or at least points to why this level of analysis is necessary. For example, Vallas (2003) outlines why teams could be said to be a particularly suitable forum for resistance. Despite his admission that teamworking clearly heightened lateral tensions between team members, he argued that 'team systems' fostered new ways of resistance by providing workers with a rhetorical framework that enables them to negotiate boundaries of managerial authority. Teams are also said to enable workers to contest or recast managerial initiatives. Teams provide workers with organisational resources that can be used to claim discretionary powers that may have been previously been denied, the contradictions of control and reality of teams (essentially a re-engineered) authoritarian practices rekindled oppositional consciousness amongst workers, and, team systems essentially encourage collectivism in an environment where unions may fail to do so. However, Vallas point to a need for further research to disentangle the micro-social processes involved in team systems, yet other than the apparently paradoxical features of teamworking philosophies and teamworking realities, what are the more explicit or localised conditions that cause team members to bite the hand that feeds?

3 APPLYING A SOCIAL IDENTITY APPROACH

This section is essentially guided by what we view as being the most appropriate method or theoretical framework for unravelling the micro-social processes implicated in team level resistance. Whilst a labour process perspective (e.g. Bain and Taylor, 2000) provides a sophisticated socio-economic explanation of the structural causes of resistance, it fails to 'get to grips' with the actual phenomenon that occurs in terms of the interactions within a group that lead to and promote resistance behaviour. On the other hand, by adopting a traditional psychological approach to team resistance (e.g. Kirkman and Shapiro, 1997; Kirkman, Jones and Shapiro, 2000), the focus on the minutiae of variations in personality profiles, team size and diversity perversely ignores any impact of structure or broader context on the resistance process. In effect, we are rejecting what is commonly referred to as 'methodological individualism' (Jenkins, 1999) For these reasons, there needs to be a focus on the social psychological processes that not only explain the course of resistance within the team, but also what triggers the responses that lead to that resistance occurring.

Hence, it is proposed that by adopting a social identity approach (Tajfel, 1978; Haslam, 2004), it is possible to start to explain and refine understandings of the experience of team level resistance. Indeed, SIT has been described as being a concept that lies at the intersection of social psychology, sociology and political science, and is rapidly gaining prominence within all these fields (Sanchez-Mazas and Klein, 2003). Although SIT (e.g. Turner, 1978) was established as a distinct theory as opposed to a theoretical perspective or paradigm, it has been argued by Haslam (2001: 26) that SIT can 'lay the foundation for an alternative way of approaching' the study of behaviour within organisations, in that the psychology of the individual can not be separated from the psychological and social reality of the groups. Social identity therefore affords a mechanism for examining behaviour at both an individual and group level.

An examination of identity enables the understanding of how social interaction is bound up with individuals' social identities, i.e. their definition of themselves in terms of group memberships, as opposed to just studying individuals as individual (Haslam, 2001). Specifically, this perspective not only recognises how dimensions of the self and identity derive from individual self-enhancement strategies, but also from membership of groups and the relationship between these groups and other groups. The weight that social identity theory puts on the process by which team members acquire shared beliefs, assist in the understanding of why some groups will resist organisational control, whilst other groups subscribe to the company's ideology.

Importantly, we need to understand the interplay between social identity processes and organisational control mechanisms and how this leads to a collective notion of resistance within a team. Let us start with the knowledge that even when placed within a team, individuals do not always operate as a collective. This is accepted within the social identity approach in terms of opposite poles of social behaviour (Tajfel, 1974). At one extreme can be found interactions that are wholly determined by interpersonal relations and individual characteristics and not by the groups and categories to which they belong (Deschamps and Devos, 1998). At the opposite pole are interactions between groups of individuals that are entirely determined by their respective membership of different groups and are not affected by inter individual relations among the relevant persons (Tajfel and Turner, 1979).

These extremes of behaviour are in practice hypothetical, as membership of a social group or social category always plays some role in shaping interaction. Tajfel (1974) alleged that social identity processes start to be performed; the further behaviour is defined at the intergroup extreme of this continuum. Namely, individuals define themselves in terms of their group membership when the context in which they find themselves is defined along group-based lines. For instance, if two departments within an organisation merge, each employee is more likely to define themselves in terms of one department or the other rather than as an individual.

Consequently, Tajfel (1978) developed an important premise, that the more that behaviour becomes defined in intergroup terms, the more that members of the group would react in a similar way to members of the outgroup. A number of other writers have supported this premise, specifically that heightened group salience is associated with an increase in perceptions that of homogeneity of the group and heterogeneity of the outgroup (Haslam, Turner, Oakes, McGarty and Reynolds, 1998). David and Turner (1999) found the extreme ingroup members were more likely to influence more moderate group members in an intergroup situation as opposed to an intragroup situation. Similarly, Abrams, Marques, Brown and Henson (2000), suggested that intergroup context is an important mechanism for conveying that the ingroup is distinct from the outgroup. Other group members evaluate group members that deviate from the group norm more negatively. This premise concurs precisely with traditional psychological theory, that individuals are attracted to people who hold similar views and beliefs (Horowitz and Bordens, 1995). Moreover, recent research has found that teams where members perceive themselves as 'being similar', have highly salient social identities regardless of whether there is the perception of the existence of an outgroup or not (Marks, 2005).

