

EXPLAINING SUCCESSFUL INFORMATION MANAGEMENT IN SMALL BUSINESS

DBA THESIS



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ABSTRACT

This thesis documents the research completed by Richard Parker during 2005 to 2007 inclusive as the final part of the Doctorate in Business Administration (DBA) from Durham Business School.

The research aims to explain successful information management in small business. It does this using critical realist theory, inductive, grounded methodology with cross-case comparison and qualitative comparative analysis (QCA) methods. The aim is to identify the complex causal conjunctions that result in successful and unsuccessful information management instances.

Research activity consisted of five phases: a pilot study, three rounds of theory development and refinement using interviews and analysis then a final testing phase. Research was iterative and recursive and a number of changes were made to the original research design including the re-definition of the case and re-interviews to better assess set membership. Both single-level deterministic MVQCA and two-level probabilistic FS/QCA methods were used to try to understand the complexity involved but best results were obtained using simple tabular and graphical techniques to identify combinations of necessary and sufficient conditions. The outcome was a simple but not simplistic model which was used to effectively describe the findings for all successful and unsuccessful information management cases.

The research concludes that QCA is a useful tool when used on remote macrosocial data but limited in its ability to explain the rich narrative case study evidence that was uncovered in this study. It suggests that previous applications have focused on structure not agency and the QCA community may be guilty of upward conflation. Retroduction techniques and the ideas of morphogenesis were then briefly employed on empirical research findings to suggest some of the structures, mechanisms and tendencies operating in the actual and real domains. Other findings included the dismantling of determinist IT theories and rational goal-seeking in small business.

A critical review of the research regrets that the deterministic / probabilistic dichotomy in QCA methods was not fully resolved and that ontological issues receive inadequate attention in this field of study. Future research proposals include a single case study analysis using in-depth critical realist retroduction ideas.

Richard Parker, March 2008

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1 RESEARCH PROBLEM

1.1 CHAPTER SUMMARY

A healthy small business sector is vital to the UK economy, and as this economy becomes increasingly knowledge-based, the effective management of information by small businesses is of similar importance. Unfortunately, previous research (and the long experience of this researcher) suggests that information management in all its guises within most small businesses is poor. Furthermore, the sheer diversity of the small business sector makes it difficult to explain why some information management projects (instances) are successful and others unsuccessful. This purposes of this research is to examine and hopefully explain successful and unsuccessful instances of information management in small business (contribution to knowledge) so that any lessons may be shared to the benefit of others (contribution to practice).

It is not hard in current times to justify research based on small business – or enterprise and entrepreneurship as it is more commonly known. Small business forms a vital part of the UK economy and as this economy becomes increasingly service-based one of the key determinants of their ability to compete is their effective use of information. Unfortunately previous research suggests that attempts to manage information in all its forms have enjoyed only limited success. The reasons for this remain largely unclear. Information management in small business is a relatively new field and previous research in this area has been mixed. At one end, large quantitative analyses attempt to provide broad-brush pictures of generalities which simply describe situations rather than explain them. At the other end small case based papers attempt to understand what is going on but with limited ability to generalise to other situations. *This research aims to help bridge this gap to provide both analytical depth and limited generalization by identifying 'what works for whom in which circumstances'.*¹

The chapter starts by proposing a grounded definition in answer to the key question of 'what is a small business?' before looking at some more important features of the sector in the United Kingdom (UK) at present. This section ends with a discussion of the problems facing the sector (1,000 UK small businesses fail every day) and positioning this research as a means to improve matters as befits a DBA thesis with a requirement to contribute to practice.

The next section provides a brief review of the fields of information technology, information systems and assorted variants using the dualism of 'hard' and 'soft' schools, before choosing Boaden and Locket's 'information management' as the preferred term to avoid undue deference

¹ Chapter summaries exclude references to avoid duplication but I feel obliged to acknowledge this brilliantly succinct statement of realist intent as provided by Ray Pawson and Nick Tilley (1997).

to either technical or behavioural camps. It goes on to review some of the more recent work in the field of information management in small business and identifies theories and methods of particular interest.

The thorny problem of defining and evaluating 'success' is then addressed. There are two quite separate fields here which Cronholm and Gholdkuhl usefully describe as 'IT as such' and 'IT in use'. 'IT as such' refers to technical success and there is an extensive body of work on formal technical evaluation based typically around return on investment analyses. 'IT in use' belatedly reflects the involvement of users ² and the behavioural aspects of information management. The thesis aims to contribute to business not to technology so the latter focus is decisively chosen.

Unfortunately much of the current literature on 'IT in use' uses prescriptive textbook definitions of success based upon early theories of the firm such as profit or sales maximisation as the dependent variable. The liberal application of such goals in a small business community dominated by frequently irrational sole traders and owner managers is questioned by both the literature and the experience of this researcher. Behavioural theories based in bounded rationality and satisficing objectives are therefore adopted as opposed to maximising or optimising ones. The section concludes by arguing strongly that a definition of success taken 'through the lens' of the small businesses themselves is not only fair and valid but superior to one foisted upon the business by the researcher, the literature or even worse the DTI Small Business Service.

The chapter concludes with a brief introduction to critical realism and how – very simply – its exposition of an objective ontology and subjective epistemology might help bridge many of the dualisms encountered during this research. The application of critical realist ideas to the fields of information management and small business is novel which means that the literature is limited and somewhat immature. It is reviewed neither the less and provides some useful insights into the research design chapter which follows.

² *An annoying inconvenience to most IT professionals.*

1.2 SMALL BUSINESS

1.2.1 Defining Small Business in Theory and in Practice

It is probably a good place to start by agreeing what is meant by a small business in the context of this research. In theory, the definition of a small business is straightforward. For statistical purposes, The Department of Trade and Industry uses the following definitions:

Table 1 DTI definitions of firm size

Definition	Size
Micro Firm	Less than 10 people
Small Firm	10 to 49 employees
Medium Firm	50 to 249 employees
Large Firm	Over 250 employees

(Source Small Business Service 2003)

The European Commission defines firm size on a similar basis, but with additional turnover, balance sheet and joint ownership criteria. In practice however, 'there is no single, uniformly acceptable, definition of a small firm' (Storey 1994, p.8).

The problems associated with defining a small business first achieved prominence in the ubiquitous Bolton Report (1971). There had been previous small business research (see Acton Society Trust, (1953) or Revans (1956)) but it was the Bolton Committee that undoubtedly raised the profile of the small business and small business research (Curran and Blackburn 2001).

When examined at a sectoral level, definitions which relate to quantitative measures such as number of employees, turnover, net worth, etc. fail. For example a 'small' car manufacturer is very different from a 'small' hairdressing salon. The Bolton Committee attempted to overcome this problem by formulating what they called an 'economic' definition and a 'statistical' definition.

The *economic definition* regarded firms as being small if they a) had a relatively small share of the market, b) were managed by owners or part-owners without a formalised management structure and c) were independent i.e. not part of a larger enterprise. Bolton then applied a *statistical definition* that addressed a) the size of the sector and its contribution to the economy, b) the change of this contribution over time and c) the contribution of UK small firms compared to other countries. The result was the range of definitions of a small firm shown in Table 2.

Table 2 Bolton Committee definitions of a small firm

Sector	Definition
Manufacturing	200 employees or less
Construction, Mining & Quarrying	25 employees or less
Retailing, Miscellaneous & Services	Turnover of £50,000 or less
Motor Trades	Turnover of £100,000 or less
Wholesale Trades	Turnover of £200,000 or less
Road Transport	Five vehicles or less
Catering	All excluding multiples & brewery- managed

(Source Bolton 1971)

Although appearing to address the sectoral problem, the Bolton definitions have received a number of criticisms. For example, the 'economic' requirement of an absence of a formal management structure is incompatible with the 'statistical' requirement of fewer than 200 employees. Commonsense and research both suggest that managerial appointments are made in organizations of much smaller size - Atkinson and Meager (1994) suggest 10 to 25 employees. Bolton also draws on economic theory of perfect competition to emphasise the inability of small firms to influence their environment. Research also suggests that by occupying niches, small firms can maintain higher prices and higher profits than the industry norm (Bradburd and Ross 1989).

An alternative economic definition is provided by Wynarczyk et al (1993) who, instead of trying to define small firms per se, try to define them by comparing them to large firms. They argue that there are three central respects in which small and large firms differ. The first is uncertainty, and Wynarczyk argues that small firms operate in conditions of far greater uncertainty due to them being price-takers, having a limited customer and product base and the much greater diversity of objectives of small firms. The second area of difference is innovation, and again the role of small firms exploiting niches was stressed. The third area is the much greater likelihood of evolution and change in the smaller firm.

A more practical approach was taken by Curran, Blackburn and Woods (1995) when researching small enterprises in the service sector. They argue that the heterogeneous nature of small businesses means that a single definition such as size is inappropriate, and that 'smallness' is a multi-dimensional concept linked with legal independence, type of activity, organization and economic activities. Their operational approach is to select firms based on a 'grounded' definition. Consultation takes place with the owner-managers, trade associations, industry representatives, etc. and a consensus emerges as to what this group envisages a small enterprise as being in their particular sector. A selection of their grounded definitions is shown in Table 3.

Table 3 Some 'grounded' definitions of small firms in the services sector

Type	No. of outlets	Employment (FTEs)	Min Employment (FTEs)	Special Conditions
Wine Bar	One	10	1	Premises owned or rented
Vehicle repair & servicing	Not specified	10	1	Car franchises excluded
Advertising	One	25	1	Must not be in top 50 agencies
Computer Services	Not specified	20	1	-
Plant and equipment hire	Not Specified	10	1	-

(Source Curran, Blackburn and Woods 1991)

This research project will therefore be based upon a grounded definition based on 'information management intensity' where a professional practice of ten employees will be just as reliant upon IT as a retail company employing one hundred. More specifically, this means a server-based infrastructure with between 10 and 50 users (see table 4). For this reason, micro businesses (i.e. those employing less than 10 employees) are excluded from the research as their information management needs are less and they are therefore less likely to provide valid examples of successful information management interventions. Other possible factors such as sector, family ownership, turnover, outlets and number of employees were all confirmed to be irrelevant to successful outcomes for the organisations studied.

Table 4 Profiles of the organisations ultimately used in this research

Name	Sector	Family Owned?	Turnover	Employees	Outlets	Users
Ins Broker	Service	Yes	£1m-£5m	10	1	10
Engineering B	Manufacturing	No	£1m-£5m	55	1	27
Hotel	Service	Yes	>£5m	120	3	21
Surveyor	Service	No	£1m-£5m	36	3	32
Retail	Service	Yes	>£5m	170	8	20
Charity	Charity	No	£1m-£5m	120	3	30
Engineering A	Manufacturing	No	£1m-£5m	45	1	13
Finance	Service	No	>£5m	55	1	48
Show B	Service	No	£1m-£5m	16	1	15
Manufacturing	Manufacturing	No	£1m-£5m	96	1	40
Show A	Service	No	£1m-£5m	12	1	11

1.2.2 The Current UK Small Business Sector

Although the number and profile of UK small businesses is quoted with apparent confidence in DTI and other government documents, the actual number is anything but certain.

The Small Business Service (SBS) relies mainly upon VAT registrations to measure the birth and death of small businesses. Unfortunately, most small businesses do not reach the VAT turnover threshold (currently £64,000) which, to complicate matters further, changes over time making temporal comparisons difficult. De-registrations may similarly not reflect business failure but simply that the small business has moved outside of the VAT threshold. The Small Business Service therefore relies on commercial banks to provide an indication of business births and deaths based on the numbers of business bank accounts opened and closed.

Incorporations registered at Companies House are another indicator, but again many registered companies never actually trade. Besides, the vast majority of small businesses are unincorporated i.e. sole traders or partnerships. The Labour Force Survey and other research sources are therefore used to try to piece together best estimates.

Small businesses including those without employees (i.e. sole traders) accounted for over 99 per cent of the UK's 3.8 million businesses at the start of 2002. Of these, it is estimated that 1.6 million (69 per cent) of these are sole traders. Approximately one quarter of small businesses are incorporated, the remainder are unincorporated i.e. they are owned and managed by self-employed people either on their own or in partnership (Small Business Service 2003).

Half of the 1.7 million VAT registered enterprises in the UK are in just two sectors - the business services sector and wholesale and retail. Over a third of all new VAT registrations in 2002 were in business services, and this sector has seen the most growth from 314,000 enterprises in 1994 to 500,000 in 2003 (Small Business Service).

The small business sector is an important contributor to employment and accounts for 56 per cent of UK employment (12.6 million people). It also makes a large contribution to job creation. New businesses - especially smaller new businesses - are the greatest single source of new jobs, providing jobs at all points of the economic cycle. A study of job-creation over the period 1995 to 1999 found that 2.3 million new jobs were created in new business, of which 85 per cent were in small businesses (Dale and Morgan 2001).

Activity levels vary spatially. Enterprise activity is particularly limited in the UK's least prosperous regions and communities. London has the highest business density and VAT registration rate; the North East has the lowest density and registration rate. In 2002 there were just 21 new VAT registrations per 10,000 adults in the North East compared to 57 in London (Small Business Service 2003).

Although the stock of enterprises is relatively stable, there is a massive amount of 'churn'. Each day in England and Wales, 440 businesses register and de-register for VAT. Astonishingly, on average over 1,000 businesses start-up and close each day (Barclays 2003). Small businesses also make an important contribution to economic activity, and account for over half (52 per cent) of total UK turnover (£1,100 billion). Their contribution to productivity appears to be growing, and in 2001 small businesses were 96 per cent as productive as large businesses (Small Business Service 2003).

The profile of the small business sector in the UK has never been higher. In January 2003, the Labour government committed itself to 'making the UK the best place in the world to start and grow a business' (Small Business Service 2003). It stressed that it does not seek to favour small businesses over larger ones, but asserts that the market mechanism is weak or incomplete in a number of important areas affecting the formation and development of small business. It describes these as imperfect information (leading mainly to poor access to finance), externalities and incomplete property rights (especially intellectual property), imperfect market structures and poor regulation.

Redressing these is the responsibility of the Small Business Service which was established in 2000 to 'ensure that small businesses have a strong voice and influence in government by providing leadership and the centre of small business expertise' (Small Business Service web site). The means of achieving this will be through an Action Plan with seven objectives (Small Business Service 2003); for example, 'increasing the proportion of businesses reporting that they want to grow'.