However, from an organisational perspective, there is one factor missing from the ingroup/outgroup equation. There is an assumption from SIT that by making the ingroup/outgroup comparison that there is some congruity in terms of size and structure between the two groups (Haslam, 2004). That is the ingroup and outgroup are two departments within the same organisation or two teams working within the same plant. The reality however, could be very different. The organisation itself could be viewed as the outgroup and the team the ingroup. Moreover, if this is the case, there is evidence from some writers that a highly salient team social identity is not always the product of viewing the outgroup as fundamentally different to the ingroup, it may also be a product of viewing the outgroup as similar to the team or ingroup. Jenkins (2000) argues that if an external body, such as an organisation is viewed as being legitimate in the eyes of a group, that this implies some shared beliefs and understandings of authority. As such, there will be a strong identification with both the organisation and the team. That is, if the role of the team is seen as being legitimate and team members accept the structures of control within the organisation the team will have a highly salient identity as a team or members of a team. However, Jenkins (2000) also argues that if the definition as a team results from an imposition of power or that the form of control that the organisation has or uses is not seem as legitimate the members of the team (or in Jenkins' terms the categorised) will resist.

Yet, this resistance and striving for autonomy of self-identification may in itself lead to an internalisation of the notion of the team and paradoxically, in this case, we may also find a highly salient team social identity. This notion is compatible with the work of Bacon and Blyton (2005), who explore how workers respond to teamworking and look at employee attributions of management motives for teamworking. Bacon and Blyton classify employee views of management by four main types: economic, political, institutional and cultural. What this reveals is not so much directly related to resistance strategies, it relates to the idea that workers are very much attuned with management motives for teamworking. Crucially, the evidence from this research suggests that these workers were able to distinguish both unfavourable and beneficial aspects of new methods of organising work and at the same time scrutinise every motive management had in implementing them. As such they make informed decisions as to whether they accept teamwork both in terms of their day to day work activities and the control mechanisms associated with it.

However, as per the norm, the story is not that straightforward. It is important to understand why a highly salient team identity will embrace group members into resisting a team rather than exiting from a situation that they feel dissatisfied with. Tajfel (1975), believed that one of the fundamental components of the social identity perspective, are an individual's belief structures which also lie on a continuum from a philosophy of social mobility on the one hand to social change on the other. As long as membership of a group enhances one's self-esteem, one will remain a member of that group. But, Tajfel argues (1978), if the group fails to satisfy this requirement, the individual may try to change the structure of the group (social change); seek a new way of comparison which would favour his/her group, and hence, reinforce his/her social identity (social creativity); or leave/abandon the group with the desire to join the 'better' one (social mobility). For those with high social change beliefs, and hence high social identity salience, there is the belief that the only way to improve negative conditions lies in

group action. Within an organisation, this may relate to forms of collective action such as through trade union membership, which actively presses forward for the cause of the ingroup. Hence, strong identity salience is underpinned by a supposition that that is not possible to escape one's group for self-advancement (in part due to the benefits of team membership to individual's self-esteem). In this case we are likely to see collective examples of resistance as a means of improving unfavourable conditions. On the other hand, social mobility beliefs are likely to result in individual action as individual team members sense they are free to move between groups in order to improve or maintain their social standing. In short, we argue that in a situation where a team could be said to have a strong social identity, we are likely to witness social change beliefs as the key to explaining resistance strategies. In the absence of a strong social identity salience, it is doubtful whether resistance will take a collective form.

4 METHODS

Hotelrest was the subject of 12 weeks of intensive data collection. The methodologies used are essentially ethnographic by nature and supplemented by recognition of company documentation. Unobtrusive participant observation was considered to be the most appropriate method of investigating this form of organisational behaviour (Analoui, 1995; Analoui and Kakabadse, 1989). The data collection was undertaken by the lead author who accessed Hotelcorp by gaining paid employment and assuming the dual role of employee and research data collector.

This method of data collection has been undertaken by many other researchers (e.g. Roy, 1952; Bradney, 1957; Analoui and Kakabadse, 1989; Graham, 1995; Calvey, 2000) and helps overcomes the unwillingness of management to let academics research the phenomenon as well as the reluctance of employees to divulge information regarding the trend under investigation. Observations are efficient because it reveals behaviour that people usually prefer not to report and the researcher has greater opportunity to identify manifestations without attempts to conceal or distort them. Furthermore, longitudinal studies may reveal causal relationships. Other than documentary information in the form of corporate literature, the vast majority of data was collected in the form of daily journal entries based on observed activities, guided discussions and regular reflective accounts of emerging patterns in team activity. To demonstrate this point and commitment to the research method, the final diary of events at Hotelrest was comprised of over 30,000 words.

The daily journal entries and company data were then analysed for keywords and phrases and themes. Both authors coded data independently. They then conferred before determining final categories and codes. This is a form of content analysis, a technique social psychologists have traditionally used to deal with qualitative data (Holsti, 1968; Babbie, 2001). Although the generation of categories and themes implicit in content analysis may not be ideal for understanding some of the subtleties of the discourse in the interviews, for analysing diary data the method provides an effective portrayal of the broader culture and work structures in the organisation. Descriptions of the work process are based on the report and experience of the researcher, who only worked the day shift. Extracts from the diary are inserted when appropriate.

Unsurprisingly, the method chosen to research the reality of teamworking in the hospitality industry comes with a range of limitations and ethical issues. For instance, commenting on unobtrusive participation observation Analoui and Kakabadse (1989) believe such methods can be a 'long, laborious and often dangerous process, with the danger of "getting sacked", one's cover "being blown" or being made "redundant" ever present' (1989, p. 13). Beyond the practicalities, however, lies a range of procedural obstacles. Indeed, it is believed that the nature of being "hidden" increases the chances of the researcher becoming passive to what is going on around him or herself (Riecken, 1967) and being (hypothetically) less free than an overt observer decreases the chances of access to wider social interaction (Dean, Eichhorn and Dean, 1967). What is more, a further consideration is of knowing when to withdraw from the research site (Viditch, 1969).

Whilst it is necessary to point out that covert data collection is a surprisingly common and efficient research method (Reynolds, 1979), we cannot ignore the lack of informed consent that comes with unobtrusive methods (Bulmer, 1982). Indeed, as the *British Sociological Association* (2004) points out, covert methods should only be considered, 'where it is impossible to use other methods to obtain essential data' (2004, p. 5). We believe the nature of what is being researched – the reality of social interaction in a busy and highly conflictual environment combined with management unlikely to grant full access to an outsider in such situations – does not allow the use of open methods of collecting data. More importantly though, we also believe no other method is likely to allow the researcher to gain acceptance from both co-workers *and* management (Hodson and Sullivan, 1990).

5 HOTELREST AND HOTELCORP

Hotelrest is the catering facility of a Hotel which is part of the Hotelcorp chain. Hotelcorp describes itself as a 'global hotel' and employs over 10,000 people in the UK alone. Its most recent management initiative is the introduction of '[Service] Standards', or in Hotelcorp's own words: 'maintaining corporate standards through brand identity, brand position supported by behaviour, attitude, product consistency and performance'. Service Standards involve the regulation and routinisation of all dimensions of work which are clearly documented and disseminated to employees through formal documentation, team meetings and training sessions.

At the research site, Hotelcorp employs around 250 employees. The hotel's restaurant takes up to 230 'covers' a day. However, there are significant retention problems for the 60 employees that work in Hotelrest. The aggregate turnover at Hotelrest is over 50 per cent despite Hotelcorp's strategy of compulsory training and development programme focusing on 'Job-related Skills' (anonymised and JRS for short). The JRS programme has a strong emphasis on teamwork. Completing JRS training can, supposedly, be up-dated to a nationally recognised vocational qualification (NVQ level II for waiting staff and level III for supervisory staff). Moreover, completion of training entitles each employee to what Hotelcorp promotes as being a lucrative hotel-related package of benefits. This includes greatly reduced admission to the adjacent health club and highly discounted room rates throughout Hotelcorp's chain of hotels. However, JRS was not viewed as particularly effective at either engendering loyalty or retaining employees. One full time member of the waiting staff, James, explained how it had taken nearly a year to complete the JRS training and nearly two years later he was still awaiting his health club membership. Some members of staff had been with the company over a month and had, to date, received no JRS training. At team meetings employees frequently complained about waiting for their card entitling them to the benefits package. Although one employee, when commenting on the discounted room rates noted, 'you get the smallest and smelliest room that they probably couldn't sell anyway.'

Hotelrest serving staff work in groups of approximately 10 employees. The composition of the shift varies day to day dependant on scheduling. Each shift team is frequently augmented with agency workers. As well as the serving staff there are about 10 individuals working in the kitchen as chefs and kitchen porters. The hotel classifies both serving and kitchen staff as members of the Hotelrest team, however there is a clear separation between the waiting and kitchen staff. Importantly, as the fieldwork was carried out in the restaurant rather than the kitchen this is the main focus of the research.