Despite this commitment, start up rates are low, failure rates are high the UK has only a middle ranking in terms of actual entrepreneurial activity. According to Harding (2002) the UK's Total Entrepreneurial Index is only 5.4 per cent compared to an average of 8.0 per cent globally, and a US score of 10.5 per cent. Improving this is not only a key aim of government, but given small business's contribution to the economy, jobs and the welfare of small business people themselves, a key aim of a large proportion of the population.

1.3 INFORMATION MANAGEMENT

1.3.1 Literature Review: Blue Shirts vs. Brown Sandals

The importance of information management in organisations has been acknowledged for some time, with Leavitt and Whistler's (1958) seminal article pointing the way and, interestingly, introducing the term 'information technology'. Undoubtedly, positivism has been the most influential research approach with much of the published research being centred upon positivistic assumptions (Orlikowski and Baroudi 1991; Walsham 1995; Marchand 2000). Indeed, much of the information management literature assumes an unproblematic, rational and objective approach to management, organisations and change, involving mechanistic assumptions about organisational behaviour (Introna 1997). However, a mounting appreciation of the essentially social nature of information management in practice has led some researchers to adopt research approaches which focus primarily on human interpretations and meaning (Walsham 1995; Myers and Avison 2002).

The founders of Soft Systems Methodology (SSM), Checkland and Holwell (1998) provide a useful summary of the concept of *information systems* (their preferred term) as an emerging field, the core concern of which can be interpreted in many ways and has led to a number of very different schools of thought in information systems work. They characterise these into the 'hard' functionalist approach and the 'soft' interpretive approach (Table 5),

Table 5 Comparison of 'hard' and 'soft' information management schools

'Hard' School	'Soft' School
Hard Science	Social Science
First Order (Factual) Questions	Second Order (Conceptual) Questions
Positivist	Interpretivist
Technology, Systems Focussed	People, Management Focussed
Practitioners	Academics
Generalizable	Specific
Technological Determinism	Social Determinism
Naturalist	Humanist

(Source Checkland and Holwell 1998: 32)

They argue that the *hard* approach is based on the assumption that the organisation is a rational, goal seeking entity and that information systems exist to support this. They cite the content of virtually all undergraduate information system texts as evidence for this with most based on the earlier framework by Gorry and Scott Morton (1971). They also identify Simon's three-stage problem solving / decision making theory as another key influence in the 'hard' school of thought (Simon 1960).

The *soft or interpretive* school arose from the questioning of the validity of the rational problem solving/decision making model for organizations and individuals. Instead, it sees social action based upon personal and collective sense making. Checkland and Holwell argue the origins for this are far more diverse and they cite Boland, Hirschheim, Klein, Lee, Lyytinen and Walsham as examples. They focus on Geoffrey Vickers (1968) however, as a significant and under-recognised source and urge us to consider information *systems* (IS) rather than information *technology* as 'we take the core concern of the fields to be the orderly provision of data and information within an organisation using IT, that information being relevant to the ever-changing activity of the organization and/or its members' (p. 50). Table 6 summarises these differences.

Table 6 Hard and soft information system traditions

	The 'Hard' Tradition (Simon)	The 'Soft' Tradition (Vickers)
Concept of organization	Social entities which set up and seek to achieve goals	Social entities which see to manage relationships
Concept of information system	An aid to decision making in pursuit of goals	A part of interpreting the world. Sense making with respect to it, in relation to managing relationships
Underlying systems thinking	'Hard' systems thinking: the world has to be systemic	'Soft' systems thinking: the process of inquiry into the world assumed to be capable of being organized as a system
Process of search and inquiry	Predicated upon hypothesis testing; quantitative where possible	Predicated upon gaining insight and understanding; qualitative
Social theory	Functionalism (stemming from Durkheim)	Interpretive (stemming from Webber)
Philosophy	Positivism	Phenomenology

(Source Checkland and Holwell 1998, p.58)

Currie and Galliers (1999) ponder similar issues 'so what exactly are management information systems (MIS), information management (IM) and information systems (IS), and should they be treated as one or even three distinct areas of business and management education?' (p.v). Their answer is that there is no agreement, and that there are many different interpretations in the worlds of academics and practitioners from business, management, computer science, information, library studies, etc. They confirm that earlier work i.e. pre 1990 tends to emphasise the harder side of the subject, but identify a definite shift later towards softer, behavioural aspects driven largely by interest in business schools in the management of information systems. Their preferred perspective is that of *management information systems* (MIS) and in their analysis of MIS literature they too find two camps. The first are books written for practitioners which tend to seek quick-fixes to information system / information technology related problems (e.g. business process re-engineering, performance evaluation, project management, etc.) which are frequently criticised by academics for being 'dumbed down' (p.vi). The second is the theoretical and interpretive literature which is often at the other extreme and fails to demonstrate any relevance in a managerial or organisational context. The authors

blame this partly on MIS being a relatively new subject and relying on development from reference disciplines such as economics, sociology or philosophy. They argue that the absence of a clearly defined field of study explains the multitude of terms and the approbation of the MIS/IM/IS by any number of business disciplines.

Callaghan (2002) looks briefly at the dichotomy as *technological determinism* where technology shapes the forms of society and organisations versus *social determinism* where cultural and social patterns determine the way in which technology is used in organisations. He argues that whilst technology undoubtedly has wide ranging impacts at a number of levels, many people struggle to manage and understand the changes it produces. He concludes that to get a fuller picture social determinism must be considered too and quotes Jones in support here 'the design, introduction and use of information systems is to be understood in terms of the playing-out of socio-political forces, rather than any inherent character of technology' (p.290).

Callaghan goes on to outline other attempts that have been made to bridge the technological / social divide. These include actor network theory (ANT) which treats the social and technical as inseparable and should be analysed with the same conceptual apparatus (Walsham 1997), socio-technical systems theory where technical and social elements are seen as independent (Grint and Woolgar 1997) and structurational which recognises that there is a tight interplay between the two, but argues that technology is 'interpretively flexible' and that there is a recursive relationship between users, technologies and the structural properties of the organisation (Orlikowski 1992).

An interesting earlier paper from Lynne Markus and Robey (1988) looks at the development of information technology from an *organizational change* perspective. They examine both technological imperatives and organizational imperatives, but decide that the emergent perspective is the best suited. This holds that 'the use and consequences of technology emerge unpredictably from complex social interactions' (p.585). This is essentially a realist perspective that recognises that technology and people will contribute to the cause of events.

A good example of the genre aimed squarely at practitioners comes from Marchand, Kettinger et al. of Insead Business School (2001). They divide the field into three streams of management ideas and practices: the application of information technology, the development of information management as an organizational activity, and an understanding of the way in which people behave and are managed in businesses (p.17). *Information technology* is rooted in decision theory, operations research and computer science and is based around the formal application of computer and telecommunications technology in business. *Information management* has its roots in the expansion of large, diversified corporations and the need to manage their complex activities. *Behaviour and control* looks at the role of information in influencing how people act in pursuit of business goals.

A much deeper analysis is provided by livari, Hirschheim et al. (1998) who compare realism with idealism rather than 'hard' and 'soft' but provide a useful summary of ontological positions in information systems research (Table 7).

Table 7 Ontological positions in IS research

Ontological Unit	Realist Interpretation	Idealist/Constructivist Interpretation
Data / Information	Descriptive facts and relevant descriptive facts	Socially constructed meanings signifying intentions
Information Systems	Technical system	A form of social systems realizing human intentions
Human Beings	Deterministic systems	Voluntaristic systems with consciousness and free will
Technology	Technology as a causal agent (technological determinism)	Malleable structures subject to social and human choice
Organizations and Society	Stable structures	Interaction systems or socially constructed systems (nominalism)

(Source livari, Hirschheim et al. 1998, p.172)

The authors go on to summarise information systems development approaches into five groups: interactionist, systems architecture, soft systems methodology, trade unionist and professional work practice but these were not felt to be useful to this study.

An analysis of the changing profile of information systems research is provided by Rademacher (2001). He finds the most popular research methodology to be based on opinion rather than observation and includes descriptive presentations, frameworks and models. A later paper with similar ambitions provides a useful analysis of methodologies used in the seven major US information systems journals in the past five years (Palvia, Mao et al. 2003). This confirms the domination of functional analyses in information management research, with survey, frameworks, conceptual models and laboratory experiment by far the most popular. They did however note a steady increase in the use of qualitative methods in recent years especially case studies and suggest 'case studies are instrumental in providing deep knowledge ... the emergence and acceptance of the case method is encouraging' (p.302).

Boaden and Lockett (1991) have synthesized these varying technologies and terminologies and propose three terms be used:

- Information technology and information and communication technologies be used to the general technical developments in the field i.e. IT as a technology.
- Information system and management information systems be used to refer to a specific system used within an organisation i.e. IT as an *applied* technology.

- Information management should be used for an overall reference to the field of research i.e. IT as technology-supported management of information.

Information management is the most appropriate definition for this research and therefore the preferred term of reference ³ throughout this project as 'information management refers to an organisation using information and communication systems and information and communication technologies to enhance information processing in support of business processes and organisational decision making.' Adapted from Kai-Uwe Brock (2000, p.388).

1.3.2 Information Management in Small Business

Although the literature on information management in all its guises is large and diverse, the majority relates to larger businesses and corporations (Kai-Uwe Brock 2000). It is only in the late 1970s when micro computers became available to smaller businesses that any attention is paid to this sector. This initially took the form of the 'hard' positivist study discussed and looked at problems with implementation, cost/benefit analysis and technical issues but the development of 'softer' research has been mirrored in the small business area and there is now a more balanced literature available looking at management, people and organisations (Swartz and Boaden 1997). It is still a diverse field however and research can be usefully classified into four groups (Kai-Uwe Brock 2000):

- Adoption research. The interest here is in the determinants of organisational adoption of information management. Its primary aim is frequently to identify organisational differences between adopters and non-adopters (Thong and Yap 1995; Fink 1998).
- Implementation research. Here the focus is on post-adoption processes, mainly implementation issues especially user involvement and acceptance (Lucas 1981; Rogers 1995).
- Strategic research. This stream looks at the potential strategic value of information systems for organisations (McFarlan 1984; Rockart and Scott Morton 1984).
- Impact research. This research is interested in the various effects of information systems on the operations of individuals, work groups and the whole organisation (Lucas 1975; Brynjolfsson and Hitt 2000).

This project aims to contribute to the *impact research* field, although the other areas will clearly contribute and are of interest.

Dans (2001) is one of several 'large n' quantitative papers and claims to be the first to mirror larger business research by investigating the alleged IT 'productivity paradox' i.e. that the large sums spent on IT have yet to produce the equivalent returns. This impact research takes a

³ Whilst information management is the preferred term for the scope of study in this thesis, other terms such as information technology of information systems will be used as referenced in their relevant papers.

large sample of small businesses from a Spanish credit rating database and uses regression analysis to correlate statistics on revenues, capital, employees, industry and expenditure on PCs. His findings suggest a positive correlation between IT investment and profitability. According to the results, firms that invest more in IT consistently tend to have higher revenues than their lower IT counterparts across practically all industries.

Another quantitative paper that tries to identify variables that determine the level of information systems (IS) adoption within small business is Thong (1999). The dependent variable is adoption of IS, and the independent variables include CEO characteristics, CEO Innovation, CEO IS knowledge, IS characteristics, organisational characteristics and environmental characteristics. Some of these variables are of interest to this research and included in subsequent analysis.

Julia Smith (1999) investigates the impact of IT in a sample of 150 new small firms and provides statistical evidence to claim that the greater the use of IT, the higher the firms' performance. An interesting feature is that it considers management information systems (MIS) rather than IT or IS as the basis for investigation. It is also unusual in adopting a longitudinal approach over a four year period. The 150 firms surveyed were divided into high, medium and low performers using cluster analysis. Also interesting are the measures used to define performance which were percentage growth in employment, profitability measured as a return on investment and sales per employee.

Kyobe (2004) investigated the strategic utilisation of IT resources in South Africa. His research is survey-based and uses simple statistical analysis (arithmetic mean, etc.) to draw its conclusions. Again, no causal explanations are offered but the variables used (top management vision, economies of scale, amount of technical staff, etc.) are of interest to our research. The paper concludes that only very few SMEs utilize their IT resources for strategic purposes.

In a rare single-case analysis of a furniture company, Sarosa and Zowghi (2003) examined drivers and barriers to IT adoption. They identified internal and external drivers and barriers including owner manager, resources and employees (internal) and competitors, suppliers and customers, government and consultants (external) as shown in Figure 2. The internal / external split is again useful and the phased approach to adoption resonates with the findings of Fink (1998) both of which were used in our subsequent model.

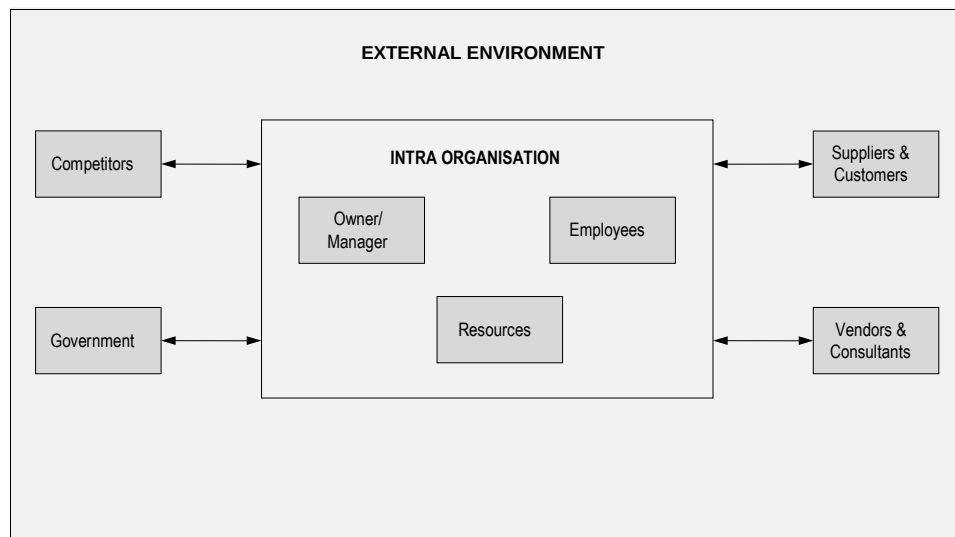


Figure 2 External and internal IT environments

(Source Sarosa and Zowghi 2003)

Another qualitative paper (Shiels, McIvor et al. 2003) tries to understand the implications of ICT adoption. It uses a pilot study of twenty four small businesses and seeks to identify the various determinants of deploying ICTs and the level of sophistication of use. The authors develop a useful taxonomy that plots the level of sophistication of ICT adoption against different companies which is useful (in that it uses 'small n' case study research) but still doesn't really explain the findings. The taxonomy and determinants were however useful in our subsequent research project.