The Hotelrest serving staff are an even mixture of waiters and waitresses, the rest are supervisors, 'hosts' or team leaders (six), two assistant managers, and one restaurant manager. All supervisory staff and assistant managers have been promoted from within; quite rapidly in some cases. However, the restaurant manager was recruited from outwith the company. There is also a dedicated trainer who works approximately 25-30 hours per week. Pay for waiting is low with those aged 22 and over receiving an hourly rate on a par with the national minimum wage (NMW). Waiters and waitresses aged 21 years or below (the majority of the waiting group) earn less than their older counterparts, but higher than the NMW for this category. Supervisors earn about ten per cent over the NMW.

6 HOTELREST AND TEAMWORKING

Hotelcorp presents the face of an organisation with a generous commitment to teamwork. This commitment is most acute for those who are front-line staff in the restaurant. For instance, potential Hotelrest employees are subjected to a mock team-based selling exercise during the selection procedure. During the day-long induction, new recruits are provided with an induction handbook with significant reference to the principles of teamworking. The most explicit representation to the devotion to teamworking is the compulsory and lengthy monthly team meeting. Furthermore, the upholding of Service Standards included in JRS training are based on teamworking and team communication processes, a typical eight-hour shift involves a minimum of three team briefings - immediately before serving starts, after serving ends and before re-organising restaurant for next setting, and prior to start of second period of service. As a final point, indiscipline is often confronted with team-based chastisements such as widely broadcast humiliations, e.g. team leaders regularly admonish front-line employees for neglecting their team-based loyalties and responsibilities. The lengths that Hotelrest go to in attempting to infuse a teamworking attitude amongst waiters and waitresses are epitomised during the monthly team meeting. The first team meeting during the research period lasted for just over three hours and included a presentation on teamworking as means of increasing sales.

Superficially at least, Hotelcorp looked as if its policy on the promotion of team based work was functioning effectively. When the hotel was closed or during quiet periods, and when the number of

waiting staff exceeded the requirement of the number of guests dining, employees appeared to co-operate with one another and with team leaders. During these periods, this co-operation was interjected by relatively open, yet playful acts of what Ackroyd and Thompson (1999) call misbehaviour or irresponsible autonomy. These acts included waiting staff engaging in a variety of horseplay, flirting rituals and playful humour. Nevertheless, this did not tend to be at the expense of the achievement of allocated work to an acceptable standard.

Yet, the reality of teamwork for most employees was inconsistent with the rhetoric presented by the organisation. Teamwork was only really implemented as a managerial ideology aimed at tightly controlling and determining a wide range of employee behaviour and activity. Despite a clear rationale by management for teamwork - as a mechanism to implement good customer service in the guise of Service Standards - the Taylorised nature of Service Standards made the performance of any teamwork behaviour, especially under stressful conditions, impracticable. Whilst the catering group were defined as a team for the undertaking of work, there was no joint nature to the technical division of work and no collective responsibility or indeed flexibility in terms of work organisation. This is demonstrated clearly in the following sections.

7 TEAMS, COLLECTIVE AND INDIVIDUAL RESISTANCE STRATEGIES

As with the current work, other research on teams in the service sector found tight control, high commitment management and low value incentives (e.g. Kinnie, Hutchinson and Purcell, 2000). We also found teamwork to be unworkable due to the size and nature of supervision of the team. Teams were so poorly defined that this form of work organisation ultimately caused great conflict between groups of employees rather than harmony. The size and structure of the teams fashioned a situation which was entirely in opposition to the unitarist ideology espoused by the firm. Even the weak or diluted form of teamwork identified by other researchers failed to materialise (e.g. Batt, 1999; van den Broek, Callaghan, Thompson, 2004). There was no indication of collective learning or problem solving (apart from the odd example of employee resistance) and the only true function of teamwork appeared to be as a structure of control over employees and Service Standards.

Any authority with the objectives of teamwork was really only apparent in times of calm when employees had a high degree of control over their work. Consent broke down under a number of specific circumstances; work intensification, mobilisation of friendship groups and endorsement of individualised strategies of resistance by management.

The diary entries detailed below demonstrate the emergence of chaos and the collapse of teamworking initiatives and other formal working policies and practices, when work conditions suddenly intensify.

> The shift itself was a bit of a disaster, i.e. from the views of the customer and the employees. For example, the use of Service Standards broke down with tables used and not re-set, remains of meals were left on tables, long queues developed, and few if any guests got their orders on time. The team suddenly appeared to lack a will to co-operate and waiters and waitresses just looked after their own immediate concerns. This was despite the close presence of two assistant managers who were themselves put under enormous strain at this particular time of the working day. It was also apparent that Hotelcorp-employed waiters made even less effort to help the agency staff brought into deal with staff shortages (Field notes, 18 September).