Hillam and Edwards (2003) use a case study approach to evaluate the IT/IS investment evaluation process within SMEs. These were based on multiple interviews within four organisations to explore both typical IT/IS issues but to also categorise them on company strategy type as either defenders, prospectors, analysers or reactors (Miles and Snow 1978). The results are disappointing however and simply identify single causal conditions (e.g. MD attitude to IT/IS in company A or evidence of prospector in company D) with little effort to explain these or look at them in more complex combinations.

In a lengthy but interesting case-study based report from Kinston Business School (Blackburn and McLure 1998), the authors provide a useful typology of owner manager types: *enthusiast* (high IT skills, positive attitude, IT management focus), *pragmatist* (low IT skills, pragmatic attitude, IT management focus) and *artisan* (low IT skills, negative attitude, IT operations / admin focus). They develop some interesting thoughts on the electronic 'culture' in small firms and provide a useful summary on the (then) Information Society initiative and the importance of IT in small businesses. The research is inductive and grounded, but with no comments on

ontology or methodology but provides a good example of how respondent quotes can be used to add rich meaning to otherwise dry content.

Another study using multiple case studies and iterative research cycles looks to develop a rule base for the specification of manufacturing, planning and control systems (Howard, Kochhar et al. 2000). The authors confirmed that semi-structured interviews, literature reviews and logic combined with multiple case study research cycles was a useful way to develop a large body of knowledge for the realization of defined goals (p.263).

In another inductive paper, resistance to change was identified as a major determinant in IT adoption (Watson and Houdeshall 1997). Reasons for this included a 'why change?' attitude where people were happy with their current methods of working and question the need for change. Technological phobia and fear of exposure (i.e. from the increased transparency that IS provides) were also important as too was loss of control where holding of information can lead to power for individuals who can lose this when shared through an MIS.

Rizonni (1991) claims the owner-manager is a 'crucial factor in determining the different innovative attitudes of small firms' (p.40). Here thirty-three small firms were sampled including eight micro (0-9 employees), twenty meso (10-50) and five medium (50+). Each firm had a semi-structured interview with owner-manager or person responsible for IT and pursued a number of key issues e.g. business background, ICT in place, ICT affect on business, etc. These were then used to create a typology of low, medium and hard users using both 'hard' and 'soft' data. There was no attempt to define whether any were more successful than another.

Perhaps the most similar research to that proposed in this study was conducted using cluster analysis (Fink 1998). Fink reviewed research in SMEs and summarised the factors identified as facilitating IT/IS adoption in SMEs. Although many of the studies cited were inconsistent in terms of company size, commonly recognised factors included organisational size, MD attitude to IT/IS, MD knowledge of IT/IS, external pressures to adopt, perceived benefits, competitive pressure and level of control and degree of planning for IT/IS implementation. The research aimed to establish the factors that lead to the successful adoption of IT in Australian SMEs and the opinions of owners and managers (10 to 500 employees) were sought and cluster analysis identified ten factors over three main acquisition phases. First, SMEs should assess IT benefits, the organisational culture and IT suitable for their firm. Second, they should determine if sufficient internal resources are available and appropriate resources exist for the successful selection and implementation of IT. Third, SMEs need to evaluate the external environment, support and resources, particularly if in house resources are lacking. At the end of each phase the decision should be made on whether or not to continue with the acquisition and this phased approach minimises the overall risk of technology acquisition.

Swartz and Boaden (1997) argue for triangulation between methods as being the most suitable to researching information management in small firms due to 'the paucity of current research' (p.53). In their study, they use inductive methods starting with a mailed questionnaire followed by in-depth case studies. Formal grounded theory then enabled the synthesising of quantitative and qualitative data. Useful to this project was the suggestion of variables affecting the exploitation of MIS within small businesses including training of users and managers, implementation, organizational and individual effects, extent of internal expertise and planning methodologies. All of these were investigated in our subsequent work.

Other papers have looked at the *internal* and *external* factors suspected of facilitating and influencing the success of IT/IS implementation and identified strong technical support and expertise, the leadership position in IT, competitive pressure, strong financial position and extensive computerised facilities as possible factors (Ballantine, Levy et al. 1998). However, factors that negatively influence the ability of an organisation to successfully use IT/IS – termed organisational inhibitors – have been studied rather less. King and Teo (1994) report lack of appropriate planning, lack of top management support and difficulty in assessing tangible contributions as major inhibitors. They also argue that SMEs are often recognised as being 'poorer' than larger organisations in terms of human, financial and material resources to support successful IT/IS implementation.

Southern and Tilley (2000) provide a review of previous information management research in small business which they too argue has been deterministic and positivist. They propose three alternative research perspectives. First, a *technological perspective* which concentrates on the important factors that influence the success of IT in small firms. 'What success actually is, or how it is determined is often defined by the idea of a successful information systems and not, for instance, a successful business.' (p.141). Second, a *management or organisation perspective* which aim to understand how the small firm's strategic approach to using IT and the capabilities and structures of the small firm to use the technology. Third, a *small business perspective* which aims to understand the domain from the perspective of the small firm owner-manager or equivalent. They use these to build a simple taxonomy of low, medium and high users of IT. They also usefully list the internal and external factors which affect small firm use of ICT's based on case studies rather than quantitative methods.

A critical review of IT Literature by the College of Estate Management (Dixon, Thompson et al. 2002) looked mainly at the question of the adoption of internet technologies within small business. The research is not rigorous and the main point seems to be to argue that further research needs to be undertaken. One valid point is the problem with previous research which has been deterministic and self-selecting i.e. firms seen to have been successful with IT are those who were aware of the business benefits. There is therefore no suggestion that all small businesses can obtain these benefits. They argue that a key research issue must be the

identification of the categories of small business which can gain the greatest competitive advantage from IT investments.

The Small Business Service (2003) argues that the typical linear model of ICT adoption maybe inappropriate. Cyclical models have a greater synergy with the reality of ICT adoption in SMEs and that it is also important to consider the SME's knowledge and skills base, age of firm, size and maturity of ICT usage.⁴ They stress that '... whereas many of the costs are tangible and quantifiable, the benefits may be often either speculative, intangible or difficult to quantify.' (p.3)

Kai-Uwe Brock (2000) in a review of the empirical literature suggests that ICT use in SMEs varies according to size of firm (the smaller internal resource base, the less likely it is to use ICT), age of firm (young firms and firms with younger employees are more likely to use ICT), industry sector of firm (wholesale and retailing are more likely to use than others), firm's experience of ICT (at both top manager and end user levels), role of external support (informal and formal sources are important) and usage pattern of ICT (SMEs use ICT mainly for operational and administrative support rather than strategic decision making).

⁴ The significance of the appeal of cyclical over linear models did not materialise in this research until complexity theory was considered in the final stages.

1.4 EVALUATING SUCCESS

1.4.1 Evaluating the Success of 'IT Systems As Such'

In a crowded and complex field, Cronholm and Gholdkuhl (2003) usefully divide information management evaluation into 'IT systems as such' and 'IT systems in use'. *IT systems as such* refers to technical success and there is an extensive body of work on formal technical evaluation based typically around return on investment analysis. *IT systems in use* belatedly reflects the involvement of users and the behavioural aspects of information management.

The large majority of literature is based on 'IT as such' and the results are not encouraging. An early study by the American Production and Inventory Control Society (Anderson 1982) found that over 76% of MRPII installations were perceived as unsuccessful by operations or production managers. Other more recent reports quote similar high figures for failure rates. Hochstrasser (1992) cited a general reported failure rate of up to 60% in that within three years of implementation the IT/IS was either discontinued or had not delivered the required benefits. Lyytinen and Hirschheim (1987) quoted a generally accepted failure rate of at least half for information systems. Flowers (1996) argues that 'total or partial failure of IS developments is endemic throughout the business world,' (p.44) stating that even though such disasters happen frequently, surprisingly little may be known about the events that contribute to particular IS failures.

Whilst the consensus amongst many researchers is that information management instance failure rates are high, the presumption seems to have been that they should succeed and the focus therefore is on finding out why they fail rather than why they work. Lyytinen and Hirschheim (1987) obligingly identify four major types of failure: *correspondence failure* where the IT/IS does not match the specific planned objectives; *process failure* where the IT/IS implementation process is not completed within planned time or cost; *interaction failure*, where the IT/IS is not used perhaps due to negative user attitudes; and *expectation failure* where the IT/IS does not match user expectations.

They argue correspondence and process failure are more easily identified since they should relate specifically to initial implementation plans or IT/IS specifications assuming these formally exist. However both interaction failure and expectation failure present greater problems since there is an implicit assumption that clear objectives can be set and measured, and that there is some common understanding and assessment of user expectations and user attitudes. Sauer (1993) argues that expectation failure is a fundamentally flawed concept since some expectations of an IT/IS are more reasonable than others. User expectations are consequently extremely varied amongst those who have a stake in the proposed IT/IS project, and will always be hard to evaluate and measure.

Hogbin and Thomas (1994) suggest evaluation should be based on usage and provide a broad classification of four types of IT/IS projects according to function: operational transaction processing systems including order processing; systems which manage company resources across the organisation such as inventory and production systems; systems which specifically target company growth and increased market share; systems of strategic importance which can often be a combination of all three. Hochstrasser (1992) also suggested a number of IT/IS project group types, each of which could be justified and measured by a related set of evaluation criteria. This classification is more detailed than that provided by Hogbin and Thomas and has the advantage of suggesting that specific evaluation criteria may vary according to IT/IS group type. Examples include internal IT projects which are aimed at increased internal efficiency, and thus evaluated by improved work practice. External IT/IS projects which tend to be measured by business performance indicators such as market share and perception of company image, and can be linked specifically to longer term business objectives.

Cronholm and Gholdkuhl (2003) distinguish between three type of strategies on *how* to evaluate. The first is *goal-based evaluation* which Walsham (1993) describes as formal-rational evaluation involving quantitative analysis of likely costs and benefits. A more interpretive approach is *goal-free evaluation* where IT systems are viewed as social systems with information technology embedded into it (Gholdkuhl and Lyytinen 1982). Finally *criteria-based evaluation*, where the interface and/or interaction between users and IT systems acts as a basis for evaluation (Nielsen 1993). The basis for these action-oriented ideals is to understand if and how the IT-system supports the actions performed in the business.

Each were then cross referenced against their two strategies on *what* to evaluate: 'IT system as such', without any involvement of users and 'IT system in use', with user involvement. The data sources for the latter can be interviews with users to gauge their perceptions and understanding of the IT system's quality, observations of users interacting with IT systems, the IT system itself and the possible documentation of the IT system. Compared to the strategy 'IT systems as such' this strategy offers more possible data sources and the evaluator can chose to combine all the data sources in order to reach high degree of triangulation.

The result is a six category matrix and by a) permitting users to choose their own definitions of success and b) placing this in a wider business and personal context the planned research in this project most closely matches type 4 '*Goal-free evaluation of IT-systems in use*' the implications of which are shown in Table 8.

Table 8 Goal-free evaluation of IT systems in use

Main Perspective	Open Minded Approach
What to achieve knowledge about	To gain a deeper and broader understanding of the system itself, its role in the business and its social and cultural consequences.
Data sources	The IT-system, observations of interactions, user perceptions of the IT system
Deductive or inductive	Inductive
Who will participate	Evaluator expert, users
When to choose this type	When a thorough evaluation is desired

(Source Cronholm and Gholdkuhl 2003)

1.4.2 Evaluating the Success of 'IT Systems In Use'

Much of the literature assessing the business benefits accruing from 'IT systems in use' applies measures based on the traditional theory of the firm (Thong and Yap 1996; Dans 2001; Hall and Bennett 2002). There is significant literature to suggest this might not be the case and the possibility that information management projects may fail these tests but still be gauged as being successful in the eyes of the people involved is only rarely considered (Blackburn and McLure 1998; Hillam and Edwards 2003).

The original theory of the firm was based upon a static partial-equilibrium analysis, assuming certainty, of the profit maximising firm in an exogenously given environment (Robinson 1951). The assumptions of rationality in the theory can be reduced to two propositions: first, firms seek to maximise profits and second, firms operate with perfect knowledge (Cyert and March 1963, p.18). One of the first to question such propositions were Berle and Means (1932) which put forward the idea that firms' objectives had been altered by managerialism, especially a separation of ownership and control i.e. divergence of interest between 'owning' shareholders and 'controlling' managers. Shareholders may not necessarily want profit maximisation but a return on capital investment. Managers in turn want salary, security, status, power and prestige.

Baumol (1959) suggested that sales maximisation may also be an aim of firms as it could lead to increased market share and hence dominance through monopoly powers. Growth may also indirectly support higher profitability through price leadership, economies of scale, cheaper financing and greater standing. Mariss's *managerial capitalism* (1964) is more embracing than Baumol, and argues that the demise of shareholder power plus undistributed business profits resulted in the assets of company passing into the hands of management i.e. managerial capitalism. When this occurs, growth of gross assets becomes the business goal with the only constraint being loss of office through fear of takeovers or business failure.

Williamson's model of management discretionary behaviour (1967) is another alternative theory with three propositions. First, shareholders have little power to influence corporate behaviour. Second, the diminished impact of competition reduces need for profit maximisation. Third, the takeover process will not ensure inefficient firms are taken over i.e. some poorly performing firms can survive. This means that managers can exercise discretion and Williamson suggests alternative goals may be salary, security, professional excellence.