> Today was a living nightmare. We were stretched well beyond our limits with over 370 guests for breakfast in a restaurant that has a capacity of 230, and therefore requires around 140 resets. The support I had at the beginning of the shift soon dissipated as the queue lengthened by the minute and the disquiet amongst the queuing customers increased (Field notes, 14 October).

With no holds barred, consent and compliance with team-based values and Service Standards collapsed the moment the pace of work intensified. An increase in pace triggered a widespread inability to cope with the pressures of carrying work out in a strict and arguably unsustainable style, which occurred on an almost daily basis, but always at the weekend when customer levels were nearly always close to or at hotel capacity. It also transpired when staffing levels dropped due to unauthorised absence and high turnover of labour. When consent broke down the behaviour that ensued varied quite dramatically. Some waiters and waitresses worked on regardless and did whatever they could to satisfy the typically understanding and tolerant customers, whilst an equal number of waiters and waitresses avoided work to some degree as a result of these pressures. Importantly, under times of work pressure,

friendship groups began to mobilise and perform collective forms of resistance. For outgroup members – those not included in friendship cliques - there was an almost automatic default to individualistic forms of resistance strategies.

Field notes suggested that many individual acts of resistance were, in fact, undertaken with the tacit support of the team (these included pilfering of food, unsolicited smoking breaks, stretching the time for room service request, disposal or deliberate damage of company materials such as crockery or cutlery, and unauthorised absenteeism). In contrast, far more overt examples of collective resistance included waiters and waitresses making their fellow team members aware that they suspect a mystery guest had arrived on the premises. Waiters and waitresses increasingly shunned agency staff sent to 'help' them, and there was evidence of an organised slow down once customers left the restaurant or the next shift was imminent. Further examples of this order included a broad-based boycott of the new incentive scheme introduced at the beginning of the research, and waiting staff stopping work at their official finishing time even when offered discretionary incentives, the chance to be praised at the next team briefing or even team meeting or threatened with disciplinary action.

Informal teams or friendship groups - sub-sections of a larger team – were largely often difficult for management to identify, although the use of teamworking was certainly applied as a measure to divide these informal loyalties. Mostly as a result of the ignorance of informal activity *and* potent commercial and operational pressures, management could only make superficial attempts to unmake these collectives. In the example below, management made an explicit attempt to counteract the 'subversive' potential of friendship groups.

> Michelle [assistant manager] was setting up for the event. She had used the £40 or so tips from the last coach trippers to pay for large amounts of sweets, crisps, soft drinks, and some wine, etc. The meeting was in the McDonald suite and was set out with tables around the outside. The refreshments were in a small room to the side. From a quick head count there were about 25 waiters and six supervisors or management staff. As people came in, whether they were on duty or not, they sat with their friends. The supervisory staff sat on a table at the front of the room and looked like a panel. Dismayed that the room had been split up into cliques, Peter [one of the restaurant's 'hosts'] re-organised the waiters and waitresses in a random fashion in preparation for team activities (Field notes, 16 September).

On the other hand, many of the explicitly individualised examples of resistance were undertaken by established members of the organisation and were at least tacitly endorsed by management. For example, long tenure waiters or waitresses were allowed to 'opt out' of specific team roles or obligations, such as specialising in one favourable aspect of restaurant work when form rules disallowed this. There was also open collusion or authorisation over activities that clearly breached Service Standards.

8 CONTRADICTIONS IN PRACTICE

We would argue that the discussion above, in part, demonstrates cynicism towards the principles of teamwork. Although Hotelrest placed a strong emphasis on the team and the notion of teamwork, the nature of the work (highly individualised) and the nature of the teams (composed of core and peripheral members) contradict the principles of teamwork and this was picked up by team members, not only in terms of behaviour, but in the way that they reacted to the formal team briefing and team training sessions. Examples of this are provided in the two diary extracts below:

> After the final presentation and the room began to quiet down Jeanette [trainer] asked the team as a whole what they thought the task was *really* about. No one responded to this. However, Jeanette ignored the silence and went on talk about how it was a 'way of expressing yourself…exchanging ideas…working together…to give you more confidence…so you can pull together as a team'. She also asked the question 'do you think you could have done the task on your own?' In reply, a few tamely said no. Jeanette finished on the words 'we can't do it on our own', which is a phrase that I had already become increasingly familiar with (Field notes, 16 September).

> The feedback session was by far the most interesting section and lasted for approximately one hour and forty minutes. I have no doubt it would have gone on much longer as after 100 minutes we had only heard from about a third of the group as other waiters and waitresses kept interjecting and upsetting the round-the-table process. Of particular note was how the session started with most staff remaining silent or failing to say much if they were asked their opinion. However, when Susan [waitress on a working

> holiday from Australia] began to speak out the tone of the event quickly changed. Specifically, most waiters and waitresses had clearly felt restrained until that point. Furthermore, her comments not only provoked others into action, the issues then on became increasingly critical of and specific to management (Field notes, 16 September).

It would seem that despite a high profile commitment to incorporating teamworking into the Hotelcorp's business and human resource strategy, the management at Hotelrest clearly has problems convincing the majority of restaurant employees of its merits. This was certainly the case when management arranged the opportunity for team-based feedback, i.e. the situation quickly turned from being a team bonding exercise into a forum for a range of responses that included passive silence and participation to a barrage of criticism.

However, this contradiction was unbearable for many and compelled many employees to leave Hotelcorp, in terms of the practice of what Thompson (2003) labels the externalisation of resistance. In other words, the high turnover of team members appears to be in part a result of the length that team members are prepared to tolerate both work intensification and incongruity in practice and policy. Whilst long term team members were less inclined to undertake informal resistance behaviour and sought solitude in favourable terms and conditions afforded by management, the behaviour was different for lower tenure employees. In the absence of robust forms of collectivism either in terms of the formal team or trade union representation, Hotelrest was typified by 'micro-collectivism' or cliques that were capable of transcending formal group boundaries and formal group hierarchies.

Teare, Ingram, Scheuing and Armistead (1997) noted that teams in the hospitality industry are characterised by inter-group conflict. This was confirmed by the findings of the current study. Not only were there tensions between young and old (the older members of staff thought that the younger employees were lazy), but also between the kitchen and the restaurant staff. On the 7th September the diary entry noted how there was a break time discussion about inter-group rivalry. One member of the waiting staff said 'chefs don't like us but we don't like them either'. This is a theme that was common in the field notes. Tensions arose when kitchen staff thought that waiting staff were not clearing up after themselves and therefore creating more work for the kitchen.

This division was re-enforced by kitchen staff not being invited to team meetings. Indeed, team meetings provided an arena for many other tensions in the group to be played out. This is illustrated in a diary entry dated 2nd of October:

> It is becoming obvious that the ideas of teamwork in the restaurant do not bring cohesion between waiters and supervisors/managers. What's more, it is clear and fair to say that the 'team' is in fact at least two groups (if not more), with teamworking limited to manageable tasks performed under ideal circumstances that are not typical to restaurant work. Where such occupational groups come together as a team appears to be on the basis of resisting higher-level commands and not concerning what the team *should* be doing (Fieldnotes, 2 October).

The disloyalty to the team, however, is not surprising as during the three months of research in the restaurant there was only one explicit attempt at a teambuilding exercise and even this was focused on customer relations and sales. Employees were placed into groups in a team meeting and asked to sell a number of items to other members of the meeting – these items included a high chair, a soup bowl, a toast rack, tomato juice and salt and pepper sachets. No one in the room appeared to take the exercise seriously apart from management.

Yet, despite very modest training activities and supervisors being on hand to reinforce team ideals, employees complained bitterly in the wider work setting that they never received help from other team members and one noted that 'it's not my problem' or 'I've not been told to do that' were phrases that were commonly heard on the shopfloor. Indeed, further conflicts between employees were mentioned in the diary on a daily basis. On the 2nd of October, one employee threatened to 'kick the butt' of another team member over the issue of re-using dirty dishes and cutlery. The more experienced of the two then started to quote teamworking propaganda to his colleague. His tirade was based on the ideas presented in the JRS handbook – focusing on the notion of 'letting other team members down' when an employee does not pull their weight. Despite being indoctrinated with teamwork principles and ideals, normative values of being a team player and cultural on cohesion were rarely put into practice. On the 17th October, one employee even stated, 'teamworking is really every man for himself'.

In a wider sense, it was not only teamworking that made employees cynical. For instance, most employees appeared unhappy with their work, as shown in this diary entry from 23rd September.

> I spoke to a woman who started at the same time as I did. She came out of her way to say hello and asked me what I though of the job so far. I asked her and she said 'I'd rather be stacking shelves in Tesco' (Field notes, 23 September).

Comments such as this were common. However, there were a few employees who appeared a little happier with the work. This was often based on the advantage of the benefits package to them. A couple of female employees liked to travel round the country so made good use of the reduced rate hotel rooms. Another employee (28th October) spent a great deal of time explaining how pleased she was with her reward club membership. Although one of her colleagues stated, 'I see you are now a fully paid up member of the brainwashed club'.