Once a firm is recognised as an organisation, the possibility arises that its organisational characteristics have implications for its behaviour i.e. it dispels the black box theory. Such ideas were put forward in a *behavioural theory of the firm* (Cyert and March 1963). They argue that a firm is a coalition of individuals and groups and whilst individuals have goals, the organisation has none. Members of this coalition have different goals that are decided by a bargaining process. Bargaining is over the distribution of side payments i.e. inducements in the form of money or policy commitments and the pattern of policy statements emerging from bargaining specifies the goals.

However, because of the imperfect way objectives are rationalised, objectives are stated in aspiration levels or non-operational form. They reject the idea of maximising anything, instead the business is striving to achieve satisfactory performance in its goals i.e. *satisficing rather than maximising*. Performance is judged to be satisfactory in comparison with the aspiration levels incorporated based on past achievements and modified as necessary with regard to the external environment. They also introduced the idea of organisational slack 'payments to members of the coalition in excess of what is required to maintain the organisation' (p 333) which allows the organisation to survive adverse changes without disintegrating by acting as a 'cushion' between good and bad times. Another aspect of behaviourism is the sequential treatment of problems, i.e. change is only considered when a problem arises. Once a problem does occur, search activity takes place to find a solution to allow them to return to the aspiration level.

Margolis (1958) has also suggested that profit maximising should be replaced with a goal of making satisfactory profits which represent a level of aspiration that the firm uses to evaluate alternative policies. Simon (1957) in particular has developed the idea of 'satisficing' which means to obtain an outcome that is *good enough* as contrasted with maximizing, which seeks the biggest, or with optimizing, which seeks the best. When satisficing we decide what constitutes a satisfactory outcome, look for ways to achieve it and, most often, look for what has worked for us before. We also stop looking when we have satisficed meaning that there may be even better ways to reach the outcome. Simon also suggests that people are only *rational enough* and in fact relax their rationality when it is no longer required or what he calls 'bounded rationality'.

Evidence from the small business sector supports these ideas. Many small businesses do not want to grow, increase sales or maximise profits (Curran 1986). Hakim (1989) found that 68% of firms with two or less employees propose no growth. Instead small firms prefer to stay as they are and satisfy their 'lifestyle needs' (Bridge, O'Neill et al. 2003). There is nothing inherently wrong with this, but it does mean that successful information management interventions become difficult to assess using standard business metrics or government policy.

This is often ignored in small business research. The Dans paper (2001) assumes primary business objectives are increases in revenue, capital, and employees and purports to positively correlate these with expenditure on PCs. But who is to say that sales, profit and employee growth are valid objectives for all those surveyed? Smith (1999) measures of improved performance were percentage growth in employment, profitability measured as a return on investment and sales per employee.

In the original Durham paper (Hall and Bennett 2002) 'successful' companies chosen for investigation are those that were less than ten years old and now employed more than 100 people, maintained planned profit performance over the period of growth and 'became recognised leaders in their market sector'. Again, such rapid growth (and the problems it can cause) is unlikely to be regarded as a goal for many small businesses. Indeed Jeffcoate and Chappel (2002) split SMEs into two distinct growth attitude groups, *growth orientated* and *quality of life*. Growth orientated is when the SME is concerned with increasing the size and therefore the value of the business whilst quality of life is when the SME is concerned with maximising the income for the owners.

Managerial economics and the experience of this researcher firmly suggest that behavioural theories of the firm encompassing satisficing, bounded rationality, organisational slack, side payments, lifestyle ambitions, salary, security, greed, vanity and sheer stupidity will often determine whether information management projects are determined to be successful or otherwise.

Given that the unqualified application of traditional definitions of success to small business is questionable, this research will therefore be based upon the premise that if the representative of the small business involved perceives their information management instance as successful then this should be adequate initial justification. Such a singular viewpoint is tempered by the researcher's in-depth knowledge of both the business in general and the instance in particular to give an element of internal validity.

Further examination to identify more objective criteria for gauging success will also be important. These may well include profit, sales or headcount increases, but might also include increased competitive ability, innovation or efficiency that have not translated into profits for other unobserved reasons or increased control or other directly non-commercial aims. They

might also include improved salary, security, status, power, prestige or professional recognition as suggested above, none of which have been recognised in previous literature. In all cases detailed justification for successful and unsuccessful instances is explained in the resulting models shown in the appendices.

This grounded approach is strongly supported by Blackburn and McLure (1998), Swartz and Boaden (1997), Southern and Tilley (2000), Hillam and Edwards (2003) and others.

1.4.3 Preferred Evaluation Approach

Carlsson (2002) identifies four traditional information system (IS) evaluation approaches:

Experimental IS evaluation is the oldest and builds on the logic of experimentation (OXO basis) but has two major problems. First, the studies are to a large extent a-theoretical and non-theoretical and do not answer the question of why an IS (or type of IS) works for whom and in what circumstances. Second, to meet the experiment requirements an experimenter (evaluator) must in most cases create an unrealistic situation and reduce intermediary variables that might affect the outcome.

Pragmatic IS evaluation represents a more user-led model stressing utilization. Here the basic aim is to develop IS initiatives (implementations of IS) which solve organizational 'problems' such as reduced competitiveness or weak customer service. The problems addressed in an intervention and the intervention's goals are not given, but are politically coloured and defined by stakeholders. Carlsson suggests there are again two major problems with pragmatic IS evaluation research. First, the studies still do not answer the question of why an IS initiative works for whom and in which circumstances. Second, since the evaluation mandate is coming from stakeholders this can lead to 'evaluation (evaluation researcher) for hire'.

Constructivist IS evaluation approaches argue that IS initiatives should not be treated '...as independent variables', as 'things', as 'treatments', as 'dosages'.' (Pawson and Tilley 1997) and in line with the general development in many social sciences during the 1970s this type of evaluation research has been steadily influenced by phenomenology, hermeneutic, and interpretative approaches. The major problem with the constructivist IS evaluation approach is its inability to grasp those structural and institutional features of society and social organization which are in some respects independent of the agents' reasoning and desires but influence (affect) an IS initiative and the negotiation process.

Carlsson envisages developing an approach combining the strengths of the three approaches: an approach combining the rigor of experimentation with the practice of pragmatism, and with the constructivist's empathy for the voices of the stakeholders. This resulting *pluralist IS evaluation* research approach was developed more or less on these premises but until recently

has lacked an ontological position. He proposes that this issue is addressed by Layder (1993) who advocates doing empirical and theoretical research from a *critical realist perspective*. In general he is sympathetic to constructivism, and even to some of the ideas in grounded theory, although he is critical of 'pure' grounded theory.

These critical realism pluralist methodology ideas are strongly supported by Mingers (2001) and will form the basis of our later evaluation methods.

1.5 THE NEED TO EXPLAIN

1.5.1 The Critical Realist Perspective

Much of the previous research on information management in small business has been limited due to its reluctance to *explain* what is actually happening in the cases studied (Hillam and Edwards 2003) or conflated empirical evidence with deeper meaning (Dans 2001). Explanation - as opposed to description - is vital if we are to understand what is happening to allow the limited generalization or transfer of knowledge. Pawson and Tilley stress:

'Realism's key feature is its stress on the mechanics of explanation, and its attempt to show the usage of such explanatory strategies can lead to a progressive body of scientific knowledge. (Pawson and Tilley 1997, pp.55-56)

Easton concurs:

'What is it that we are trying to do when we do research? The realist position is that we seek valid explanatory knowledge' (Easton 2000, p.207)

This research is based firmly on a realist ontology i.e. there is a world out there that exists irrespective of our knowledge or experience of it. It also acknowledges that people interpret this reality in different ways and that there is a subjective element to our knowledge of this world which is denied by empirical realism. One answer to this dilemma is the philosophy of critical or natural realism which, in its simplest terms supports an objective ontology and subjective epistemology (Morton 2003).

Critical realism is a theory of being (i.e. a theory of ontology) not primarily a theory about the knowledge of that being. It explicitly acknowledges two realms - that of the object of analysis and that of knowledge about the object – which are called *intransitive* and *transitive* dimensions respectively. For realists, the world is 'real' and exists independent of the ideas we have about it. Realists may have different theories about the world (transitive dimension) but the world we theorise about remains the same (intransitive dimension). The distinction between these dimensions means that the world should not be conflated with our experience of it. As such, it is incorrect to talk of the 'empirical world' and critical realism differs from empirical realism which does identify the real with the empirical. Traditionally, researchers have wrongly conflated descriptions (thought statements) with objects (factual statements) (Sanghera 2004a, p.1).

The rejection of simply assuming that the world is as we experience it, is taken further by Bhaskar (1978) when he divides social reality into three different layers of social objects: the real, the actual and the empirical (Table 9).

Table 9 Classification of real, actual and empirical events

	Domain of Real	Domain of Actual	Domain of Empirical
Mechanisms	✓		
Events	✓	✓	
Experiences	✓	✓	✓

(Source Bhaskar 1978)

The *real* is whatever exists, be it natural or social, and consists of the processes, structures, powers and causal mechanisms that generate events which may or may not be observed or active (e.g. technological advances generating demand for new products or services). The *actual* refers to what happens if these powers are activated, and may include events that happen whether we observe them or not (e.g. the implementation of broadband technologies in small business).

The *empirical* is defined as the domain of experience i.e. what we observe to happen (e.g. reading broadband uptake statistics on a BT web site) which may or may not help us to understand the actual and real domains beneath. Empirical objects refer to our senses and impressions of the actual objects; i.e. our interpretation and imagination of the actual e.g. a half-full or half-empty glass of water.

Sayer (1992) divides these another way for research purposes i.e. into *concrete research* and *abstract research* (Figure 3). *Abstract research* examines structures and mechanisms in the real and actual domains; concrete research looks at the events observed in the empirical domain.

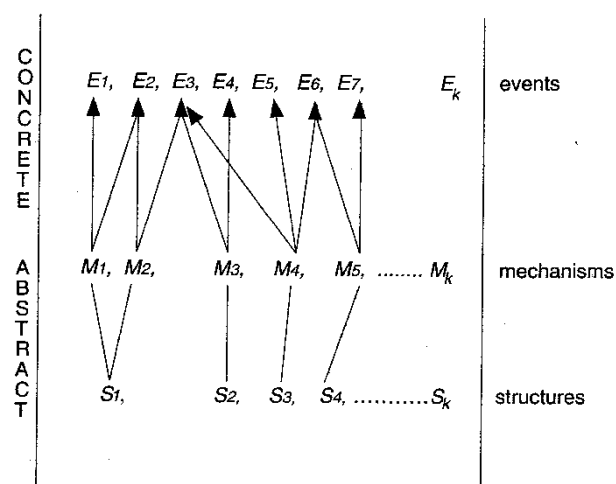


Figure 3 Structures, mechanisms and events

(Source Sayer 1992, p.117)

A crucial implication of this ontology is to recognition of the possibility that powers may exist as yet unexercised. Critical realist ontology therefore makes it possible to understand how things *might* happen in the future even though they have not happened in the past, unlike empirical realism which relies on regularities.

By separating the real, actual and empirical, critical realism proposes what is known as a *stratified* ontology. This differs crucially from empirical realism which is *flat* and conflates the actual and empirical and assumes that what we can observe is all that exists. It is an ontology of intransitive structures and mechanisms (i.e. the real and objective dimensions that occur independently of us) which are distinguished from transitive concepts, theories and laws that are designed to describe them. Pawson and Tilley relate this to embeddedness of all human action within a range of social processes and give the useful example of signing a cheque which in itself is meaningless unless embedded within the social organization known as the banking system (wherein reside the causal powers) (1997, p.64).

Another feature of critical realism is that of *emergence* i.e. 'situations in which the conjunction of two or more features or aspects gives rise to new phenomenon, which have properties which are irreducible to those of their constituents, even though the latter are necessary for their existence' (Sayer 2000, p.12). Pawson and Tilley quote the favoured gunpowder example here i.e. it has the causal power to explode, but will only do so in the right conditions (1997, p.69) and once exploded cannot be reduced to its subsequent parts.

Another key feature of critical realism is *causation* which emerges from structures where 'structure suggests a set of internally related elements whose causal powers, when combined, are emergent from those of their constituents' (Sayer 2000, p.14). Whether these causal powers are ever exercised depends on the conditions or context in which they exist. Importantly, critical realism's concept of causality differs from positivism's in that it emphasises the *tendency* of things to occur, rather than regular patterns of events. This tends to invalidate the conventional means of proving causation by gathering data on regularities, as what caused something to happen has nothing to do with the number of times it is observed happening. Instead, we need to identify the causal mechanisms and how they work, and discover if they have been activated and under what conditions (Figure 4).

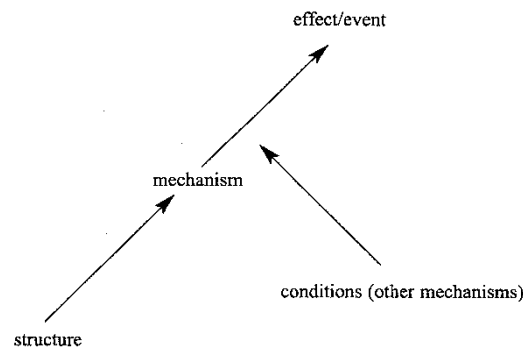


Figure 4 Different views of causation
(Source Sayer 2000, p.14)

Pawson and Tilley stress the importance of different layers or reality and need to apply a generative conception of causality. 'Thus when we explain a regularity generatively, we are not coming up with variables or correlates which associate one with another; rather we are trying to explain how the association itself comes about.' (p.66)

Another key issue is the nature of open and closed systems. *Closed systems* require that the object possessing the causal power is stable (the intrinsic condition) and that the external conditions in which it is situated are constant (the extrinsic condition). Closed systems are rare and usually created artificially by natural science, and in the *open systems* of the social world, the same causal power can produce different outcomes according to how the conditions for closure are broken. Sometimes different causal mechanisms can produce the same result, or the same causal mechanisms produce different results depending on the conditions in which they operate.

Critical realism also recognises that meaning has to be understood not simply measured or counted, and hence there is always an interpretive or hermeneutic element in social science. This means that critical realism is only partly naturalist, for although social science can use the same methods as natural science regarding causal explanation, it must also diverge from them in using 'verstehen' or interpretive understanding. While realism shares with interpretive social science the view that social phenomenon are concept-dependent and have to be understood, unlike interpretivism it argues that this does not rule out causal explanation (Sayer 2000, p.17).

Critical realism therefore provides a better explanation of why something should work and in which circumstances, as opposed to broad quantitative analyses based on a search for commonality, or solitary case studies based on un-generalizable constructions (Ragin 1987). This project will therefore use critical realism as the theoretical perspective to underpin it.

For its epistemology, critical realism is based on the building of models of mechanisms that, if they were to exist in the proposed way, would account for the events being encountered. Because it aims to cumulatively uncover actual and real domains, critical realism is compatible

with a wide range of research methods. Sayer argues though, that the particular choices should depend on the nature of the object of study and what one wants to learn about it (p.19).

Because the social systems will always be open and complex, it is vital that the abstraction conducted on the various components or influences is carefully thought out, and requires a deep knowledge of the object of study in question.

1.5.2 Critical Realism and Information Management

Critical realism is finding increasing numbers of exponents in information management and other management research areas. Mutch argues strongly that critical realism has a role to play in information management research, and takes the word critical to mean 'to assume a position which stands outside the existing arrangement of things and seeks to suggest alternatives' (1997, p.1). In another paper he argues that an approach based on critical realism has the potential to not only give us a better account of the use of information at work, but also of forging a better integration between worlds of organization and information theory (Mutch 1999).

Morton (2003) argues that critical realism provides a well argued ontological and epistemological basis for evaluating the choice of methodology and theoretical lens in multi-method approaches to research. He supports a research perspective that sees information systems as social systems hence requiring an open systems analysis. This provides greater recognition of the interaction between structure and agency, which can be applied to the analysis of the structuring effect of technology in an organization. He sees the key benefits of critical realism in information management research as being:

- Providing the basis for unity of the natural and social sciences through an ontologically stratified reality,
- Explaining causality of phenomenon not just constant concurrent events,
- Accommodating social construction of knowledge but avoids relativism through an objective ontology,
- Encompassing multi-method approach to research,
- Providing explanations based on structural analysis and abductive reasoning that can be corroborated by inductive and deductive techniques.

Dobson (2001) agrees that critical realism provides the potential for a new approach to social investigations by providing an ontology for the analytical separation of structure and agency. He goes on to suggest that critical realism may provide a useful grounding for information systems research in general, by elevating the importance of philosophical issues and thus allowing for a more consistent approach to research. Its recognition of a transitive and intransitive dimension to reality provides a useful basis for bridging the dualism between subjective and objective views of that reality. In another paper, he argues that as the information systems research arena matures, it is not surprising that a number of IS researchers

have called for a clearer definition of the underlying philosophy and assumptions of information systems research. He proposes that critical realism has much to offer in this field (Dobson 2002).

Mingers (2001) puts forward arguments in favour of a pluralist approach to IS research. Rather than advocating a single paradigm, he argues for use of a plurality of paradigms and that this is consistent with the philosophy of critical realism in that there are many ways to view and understand reality. He suggests that research results will be richer and reliable if combined from different paradigms. He goes on to quote Archer (1998) in that philosophy should play the role as 'under-labourer' to research and practice. The critical realist agrees that knowledge of reality is a result of social conditioning and therefore cannot be understood independently of the social actors involved in the knowledge derivation process.

Research from Sweden applies critical realism approach to IS evaluation. Carlsson (2002) looks closely at the issue of structure and agency and argues the way critical realism and realistic IS evaluation research addresses the agency / structure dilemma means that we avoid the fallacy of central conflation i.e. agency closely entwined with every aspect of practice. He again discusses real, actual and empirical domains and of mechanisms, events and experiences from an IS perspective.

1.5.3 Critical Realism and Small Business

The literature that explicitly reference critical realism in small business is practically non-existent. Blundel (2006, p.58) concludes that critical realism can be useful to entrepreneurship. because it can:

- Help to revive a longstanding realist tradition in entrepreneurship research,
- Promote the much-needed contextualization of entrepreneurial phenomena in research studies,
- Facilitate greater theoretical integration between disciplines and across multiple levels of analysis,
- Enhance the explanatory potential of existing qualitative research techniques, including the case study approaches,
- Contribute more 'useful' knowledge than rival paradigms.

Fleetwood and Ackroyd (2003) include a substantive contribution on routines, strategy and change in high-technology small firms (Costello 2000) but that's about it at the moment.

2 RESEARCH DESIGN

2.1 CHAPTER SUMMARY

One of the contributions to knowledge this project aims to make is the use of critical realist ideas to underpin research activity and findings. Although such philosophical underpinning is advocated by many who feel it to be the ‘midwife or under-labourer’ of quality research (Bhaskar in Sayer, 2000) it is seldom explicitly referenced despite research often being – perhaps unwittingly – based on critical realist ideas e.g. plurality in methodology justified as triangulation (Swartz and Boaden 1997; Hllam and Edwards 2003; Thompson and Perry 2004).

The primary interest in critical realism for this researcher stems from nearly twenty years trying to understand why some small organisations which clearly need to manage information to be successful, take appropriate action and succeed; whilst other very similar organisations take similar action yet fail. Conversely, others with equal or even greater needs deliberately choose to do nothing and yet still believe inaction to be ultimately successful or (when the data is permanently lost or the competition unassailable) unsuccessful.

The desire to understand and explain rather than simply describe immediately ruled out arms-length, large-scale, typically quantitative methods based on naïve realism as these conflate reality with descriptions of reality. Similarly, nominalist approaches using ideographic methods such as single, very in-depth case studies would fail to explain any patterns which occur and thereby limit the generalizability needed to hopefully contribute to practice.

Critical realism provides an alternative by plausibly arguing for an objective reality, interpreted subjectively. Retroductive research strategies are therefore adopted to identify possible generative mechanisms to explain research findings. These subsequently were found to be intransitive powers such as family pressures or broken promises – neither of which have surfaced in previous research in this field and would have been difficult to justify without a stratified ontology and other critical realist ideas. These and other findings are explained in more detail in the Conclusions chapter.

It is also worth stressing that the aim of this thesis (from a supervisory perspective) is primarily *method development*. The application of qualitative comparative analysis methods to small n case-studies with rich narratives is rare and the success or otherwise is believed to be of great interest to the QCA community.

A central theme of both DBA taught modules and subsequent research has been difficulties surrounding the presentation of ideas in the form of dualist extremes. A typical example from Burrell and Morgan is shown in Table 10.

Table 10 The subjective - objective dimension

	Subjectivist	Objectivist
Ontology	Nominalism	Realism
Epistemology	Anti-Positivism	Positivism
Human Nature	Voluntarism	Determinism
Methodology	Ideographic	Nomothetic

(Source Burrell and Morgan 1979)

There are of course 'shades of grey' in between but to venture too far from the extremes suggests relativism as made very clear by Easterby-Smith et al (Table 11). This doesn't appeal as 'to say of something simply that it is relative is uninformative, since everything stands in relation or other to something else' (Mautner 2000, p.206).

Table 11 Methodological implications of different epistemologies

	Positivism	Relativism	Social Constructionism
Aims	Discovery	Exposure	Invention
Starting Points	Hypotheses	Suppositions	Meanings
Designs	Experiment	Triangulation	Reflexivity
Techniques	Measurement	Survey	Conversation
Analysis / Interpretation	Verification / Falsification	Probability	Sense-Making
Outcomes	Causality	Correlation	Understanding

(Source Easterby-Smith, Thorpe et al. 2002)

To be fair, an introductory text on management research can only touch on such matters but these are fundamental issues to a chapter on research design and ones which kept this tyro researcher grappling with for many months.⁵

The intellectual 'light bulb' finally flickered into life on Frinton beach on Sunday, 8 August 2004⁶ when a brief venture into critical theory inadvertently threw up an article on critical realism in information management (Carlsson 2002). Here at last seemed a plausible philosophy which

⁵ Indeed, the subtitle of my first assignment in August 2003 perceptively described myself as 'a positivist struggling with latent constructionist tendencies.'

⁶ If the benefits of a research diary were ever in doubt

happily married the researcher's objective ontological and subjective epistemological worldview. A 'conversion on the road to Damascus' moment occurred which has not been regretted.

The message hasn't got though to Crotty (1998) however who whilst providing an excellent framework for social research makes no reference to critical realist ideas due probably to the almost total focus on matters epistemological rather than ontological. Adding this dimension to his 'four elements that inform one another' (p.1) produces our design framework (Figure 5):

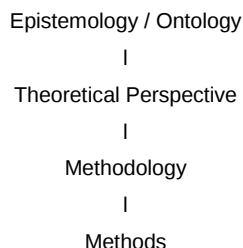


Figure 5 Four elements of social research
(Based on Crotty 1998: 1)

The chapter starts therefore by confirming our chosen theoretical perspective of critical realism and a number of research strategies based on this are discussed including Sayer, Sanghera, Danermark et al, etc. Sayer has continued to provide theoretical underpinning throughout the research project ably supported by Pawson and Tilley's practical approach to realist evaluation.

Although methodologically pluralist, critical realist research lends itself especially well to qualitative data analysis and an inductive, 'grounded theory lite' methodology is proposed and justified. Theoretical sampling, constant comparison and saturation sampling are all outlined and applied during the iterative research phase. Case methods and particularly cross-case comparison are then put forward as means to achieve limited generalization. Casing theory from Ragin and Becker and the qualitative data description ideas from Miles and Hubermann prove of especial benefit.

Finally Ragin's comparative method is introduced as an (allegedly) excellent way to bridge the qualitative / quantitative divide by providing a synthetic approach that uses qualitative variables but formalised processing. QCA appears ideally suited to identifying causal factors by 'providing a robust, combinatorial analysis that accounts for every instance of a phenomenon'.⁷ The development of the mechanics behind qualitative comparative analysis (QCA) is explained in some depth including the vital concepts of necessity and sufficiency. Latest developments in fuzzy-set software and managing distance and time are then reviewed before concluding with thoughts on validity and reliability of the proposed methods from a realist perspective.

⁷ I am also obliged to recognize the contribution the ideas of Charles Ragin have made to this work.

2.2 THEORETICAL PERSPECTIVE (CRITICAL REALISM)

2.2.1 Realist Research Strategies

Andrew Sayer is always a good place to start, and the scope of the proposed research will be 'intensive' as defined by him (1992, p.236) in that we will seek limited generalisation using both concrete and abstract research to link tangible events with intangible mechanisms and events (Figure 6).

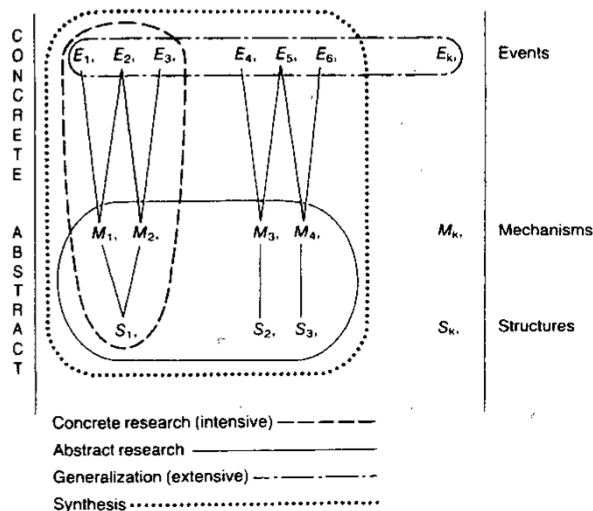


Figure 6 Types of research
(Source Sayer 1992, p.237)

Sanghera (2004) builds on this to suggest that critical realism requires a *retroductive* research strategy involving three steps:

1. Research begins in the domain of the actual, with observed connections between phenomena. The task is to explain why such connections or relations occur.
2. The next step is to postulate the existence of real structures and mechanisms, which if they existed, would explain the relationship.
3. The final step is to try to demonstrate the existence and operation of these structures and mechanisms. The central problem for critical realism is how to establish the plausibility of hypothesised structures and mechanisms given that they are not immediately available to experience.

The construction of hypothetical models requires a disciplined imagination to produce three types of mechanisms:

- Reasonably accessible mechanisms are those that can be uncovered with a modest extension of the senses e.g. Meeting respondents to clarify written survey responses.

- Quasi-accessible mechanisms can be discovered from empirical studies using an analogy from an associated field of study e.g. information flows acting like traffic on congested motorways.
- Inaccessible mechanisms require a combination of reason and imagination, and the use of metaphors, models and analogies e.g. market forces acting like 'an invisible hand'.

The importance of the distinction between *models of* and *models for* is stressed. Some models represent the characteristics of a known object or phenomenon (a model of), while other models speculate on the characteristics of an unknown object or phenomenon (a model for). Critical realists are also careful to differentiate between the subject of a model (what it is intended to represent) and the source of a model (whatever the model has been based in or used to construct it) (Sanghera 2004, p.3). Sanghera proposes a critical realist research strategy consisting of:

- Gather observable information management phenomena and identify any regularity that obtains between them.
- Construct a model of the unobservable structures and mechanisms that may have generated and causally explain the phenomena.
- Test the model by examining its further consequences e.g. by trying to find similar or predictable events in different contexts.

Danermark, Ekstrom et al (2000, p.109) propose a six-stage model of the critical realism research process as a way from the concrete (stage 1) to the abstract (stages 2-5) and then back to the concrete (stage 6). Their model is summarized as:

- Stage 1: Description. Describe the complex and composite events you intend to study using qualitative as well as quantitative methods.
- Stage 2: Analytical resolution. Separate the composite and complex by distinguishing the various components, aspects or dimensions.
- Stage 3: Abduction / theoretical redescription. Interpret the different components from hypothetical conceptual frameworks and theories about structures and relations. Different theoretical interpretations can and should be presented, compared and possibly integrated.
- Stage 4: Retroduction. Identify hypothetical mechanisms and structures that if they exist it would produce the phenomenon.
- Stage 5: Comparison between different theories and abstractions. Elaborate and evaluate the relative explanatory power of the mechanisms and structures described in stages 3 and 4.
- Stage 6: Concretization and contextualisation. The aim here is twofold: first, to interpret the meanings of mechanisms as they come into view in a certain context; second, to contribute to explanations of concrete events and processes.