9 A RE-EVALUATION OF TEAM RESISTANCE USING A SOCIAL IDENTITY APPROACH

Taking a very superficial analysis of events, it would appear that our findings concur with the basic premise of SIT, that by merely placing individuals within a collective that they will identify with the group (Tajfel, 1974; Tajfel, 1979). The waiting staff, in times of quiet, demonstrated communality in their work and compliance to the guiding principles of teamwork as presented by the organisation. However, when work intensified, in the terms of the labour process debate, this compliance, or in the terms of SIT, this identification with the team, dissipated, and led to a clear division in terms of both collective and resistance behaviour. This follows Jenkins' (2000) argument that suggests that if power and control mechanisms are not seen as legitimate, this may facilitate identity work. That is an individual response to pressure, which involves coping strategies that tend to be instrumentally derived tactics and accommodation to the dominant culture as well as different types of resistance (Thompson and McHugh, 2002). Instead of necessarily being controlled by the organisation, individuals are viewed as managing in the best fashion that they can, in the given circumstances and the 'form of response being determined in subjective terms by available scripts and what appears to work' (Thompson and McHugh, 2002: 346).

In this case, it was frequently at the point where work built up to potentially unmanageable levels that we started to observe the interplay in terms of behaviour between resistance and identity strategies. What is more, employees quickly sensed what was required was unreasonable, lacked legitimacy and went on to engage in behaviour to manage this situation. A social identity approach would suggest that the group as a whole would engage in behaviour to either resist or cope with the pressure. However, in the case of Hotelrest, behaviour was not that straightforward. Instead of employees' behaving in terms of the organisationally imposed idea of the team, any collective behaviour focused on illicit inter-occupational coalitions, friendship groups and cliques. Members of the team that were not part of the friendship group either failed to engage in any resistance behaviour and continued with their work or used highly individualised methods of coping. Except to continue working in an individualistic fashion made the team less efficient and likely to make committed team members cynical of teamworking. The friendship groups, in a classical correspondence with theories of group attractiveness and SIT (e.g. Horowitz and Bordens, 1995; Tajfel and Turner, 1979) resisted collectively.

Yet, contrary to the work of David and Tumer (1999), who suggest that core group members define the behaviour of the entire group, these friendship groups or extreme ingroup members did not affect the behaviour of other group members. Hence, not only was there an ingroup-outgroup separation between managers and ingroup members on formal functional duties, there was a separation within the group between the cliques or friendship groups who resisted collectively and the other team members who resisted individually. Perceptions of homogeneity or attraction caused an identity affect but not throughout teams as a whole.

These group members or cliques who had a highly salient group identity when dissatisfied with the existing situation undertook resistance or misbehaviour as a group. Being a member of a subgroup or an alternative team-nurtured group served a valuable purpose in terms of self-esteem and getting work done. As such, having multiple group memberships allows in one sense alternative paths to being capable of coping with work and retaining a sense of dignity, but in another, highlights the crucial trigger for employees who in this instance are constantly faced with being members of an inferior and substandard group – that is, the team. Whereas the other members of the team, took what Tajfel (1978) would classify as a combination of a social creativity and social mobility response, that is appear to abandon the group (possibly the organisation as well) but also adapt the existing situation to a point which favours the individual. It is believed that the adopted research approach allowed such acute nuances to be observed and relayed to non-organisational members.

Although on the face of it this case demonstrates that the imposition of teamworking can lead to team-based forms of resistance, this is a highly simplified picture. As we have demonstrated there are some serious limitations or generalisations from the social identity approach, in the assumption that by labelling people as a group that they will behave collectively. However, one compensatory factor has been to promote and *not* neglect the deep-seated significance of asymmetrical employment relations in forming the basis of formal and informal group activity. Moreover, this study provides further insight into a recent trend of introducing teamworking initiatives to organisations where work at an even superficial level, is in reality highly individualised.

We moved beyond an analysis that focuses on the inappropriateness of the label and the transposition of teamwork to individualised work (e.g. van den Broek, Callaghan and Thompson, 2004). We have focused on the impact that this label the label of 'team' has had on the groups with Hotelrest. We believe that, in part, the organisation created a situation that has presented little benefit in terms of motivation or productivity but may have led to team based resistance for subgroups or cliques. For these subgroups, teamworking nurtures tacit counter collectivism, despite the fact that employees themselves were also fully aware of the contradictions that they were faced within in terms of the forced commitment to teamworking without the real opportunity to practice as a team. This conflict between ideology and practice and the reaction to it by employees was expressed most clearly within the forum of the monthly team meeting.

It could be argued that the scenarios of team based resistance within manufacturing settings which have a clearer infrastructure for collective behaviour would provide more simplified and lucid accounts of the relationship between the identity process and group level resistance (e.g. McKinlay and Taylor, 1996a and 1996b; Ezzamel and Willmott, 1998). However, the benefits of the teamwork paradox observed in this study, are that they allow for a more complex understanding of why teams fail to function as planned and why identity and resistance behaviour may grow or persist on such introductions. Moreover, further benefits of this particular case study (and methods) are that they allowed observation of behaviour that may not manifest so obviously or quickly elsewhere - that is, if the intolerable conditions at Hotelrest were apparent in a highly unionised context we may expect to see serious formal industrial action, on a regular basis, and the same time less informal resistance or group behaviour.

We suggest that this work needs to be interpreted in the context in which the data was collected. Hence, it is essential to account for, if only briefly, the strengths and weaknesses of the current study. Importantly, the work reported in this study is a single organisational case study, and as such the generalisability to other organisations maybe limited. Furthermore, one researcher using a single method collected the majority of the data. Although the method was highly rigorous and detailed there is still the potential for bias. Nevertheless, there were many interesting dynamics that have emerged from this analysis and support the propositions made earlier in the paper. This work develops existing studies and theorising regarding both SIT and resistance.

Further research is required to incorporate a greater variety of team structures, team sizes, and management approach to teams. Moreover, future research into team-related resistance must cater for unionisation, professional or occupational affiliation, or any other salient identities that are prone to manifestation in the context of the workplace. It should be acknowledged at this point, that most research on workplace identity looks at employees where occupation forms a core element of an individual's identity (e.g. Marks and Lockyer's 2005 study on software developers). It is unlikely that waiting staff embrace their occupation as a strong element of their identity, which is why friendship groups were of such importance and resistance strategies so overt. If the occupation in itself, rather than the social group in the workplace, had had a greater impact on identity we may have seen less resistance behaviour. Similarly, although we can look at tensions between formal requirements and the informal group, any examination of multiple workplace identities (e.g. the organisation and the profession) are problematic due to the weak ties with work based entities. Finally, additional work using a wider array and combinations of research methods is likely to shed further light on such strategies.

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Book Review:

Innovation Management and New Product Development

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BOOK REVIEW

This book, written by Paul Trott, an experienced author in the area of innovation management and a Principal Lecturer at the University of Portsmouth Business School, is aimed at both business and technology students and has a mission to explain innovation and product development as a management process encompassing the whole firm, rather than a functional activity reserved for one department. The key to innovation management is clearly identified in the introductory chapters and throughout the text as the interaction and flow of knowledge between functions internal to the firm (including research and manufacturing, marketing and business planning) and the external environment.

The third edition of this book is significantly restructured into three parts covering innovation management, managing technology and knowledge, and new product development. The purpose of each part is clearly explained in a brief introductory summary which also outlines the content of the chapters within the particular part. Each chapter commences with a clear summary, contents and learning objectives and concludes with a chapter summary, discussion questions, annotated details of websites worth visiting, detailed references and recommended further reading.

In the first part of this third edition Trott introduces the conceptual framework which emphasizes innovation as a management process involving all the internal functions of the firm influenced by external inputs. He then goes on to explore the role of the state in the innovation process, before devoting three chapters to the study of innovation management within the firm, covering the way in which the organisational structure of the firm affects the innovation process, innovation in operations management and the way in which intellectual property matters affect innovation management and new product development.

Part two focuses on the management of technology and knowledge and the key question of how to turn technology into profit. This part includes chapters on strategic alliances and the risks and issues that arise with them, the role and management of research and development, the difficulties of research and development project selection and evaluation, and a final chapter examining the role of knowledge transfer and the issues it raises.

Part three represents a distinctive and especially valuable aspect of the book. In the five chapters of this part, Trott explores the importance of brand strategy in relation to product development, reviews the new product development literature and examines models of new product development, introduces a new chapter on the role of packaging in the new product development process, highlights the ongoing debates about the use of market research in new product development and concludes by examining the functioning of the new product development team.

Innovation Management and New Product Development is written in a very readable style with many 'real-life' examples to illustrate the concepts introduced. New up to date case studies, examples and illustrations are included in the third edition and this edition has many touches which makes the text even more accessible and user-friendly. A two-colour design makes the structure of the book clearer and 'pause for thought' questions are introduced as a pedagogic device to encourage students to reflect on what they have read. The book is supplemented by substantial internet-based resources for both lecturers and students.

This book successfully conveys the message that innovation is a complicated, challenging management process, requiring insights into technology, development, changing markets and organisational structures. It highlights many practical issues facing firms in their management of the innovation process and emphasises the topical relevance of many of the matters discussed by illustrating them with extracts from the *Financial Times*. When this book was first published in 1998, Baroness Hogg, in her foreword, noted that the previous year the House of Lords Select Committee on Science and Technology had held an inquiry into the barriers to the exploitation of scientific ideas and had recommended that business schools should have a greater role in teaching the management of innovation. This book is very much written from a business management perspective and, while there is an ever increasing range of innovation textbooks, I would recommend this book for both undergraduates and postgraduates with an interest in the *management* of innovation. It should act as both a lively textbook during their studies and a useful resource should they be involved in the management of innovation during their career.