Abduction means arguing from effects to cause and was originated by Charles Peirce as a key part of his pragmatism theories (Layder 1993). It helps us to understand a phenomenon in a new way by observing and interpreting it within a new conceptual framework to discover new relationships. *Retroduction* is to identify hypothetical mechanisms and structures that if they were to exist would produce the phenomenon.

Mingers (2002, p.35) argues that retroduction is the same as abduction and quotes Habermas here to support his argument. He stresses that the hypotheses themselves do not prove the mechanism exists and there may be competing explanations, so the next step is towards eliminating some explanations and supporting others. Bhaskar summarizes this as description, retroduction, elimination and identification or DREI (1989, p.24)

Pawson and Tilley (1997, p.85) offer an approach that differs slightly from the above. In their 'realist effectiveness cycle', they argue that you should start with theory, then hypotheses, then observations to arrive at an evaluation programme (Figure 7):

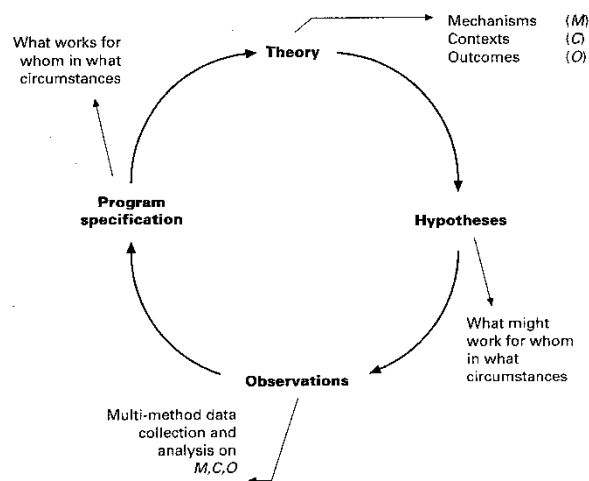


Figure 7 The realist evaluation cycle

(Source Pawson and Tilley 1997, p.85)

Here theories are framed in terms of propositions about how mechanisms are fired in contexts to produce outcomes - this can be done using analogy and metaphor. The second step is to generate hypotheses about what works for whom and in which circumstances. The cycle then turns to observations and the methods of data collection and analysis needed to test the hypotheses. Once hypotheses have been proven, the cycle specifies what works for whom and in what circumstances.

Finally, Wendy Olsen suggests the following research strategy using QCA methods based on the 'Durham Case 2004' ESRC sponsored training course on case study methodologies (Byrne and Olsen 2004a)

- Get 'small n' of cases
- Compare them deliberately
- Use variable types of evidence
- Summarise the intermediate results in a table
- Reduce the table using Boolean logic
 - Look for necessary causes
 - Look for sufficient causes
 - Decide whether the outcome was specified or not
- Iterate – move back and re-do
- Draw conclusions
- Fascinating!

A number of themes arise from the above analysis of critical realist research strategies: small numbers of cases, examined in depth; multiple research methods and/or types of evidence; inductive (then retroductive) analysis and an iterative, recursive research process. These underpin our research design and are used to guide our choice of methodology which is based upon qualitative data analysis and grounded theory.

2.3 METHODOLOGY (GROUNDED THEORY)

2.3.1 Qualitative Data Analysis

Critical realist research lends itself well to qualitative data analysis which Bryman describes as 'a framework that is meant to guide the analysis of data' (1989, p.389). Due to its iterative nature, qualitative data analysis tends to cover strategies of both data collection as well as analysis. This approach supports our aim of theory development and is one of three outlined by Fielding and Lee (1998) shown in Table 12.

Table 12 Forms of qualitative analysis

Type	Method	Objective
Content analysis description	Code and count	Statistical and modelling
<i>Qualitative classification</i>	<i>Code and interpret</i>	<i>Construction of formal theory</i>
Discursive approaches	Delineation of narratives	Cultural interpretation

(Source Fielding and Lee 1998)

An early form of qualitative data analysis was *analytic induction*, a term coined by Znaniecki (1934) to help distinguish between research based on many cases - typically using statistical analysis or surveys - and those who worked with a single or small number of cases. Whilst Znaniecki advocates testing hypotheses, this testing is not through measurement and statistical calculation, but is 'much more iterative and works by a process of case based constant comparison in which hypotheses are continually reformulated in order to develop an adequate overall account of the social process being considered' (Byrne 2004b, pp.35-36).

Analytic induction is an approach to the analysis of data in which the researcher seeks universal explanations of phenomena by pursuing the collection of data until no cases that are inconsistent with a hypothetical explanation of a phenomenon are found (Bryman 1989). It is an extremely rigorous method of analysis because every additional deviant case means further data collection or hypothesis reformulation (deemed the soft option!). Furthermore, the final explanations produced are sufficient but rarely specify all the necessary conditions for a successful outcome. Analytic induction doesn't provide useful guidelines on how many cases need to be investigated which, combined with the extreme rigour of this analysis means formal analytic induction is not often practised in true form since the 1940s or 1950s.

Another reason for an inductive approach is that a researcher interested in inter-disciplinary work in the fields of information management and small business faces the problem that research in this area is in its infancy (Swartz and Boaden 1997). With the absence of theory an inductive methodology is more appropriate and was used in the Aston Studies into organisational structure to:

'... conduct nomothetic studies to produce generalizable concepts and relationships and then conduct ideographic studies moderated by and developed from a generalized framework that can give proper balance to the common and specific aspects of a particular organisation's functioning.' (Pugh 1988)

2.3.2 Grounded Theory

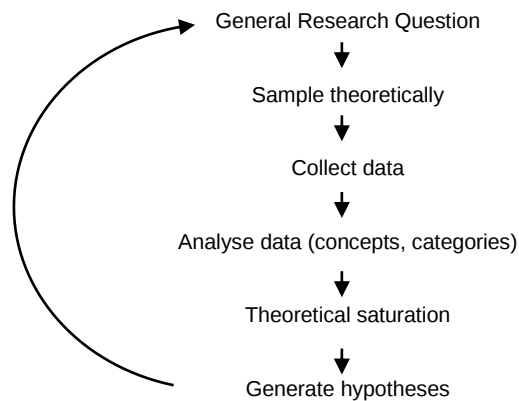
The widely used framework for analysing qualitative data stems from the work of Glaser and Strauss (1967). This has gone through numerous iterations and variants since inception and the most recent incarnation is defined as 'theory that was derived from data, systematically gathered and analysed through the research process. In this method, data collection, analysis and eventual theory stand in close relationship to one another.' (Strauss and Corbin 1990, p. 12)

The approach has two central features: the development of theory from data and an iterative or recursive approach, both of which resonate well with the best practice required of QCA. Another useful concept is that of *theoretical sampling* i.e. 'the process of data collection for generating theory whereby the analyst jointly collects, codes and analyses his data and decides what data to collect next and where to find them in order to develop his theory as it emerges. The process is controlled by the emerging theory whether substantive or formal.' (Glaser and Strauss 1967, p.45).

Theoretical sampling is an ongoing process, not a single step, and is concerned with the refinement of ideas, rather than simply boosting sample size. As such, it differs from statistical sampling which Glaser and Strauss felt was inappropriate to qualitative research. 'Theoretical sampling is done to discover categories and their properties and to suggest the inter-relationships into a theory. *Statistical sampling* is done to obtain accurate evidence on distributions of people among categories to be used in descriptions and verifications' (Glaser and Strauss 1967, p.62). It is important to note that theoretical sampling involves not just people who are being sampled but events and contexts too.

Grounded theory also provides us with the useful concept of *theoretical saturation*. Sampling until you reach theoretical saturation means that a category has been saturated with data i.e. no new or relevant data is emerging regarding a category. The category is then well developed and the relationships among categories are well established and validated (Figure 8).

Proponents of grounded theory argue there is a great deal of wasted effort in statistical sampling. Why bother interviewing x% of the population if you don't need to? Instead grounded theory advocates you 'sample in terms of what is relevant to and meaningful for your theory'. *The key is to sample so as to test your emerging theoretical ideas.*

Figure 8 The process of theoretical sampling

(Source Bryman 1989, p.303)

Coding is another key feature of grounded theory, and we need to differentiate between open, axial and selective coding. *Constant comparison* is another key feature and means 'maintaining a close connection between data and conceptualization, so that the correspondence between concepts and categories with their indicators is not lost.' (Glaser and Strauss 1967, p.391).

The outcomes of grounded theory include:

- Concepts. The labels given to discrete phenomena produced through open coding; the 'building blocks of theory' (Strauss and Corbin 1990, p.101).
- Category. A concept that has been elaborated so that it is regarded as a real-world phenomena. A category may subsume two or more concepts. Research may derive just one core category.
- Properties. The attributes or aspects of a category.
- Hypotheses. Initial hunches about relationships between concepts.
- Theory. 'A set of well developed categories that form a theoretical framework that explains a social phenomenon' (Strauss and Corbin 1990, p.22). There are two levels of theory: substantive and formal. Substantive relates to a certain empirical instance or substantive area; formal to a higher level of abstraction or multiple substantive areas.

Criticisms of grounded theory include that it is impossible not to take own pre-conceptions to start with and the practical difficulties with volume of work, transcriptions, etc. (Bryman 1989). The relevance to this project is clear however and Bryman notes that it is 'striking that one of the main developments of qualitative data analysis in recent years – computer aided qualitative data analysis (CAQDAS) – has implicitly promoted many of these processes, because the software programs have often been written with grounded theory in mind' (Bryman 1990, p.397).

Given the slow movement from positivistic to more inductive methods in information management research (Klein and Myers 1999; Hughes and Jones 2004), it is not surprising that the use of grounded theory in information systems research is a relatively new phenomenon. A usefully summary of the more recent literature (Jones and Hughes 2004) lists twelve uses of grounded theory in information management which range from those concerned with organisational change (Orlikowski 1993) to those concerned with the practical use of the method to inform knowledge based systems design (Galal and McDonnell 1997). For some the full-blown use of the method is important (Pidgeon, Turner et al. 1991) whilst for others it is used to help overcome deficiencies in another research strategy or tailor it to the purposes of their research (Fitzgerald 1997). This is more relevant to our study.

Jones and Hughes (2004) conclude that use of grounded theory in case study research can assist conceptually in the understanding of a problem situation and can also assist with articulation of lessons learned. They stress that it is more concerned with agency than structure and warn however that it can be a very time-consuming method and re-iterate Strauss and Corbin's concerns about 'the need for sensitised, trained and experienced GT researchers' (p.5). Swartz and Boaden (1997) agree and found the method to be complicated and lengthy and simplified their study to that recommended by (Easterby-Smith, Thorpe et al. 2002):

- Familiarization with the data
- Reflection on the data and any themes which emerge
- Conceptualization
- Cataloguing concepts
- Recoding of concepts
- Linking concepts
- Re-evaluation

This process was followed in the research and 'facilitated a synthesis of quantitative and qualitative methods, allowing a return to the case study data to seek clarification of findings; alternatively returning to the quantitative data to generate more macro level data' (Swartz and Boaden 1997, pp.60-61).

2.3.3 Case Study Research

This research also plans to extensively use case studies which Gerring defines as 'the intensive study of a single unit, or a small number of units (the cases), for the purpose of understanding a larger class of similar units (a population of cases)' (2005, p.3). Across a wide range of disciplines, the case study method is thought to provide content validity, excellent training for the researcher's intuition and convergence towards facts using data triangulation.

Case studies are increasingly used as a research strategy (Yin 2002) and they have long been a significant part of management research. 'Case studies have capacity to facilitate understanding of complex phenomena especially when the researcher's focus is on *how* questions and on *why* questions' (Hitt, Harrison et al. 1998, p.167). Yin emphasises this point when he argues for the distinctive power of case studies to help understand complex social phenomena such as organizational and managerial processes (Yin 2002, pp. 3-6).

One major advantage of case study research is argued to be its relevance to management practice (Harrigman 1983) but Byrne (2002) sees 'classic' managerial case-study methods contrasting with that proposed by those working in 'realist' mode. First the concept of a 'case' has been redefined as a whole time-specific conjunction of real structures, within which specific mechanisms work contingently. Secondly, realists are interested in cases at several levels (e.g. firms and individuals) and third, the representation of causal mechanisms within the study becomes part of the researchers' self-conscious interpretation.

Byrne (2006) goes on to argue 'that case based methods are not only superior to the tradition of quantitative explanation using derivatives of the linear model, but that serious consideration of the underlying ontological basis of case based methods, fundamentally challenges the legitimacy of linear based accounts of social causation.' (p.1). His arguments are usefully summarised in Table 13.

Table 13 Modes of description and causal representation of the social

Modes of description		Modes of causal representation			
Quantitative	Qualitative	Quantitative		Qualitative	
Measurement	Text and/or images - sound	Variable based	Case based	Single narrative - ideographic account	Multiple narratives – text based comparison
Descriptive statistics, graphs and classifications		Linear models	Multiple causal configurations		

(Source Byrne 2006)

Generalization from case studies can be a problem yet according to Yin (2002) it is possible to make analytical generalizations derived from case study material where case studies are generalized to theoretical propositions, not to populations. 'The goal of the investigator conducting case studies is therefore to extend and generalize theories (analytic generalization) and not to enumerate frequencies (statistical generalization)' (Oz 2004, p.168). One answer is to do cross-case research which Gerring compares to a single case study in Table 14.

Table 14 Case study vs. cross-case research designs: tradeoffs and affinities

PROPERTY	TRADEOFF	AFFINITY
1. Causal distance	a) Proximal b) Distal	Case study Cross-case
2. Scope of proposition	a) Depth b) Breadth	Case study Cross-case
3. Causal insight	a) Causal mechanisms b) Causal effects	Case study Cross-case
4. Causal strength	a) Strong b) Weak	Case study Cross-case
5. Strategy of research	a) Explanatory (theory generation) b) Confirmatory (theory testing)	Case study Cross-case
6. Population of cases	a) Internal b) External	Case study Cross-case
7. Validity	a) Proximal b) Distal	Case study Cross-case
8. Style of evidence	a) Qualitative b) Quantitative	Case study Cross-case
9. Quasi-experimental evidence	a) For only a single case b) For many cases	Case study Cross-case

(Source Gerring 2005)

Case studies are however labour-intensive and it can be difficult to draw meaning from the vast amounts of information produced especially in the cross-case comparisons advocated by Eisenhardt (1989, p.547). Yin recommends four techniques to help here: pattern matching, explanation building, time-series analysis and program-logic models (2002). Miles and Huberman (1984) concentrate on data reduction, data display, conclusion drawing and verification each of which employs a variety of devices such as tabular displays and graphs. Multiple cases they argue, analyzed with care, can help us answer the question ‘Do these findings make sense beyond this specific case?’. Yin concurs and a multiple case study approach is an adequate research strategy ‘when how and why questions are being posed, when the investigator has little control over events, and when the focus is on a contemporary phenomenon within some real-life context.’ (2002, p.32).

Multiple cases should be considered as multiple surveys not as multiple respondents in a survey as the method of generalization is ‘analytic generalisation’ not ‘statistical generalisation’ (Yin 2002). Crucially, cases do not represent a ‘sample’: *they are generalizable to theoretical propositions and not to populations* (p.375). Stake (1995) distinguishes here between *intrinsic* case research where the case itself is the focus and *instrumental* case research where the case is being used to understand something else. Corroborative case studies are also vital to open systems research methods (Morton 2003) followed by development of explanations (using abductive techniques to identify conditions, structures and causal mechanisms) and corroboration to apply the findings to other settings.

Multiple cases are also advisable when causation is complex (which is more likely to be the rule than the exception) as no single cause is likely to be necessary or sufficient. Researchers therefore need to search for similarities between cases in order to develop typologies and this

means, rather than viewing their cases as instances of the ‘same thing’, researchers differentiate types of outcomes and try to identify causal commonalities within each type, and differences between types’ (Kitchener, Beynon et al. 2002, p.487).

2.3.4 Case Definition

The problem with defining ‘what is a case’ is acknowledged. ‘In short, the term ‘case’ and the various terms linked to the idea of case analysis are not well defined in social science, despite their widespread usage and their centrality to social scientific discourse’ (Ragin and Becker 1992, p.1). Whilst it is tempting to define our case from the outset, the inductive, iterative nature of grounded research means that ‘researchers will probably not know what their cases are until the research, including the task of writing up the results, is virtually completed. What is a case will coalesce gradually, sometimes catalytically, and the final realization of the case’s nature may be the most important part of the interaction between ideas and evidence’ (p.6).

Ragin and Becker address the issues by looking at two case dichotomies. The first is to decide whether *case categories* involve empirical or theoretical categories and this overlaps with philosophical distinctions between realism and nominalism. Realists believe there are cases ‘out there’; nominalists think cases are theoretical constructs that exist to serve the interests of investigators. The second dichotomy is generality of *case conceptions*. Are case definitions specific and developed in the course of research or are they general and relatively external to the research (p.8). They provide a useful conceptual map (Table 15):

Table 15 Case study conceptual map

	Case conceptions	
Understanding of cases	Specific	General
As empirical units	1. Cases are found	2. Cases are objects
As theoretical constructs	3. Cases are made	4. Cases are conventions

(Source Ragin and Becker 1992)

Of these, the most appropriate definition for our research seems to be ‘3’ i.e. that cases are made or coalesce in the course of the research. Our understanding of what a case is will gradually be imposed on empirical evidence as it takes shape in the course of research. ‘The investigation might lead to an identification of an important subset of instances with many common characteristics, which might be conceived, in turn, as cases of the same thing (p.12).

Ragin uses the term ‘casing’ here, and argues that the primary goal of researchers is to link the empirical and the theoretical ‘to use theory to make sense of evidence and to use evidence to sharpen and refine theory’ (p.225). Casing is a key part of this process i.e. producing theoretically structured descriptions of social life and using empirical evidence to articulate

theories by limiting the empirical world in different ways. A case is most often an intermediate product in the effort to link ideas and effort: 'a case is not inherently one thing or another, but a way station in the process of producing empirical social science' (p. 226). Ragin considers cases not as empirical units or theoretical categories, but as products of basic research operations i.e. the process of matching ideas and evidence as a kind of 'inductive formulation'.

Bonnell (1980) agrees and the sifting of cases is usually carried out in conjunction with concept formulation and elaboration. In much comparative case study research, cases are not predetermined but coalesce. Ragin (2000, p.59) argues we should deliberately select positive cases then identify the causal conditions each share. This is often enough in case-study research, but negative cases will also be needed to identify sufficiency conditions which leads us neatly to comparative method.

2.4 METHOD (QUALITATIVE COMPARATIVE ANALYSIS)

2.4.1 The Comparative Method

As discussed in earlier sections, previous attempts to explain successful information management in small business have been mixed. At one extreme are the positivist, quantitative papers that seek similarities across large numbers of surveyed respondents (Thong and Yap 1996). At the other are the interpretivist, qualitative papers that look in depth at one or very few individual examples (e.g. Walsham 1993). Both have flaws.

In the 'large n' variable-orientated approach, cases are aggregated into variables and their distribution analysed. Examination of patterns of variation among variables is used as a basis for making general statements about relations between aspects of cases (Ragin 1987). This conventional impulse to prove causation by gathering data on regularities or repeated events is misguided (Sayer 2000). *What caused something to happen has nothing to do with the number of times we have observed it happening.* Explanation depends instead on identifying the causal mechanisms, how they work, whether they have been activated, and in what conditions.

While the case-orientated approach avoids many of the simplifying assumptions of the variable-orientated approach, it cannot be used to address similarities and differences among many cases due to time issues. Whilst case studies highlight complexity, diversity and uniqueness and provide a powerful basis for interpreting cases, it is very difficult to use this approach to explain more than a few cases at a time. Furthermore, the interpretivist concept-laden approach often limits generalizability.

The quantitative / qualitative divide in social research is also an issue here, elements of which are shown in Table 16.

Table 16 The qualitative / quantitative divide

Feature	Qualitative	Quantitative
N	Very Small	Large
Cases	Known	Anonymous
Selection	Purposeful (MSDO / MDSO)	Preferably random
Relevance	Each case relevant	Outliers ignored
Complexity	High	Low
Causal Patterns	Possibly conjunctural	Correlational
Explanations	Thick	Thin
Predictions	Deterministic	Probabilistic
Validity	Internal	External
Range of Theory	Medium	Wide
Methods	Interpretive	Statistical

(Source Systematic Qualitative Methods, University of Essex, 2005)

Until recently, one of the less obvious consequences of this divide was the inability to provide adequate tools to conduct *small-N* research i.e. from 3-4 cases up to 50-100. Rihoux (2005) describes this as a battle between the 'science of words and science of numbers' and argues that neither qualitative nor quantitative methods are suited to correctly manage small-N cases.

At one extreme qualitative research examines similarities and differences among a limited number of cases; at the other quantitative research looks at relations between variables using samples to approximate large populations. The person widely regarded as originating many of the ideas discussed in this paper, Charles Ragin, calls these *variable-orientated* and *case-orientated* strategies respectively (1987).

In the variable-orientated approach, cases are aggregated into variables and their distribution analysed. Examination of patterns of variation among variables is used as a basis for making general statements about relations between aspects of cases. While the case-orientated approach avoids many of the simplifying assumptions of the variable-orientated approach, it cannot be used to address similarities and differences among many cases due to time issues.

So whilst case studies highlight complexity, diversity and uniqueness and provide a powerful basis for interpreting cases, it is very difficult to use this approach to examine more than a few cases at a time. A common resolution is to combine the two strategies in some way but this often presents inadequate relativist results.

Ragin's answer to this problem is the comparative method. This method uses all available and pertinent data concerning the pre-conditions of a specific outcome by examining their similarities and differences. It does not work with samples or populations, but with all relevant instances of the phenomenon of interest. Ragin argues the comparative method is superior to the statistical method in four respects (1987, p.15).

1. Statistical methods are not combinatorial (i.e. relating to combinations of items selected from larger groups) and typically examine items piecemeal rather than looking at combinations of events,
2. Application of the comparative method produce explanations that account for every instance of a phenomenon,
3. There is no need to test for statistical significance of results,
4. The comparative method forces the researcher to become familiar with the cases investigated.

Ragin argues that social scientists interested in discovery need to relinquish many of the homogenising assumptions that underpin quantitative methods. Instead he argues that researchers should focus on *diversity* instead. Diversity orientated research emphasises difference - especially differences in kind - using a configurational approach to social research.

That is, it treats cases as specific configurations of aspects and features. As such, it is an ideal method to support the grounded theory methodology and critical realist theory which underpins this research.

'When qualitatively orientated comparativists compares, they study how different conditions or causes fit together in one setting and contrasts that with how they fit together in another setting (or how they might fit together in some ideal-typic setting). That is, they tend to analyze each observational entity as an interpretable combination of parts – as a whole. Thus, the explanations of comparative social science typically site convergent causal conditions, causes that fit together or combine in a certain manner.' (Ragin 1987, p.14)

Much of the comparative method is based on John Stuart Mill's theory of 'chemical causation' (Mill [1843] 1967), and the concept of *multiple conjunctural causation* is important. The idea here is that phenomenon emerge from the intersection of appropriate conditions i.e. the right ingredients for change. The absence of any condition, or indeed the addition of other conditions that negate others' mean that the phenomenon or change does not emerge. 'This conjunctural or combinatorial nature is a key feature of causal complexity' (Ragin 1987, p.25) and has clear parallels with the *emergence* in realist philosophy e.g. 'situations in which the conjunction of two or more features or aspects gives rise to new phenomenon, which have properties which are irreducible to those of their constituents, even though the latter are necessary for their existence' (Sayer 2000, p.12).

There are those who disagree with the comparative method and argue that quantitative methods are capable of explaining qualitative issues. King, Keohane and Verba (KKV) (1994, pp.75-91) disagree that quantitative research is merely descriptive, and argue that 'at its core, real explanation is always based on causal inferences'. Any failure to explain is not due to poor research or lack of imagination, but the nature of the difficult and significant problems in the data they are researching. 'Good description of important events is better than bad explanation of anything' (p.75).

For KKV, the definition of causality is crucial. They define causality as 'a *theoretical* concept independent of the data used to learn about it. Subsequently we consider causal *inference* from our data.' (p.78 original emphasis). They go on to look at different types of causality including the *causal mechanisms* proposed in critical realism, but dismiss these as being impossible to measure using their techniques due to problems with infinite regress. They find the idea of *multiple causality* more useful, and using Ragin's definition describe this as 'the phenomenon under investigation has alternative determinants' (Ragin 1987, p.42). KKV acknowledge that the same outcome can be caused by combinations of different independent variables, but argue that they can manage this providing the counterfactual conditions are specified to avoid 'omitted variable bias' (p.86).

Ragin replies to them in Brady and Collier criticising their need for large samples and a lack of attention to the case (2004, p.134). He counters their multiple causality argument by showing how a Boolean statement which requires a condition to be present in some cases but absent in others could, even with controls in place, result in no relationship (Pearson's r of 0) using traditional quantitative analysis of the bi-variate relationship.

But the comparative method and the critical realist philosophy which support it have far wider implications for small business and information management research. Rihoux (2005) suggests it can add value to such research by:

- Enabling the analysis of more than a few cases at a time thus enabling a certain amount of generalization.
- Enabling a controlled observation of cases by careful selection and grading of conditions.
- Using the conception of causality to logically manage complexity.
- Reducing complexity by identifying causal regularities (prime implicants) which can be expressed without reproducing all potential explanatory variables.
- Combining holistic (each case is treated a whole) and analytic (each case is sliced into variables) perspectives.
- Encompassing qualitative (differing by nature) and quantitative (differing by degree) phenomena.
- Allowing replication through formal Boolean analysis and transparent methods.
- Providing simplicity and accessibility by avoiding complex statistical processes.
- Offering different uses including data description, theory development and hypothesis testing.
- Supporting different fields of research including politics, public policy and management.

Miles and Huberman (1994, p.40) are also advocates of the comparative method, and argue it represents a good method of cross-case analysis. They stress that researchers need to understand case dynamics and the effects of key case attributes or variables, and that the comparative method '... does this: you can analyze multiple cases, using key variables, preserving their configurations case-by-case' (1994, p.208). They believe researchers should be interested in exploring causal relationships, and strongly support iterative display and analysis to do this.

2.4.2 Literature Review: Previous Relevant QCA Work

Interest in the comparative method has been growing steadily and there are now numerous studies listed on the Compasss web site (www.compasss.org) dedicated to QCA research. The majority of papers are however in the field of retrospective, macrosocial political science

(Coverdill and Finlay 1995; Kompier, Cooper et al. 2000; Kitchener, Beynon et al. 2002). However, as Miles and Huberman state 'QCA clearly has the potential to go beyond the historical and cross-national contexts originally envisaged by Ragin' (1994, p.162) and there are encouraging signs that these ideas are being used in other fields too.

Management and business papers are still few and far between but examples include organisational configurations (Fiss 2004), entrepreneurial traits (Bell and Loane 2003) and employee representation on boards of directors (Jackson 2005). An early example of work investigated the 'configuration of attributes' affecting post-acquisition performance in US firms (Hitt, Harrison et al. 1998) and the results were sufficiently positive that QCA was encouragingly seen as 'an inductive method allows unknown attributes and groupings to emerge and permits a better understanding of complex phenomena' (p.93). A recent paper reviews the application of Boolean and fuzzy-logic methods to analyze multiple case study evidence in management research (Oz 2004). It quotes a number of examples of this which are of some interest, but perhaps the most relevant of which is an analysis of the reasons for, and obstacles to, adopting new technologies in small Italian manufacturing firms (Panizzolo 1998).

A particularly useful paper comes from Befani and Sager (2005) who explicitly link QCA with the CMO ideas of Pawson and Tilley to evaluate the Swiss Environmental Impact Assessment. They identify a number of similarities between QCA and realistic evaluation as proposed by Pawson and Tilley.

The first is *complex causation* and both assume that social phenomena have multiple and conjectural causes. 'the relationship between causal mechanisms and their effects are not fixed, but contingent. Context matters because it turns (or fails to turn) causal potential into causal outcome' (Pawson and Tilley 1997, p.69). Similarly Ragin 'What makes a certain feature ... causally relevant in one setting and not another is the fact that its causal significance is altered by the presence of other features.' (Ragin 1987, p.49)

The second is a *generative perspective* and Pawson and Tilley argue that sectioning cases into mere sets of independent variables mean that statistical methods (which look at variables and correlations) miss out on the singularity and wholeness of each case. QCA ensures that the 'trajectory' or path of each case is interpreted individually, thereby taking into account its historicity and its specific features. (De Meur and Rihoux 2002)

The third similarity is *theory driven observation*. Pawson and Tilley emphasise the importance of building on theory in determining the focus of an evaluation 'It is high time we looked again at the potential for an application of 'theory' to settle the issues by focusing and prioritizing inquiry' (p.159). For QCA, theory is a tool to select important conditions / variables which are not real causes, but mere representations of them and the knowledge about the causes must be ground

in theoretical frameworks. De Meur & Rihoux (2002, p.27) also stress theory as well as insights from previous studies.

Finally, *limited generalisation* and Befani limits findings to Middle range theory (Merton 1968). While an empirical test of specific programme outcome theories is well possible it ought not to be the aim of empirical research 'rather the task is to test, refine and adjudicate middle-range theories.' (Pawson and Tilley 1997, p.124)

Another paper relevant to this project uses the approach to interview analysis (Rantala and Hellstrom 2001). They are positive about the use of QCA to support interpretive work, but stress the importance of the construction of the statements and truth table and the need for close association with the data from the beginning. A rare paper using constructivist and fuzzy set approaches finds that QCA '... allows for the easy formalization of qualitative research, it provides a close link between theory and data analysis, is applicable where the number of cases is limited, and recognizes the importance of context and possible interdependencies among conditions.' (Hage 2005, p.28)

2.4.3 Qualitative Comparative Analysis (QCA) Explained

The technique Ragin proposes as a way to help understand this complexity is known as qualitative comparative analysis or QCA. Although relatively new to social sciences⁸ the classic logic, truth tables and set theory at work in the QCA 'Black Box' go back a long way. Gottfried Leibniz in the seventeenth century dreamt of a simple language of 0s and 1s, and provided much of the classic logic and truth table theory. George Boole later turned this dream into reality through Boolean algebra. John Venn was another who's ubiquitous diagrams prove invaluable in helping understand simple QCA logic. More recently, Willard Quine provided the algorithms that power much of QCA software.

Qualitative comparative analysis uses Boolean algebra in a truth table to help understand causal complexity. In Ragin's (1987) work, he uses 'crisp' sets of data i.e. a dichotomous set where an object is either in or out of a set and can therefore be expressed as a binary variable with two values '1' or '0'. Recent advances have enabled multiple value and fuzzy set approaches to overcome this restriction, but crisp sets are used for the below simple illustration.

Converting qualitative characteristics into Boolean algebra allows us to manipulate them in a number of ways. We typically write a condition in uppercase if is present and lowercase if not. Supposing we had only two cases with combinations of three conditions – A.b.C and A.B.C. – and both led to successful outcome Z, then we could write the Boolean formula (where '+' means logical 'OR' and '.' means logical 'AND') as:

⁸ Ragin's first book in this field was published in 1987

$$A.b.C + A.B.C = Z$$

Logical minimisation says that if outcome Z occurs no matter whether B is present or not, then it is irrelevant and can be removed. The formula can therefore be reduced to:

$$A.C = Z$$

As Ragin (1987, p.93) puts it: *'If two Boolean expressions differ in only one causal condition yet produce the same outcome, then the causal condition that distinguishes the two expressions can be considered irrelevant and can be removed to create a simpler, combined expression.'*

Until recently the computing power required to manage such calculations was not available. Just three conditions means there are eight possible zones (2^3) that cases could reside in and by joining cases together (using logical 'AND' 'OR' 'NOT') we can create new objects and even at this level have 256 possible combinations (2^8) to cope with. It is these combinations that create the complexity encountered in the real world, but with QCA techniques and supporting software we can try to explain this.

Qualitative comparative analysis can be conducted using a five step procedure (Rihoux, 2005):

Step 1. Qualitative Description Of The Cases. Rihoux regards this phase as indispensable for both intrinsic value and to gauge the richness and complexity of individual cases. Ragin concurs and stresses the need for familiarity with the theory, literature and 'most important of all, the relevant cases'. (Ragin 1987)

Step 2. Data Reduction To A Set Of Binary Variables. We need to choose one outcome and a number of characteristics / variables / conditions / causes. The number of variables is best between three and nine. Multiple value variables can be managed using MVQCA or FS/QCA (see below) but multiple outcomes can only be managed by creating separate truth tables. The choice of variables and their dichotomisation must be both theoretically and empirically informed.

Step 3. Produce Quality Truth Table. Transforming a table of dichotomised data into a truth table (list of types of configurations) is easily done using QCA software, and allows a much clearer picture of the data. A quality truth table must be free of contradictions, and is often useful to highlight non-observed cases (remainder or logical) cases.

Step 4. Run Boolean Minimisation. This removes redundant conditions to reduce the cases to a number of prime implicants. Logical remainders may be included to

make the final terms as short as possible. We always have to perform four analyses – minimising successful configurations with and without remainders, and minimising unsuccessful configurations with and without remainders.

Step 5. Interpretation of Minimal Formula. The results need to be interpreted and this will usually require the researcher to return to both the theory and the cases. The process will probably need repeating before an acceptable result is obtained and repeated iteration between data, theory and cases is a key feature of the QCA method.

QCA is a *synthetic approach* that uses qualitative variables but formalised processing. As such, it belongs both to the quantitative world in terms of its methods and the qualitative approach in terms of its goals. Rihoux argues that it tries to reconcile both methods, but remains modest in terms of generalisation by moving beyond single-case description but rejecting 'grand theories' (2005). It is important to remember that QCA does not try to identify a *unique* causal model, but instead determine the number and nature of different models of causality that are at work in comparable cases (Ragin 1987).

2.4.4 The Development of QCA Techniques and Supporting Software

QCA can be processed manually but the routine, repetitive nature of Boolean minimisation lends itself perfectly to computer processing. The first such program was 'QCA' - a DOS-based application based on the Quine algorithm written by Ragin and colleagues which permits only dichotomous coding and processing. This weakness was overcome using Multi Value QCA (MVQCA) software created by Lasse Cronqvist which has technical and conceptual advantages over crisp or dichotomous QCA. Its main use is to reduce the number of contradictory cases by permitting a *range* of ordinal variables (e.g. High, Medium, Low) instead of dichotomous '0' or '1'. This feature has to be used sparingly however, or it will produce 'individuality' of cases with limited common combinations of features.⁹

Unlike FS/QCA which initially used fuzzy set scaled variables with probabilistic tests to avoid dichotomous measurements (Ragin, 2000), MVQCA retains the original objective of producing a parsimonious solution: 'The solution contains one or more *implicants* which each cover a number of cases with this outcome, while no cases with different outcomes are explained by any of the implicants' (Cronqvist 2005, p.2). MVQCA uses the ideas of Multi-Value Logic Synthesis developed by electronic engineers at Berkeley University (Brayton and Khatri 1999). The software Cronqvist has created to perform these calculations is called 'Tosmana' (Tools for Small n Analysis) and helps by grouping these values into sets by using a 'Threshold Setter' to choose and evaluate appropriate ordinal thresholds.

⁹ As seen in our subsequent research.

Ragin (2000) has gone on to develop his ideas further by using fuzzy set techniques to replace dichotomous sets. Fuzzy sets define membership in the interval between zero and one whilst still relating to qualitative states, and make it 'possible to extend and deepen diversity-orientated research strategies' (p. 5). Fuzzy sets combine qualitative and quantitative assessment in a single instrument in that there are two qualitative states: fully in (1) and fully out (0), but there can have any number of states in between and a cross-over point of (.5). Fuzzy sets also provide tools for the assessment of set-theoretical relationships - critical to managing causal conditions. 'A fuzzy set is much more than a continuous variable because it is much more heavily infused with theoretical and substantive knowledge. A fuzzy set is more empirically grounded and precise than the conventional variable.' (p.7) and transforms rankings relative in nature to ones that show degree of membership in a well defined set.

Whilst MVQCA still uses crisp sets for analysis, in FS/QCA the boundaries of the set become blurred. Initially FS/QCA used probabilistic numbers and therefore needs to work on larger numbers of cases to produce reliable results. As a rough guide MVQCA works well up to 50 cases, FS/QCA from 30 upwards; either can be used in the 30 to 50 range (Cronqvist and Herrmann 2005). Others have used FS/QCA in smaller studies however (Jackson 2005) and are adamant it retains adequate detail.¹⁰

Another difference is that FS/QCA use *continuous scales* not *ordinal data*. The scales are of equal grade and because it is probabilistic, FS/QCA looks for necessary and sufficient causes. To change ordinal data thresholds, adjustments to the probability threshold (e.g. 60%) and probability of error (e.g. 5%) are required to adjust the result's sensitivity. Ragin proposes a six-step process for designing fuzzy membership sets (2000, p.166):

Step 1. Specify the relevant domain of assessment. This is broadly small businesses demonstrating successful information management events.

Step 2. Define the fuzzy sets that follow from the concepts guiding the investigation. Each case's degree of membership of a set, not its position on a continuum e.g. degree of membership of 'owner manager is actively supportive'.

Step 3. Determine the type of fuzzy set that is feasible for each concept e.g. three, five or seven value schemes. Five is probably preferred if linked to a Likert scale.

Step 4. Determine the likely range of fuzzy membership. Unlike statistical methods using central tendency and a mean, the fuzzy set crossover point of 0.5 is conceptual and can be set where best to calibrate the range.

¹⁰ This assertion is questioned in the third phase of our research.

Step 5. Identify appropriate empirical evidence for indexing fuzzy membership scores. These may be individual variables or a combination that best fits the set.

Step 6. Translate empirical evidence into scores. Here we establish connections between the case evidence and the fuzzy membership scores.

Ragin originally bypassed the problems with dichotomous causal conditions by developing an algorithm for analyzing configurations of fuzzy-set memberships that bypassed truth table analysis. While remaining true to fuzzy-set theory by using the containment or inclusion rule it failed to use many of the analytic strengths found in truth tables e.g. the ability to explore the impact of differing simplifying assumptions to reduce complexity. This all changed in 2006 when FS-QCA moved back to truth-table analysis due to three main pillars (Ragin 2006):

- The *direct correspondence* that exists between the rows of a crisp truth table and the corners of the vector space defined by fuzzy set causal conditions.
- The assessment of the *distribution of the cases* across the logically possible combinations of causal conditions i.e. the distribution of cases within the vector space. Some corners may have many cases with strong membership, others none.
- The fuzzy set assessment of the *consistency of the evidence* for each causal combination with the argument that it is a subset of the outcome.

The formula for consistency is provided by:

$$\text{Consistency } (Xi \leq Yi) = \sum(\min(Xi, Yi)) / \sum(Xi)$$

Where 'min' indicates the selection of the lower of the two values, Xi represents the membership scores in a combination of conditions, and Yi represents membership scores in the outcome. Once these are in place it is possible to construct a truth table summarizing the results of fuzzy set assessments and then to analyse this truth table using Boolean algebra.

Ragin (2007) went on to introduce a new technique which constructs a conventional Boolean truth table from fuzzy-set data but which 'takes full advantage of the gradations in set membership central to the constitution of fuzzy sets and is not predicated upon a dichotomisation of fuzzy membership scores' and is 'superior in several respects to the one sketched in Fuzzy-Set Social Science' (p.22). This method is described below with relevant screen shots for illustration from this research project.

1. Create a data set with fuzzy-set membership scores. The framework provided works best when the 0.5 membership score and membership scores close to 0.5 are used sparingly.
2. Input the fuzzy-set data into FS/QCA version 2.0 dated June 2006 or later.

The screenshot shows the 'FS/QCA Data Sheet' window. It contains a table with 19 rows (cases) and 10 columns (variables). The variables are: company, obj, mgt, res, user, prov, mkt, int, ext. The data is as follows:

Case	company	obj	mgt	res	user	prov	mkt	int	ext
1	Ins Broker (1)	0.83	0.83	0.83	0.83	0.67	0.67	0.83	0.67
2	Ins Broker (0)	0.17	0.33	0.33	0.67	0.33	0.33	0.17	0.33
3	Engineering B (1)	0.83	0.67	0.67	0.83	0.83	0.67	0.67	0.67
4	Engineering B (0)	0.67	0.5	0.33	0.17	0	0.33	0.33	0
5	Hotel (1)	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67
6	Hotel (0)	0.33	0.33	0.17	0	0	0.33	0.17	0
7	Surveyors (1)	1	0.67	0.67	0.67	1	0.67	0.67	0.67
8	Surveyors (0)	0.17	0	0.33	0.83	0	0.33	0	0
9	Retail (1)	0.83	0.67	0.67	0.83	0.83	0.67	0.67	0.67
10	Retail (0)	0.17	0.33	0.33	0.33	0	0.33	0.17	0
11	Charity (1)	0.83	0.67	0.83	0.83	1	0.67	0.67	0.67
12	Charity (0)	0.17	0.33	0.17	0.33	0.17	0.33	0.17	0.17
13	Engineering A (1)	1	0.67	0.83	0.67	0.67	0.67	0.67	0.67
14	Engineering A (0)	0.33	0.33	0.33	0.33	0.33	0.17	0.33	0.17
15	Finance (1)	0.67	0.83	0.67	1	1	0.67	0.67	0.67
16	Finance (0)	0.33	0.17	0.33	0.33	0.33	0.33	0.17	0.33
17	Show B (1)	0.83	0.33	0.67	0.83	0.83	0.67	0.33	0.67
18	Show B (0)	0.17	0.33	0.17	0.33	0.17	0.17	0.17	0.17
19	Marl (1)	1	0.83	0.67	0.67	0.83	0.67	0.67	0.67

Figure 9 FS/QCA data sheet (FS/QCA v2.0)

3. Select preliminary causal conditions (best numbered between three and eight). Combine causal conditions into 'macro-variables' to reduce the number if too many.
4. Create a truth table by specifying the outcome and causal conditions (Analyze, Fuzzy Sets, Truth Table Algorithm). The resulting table will have 2^k rows reflecting the different corners of the vector space. For each row the program reports the number of cases with greater than 0.5 membership in the vector space corner. Two columns to the right of number is consistency, the measure assessing the degree to which membership in that corner is a subset of membership in the outcome.

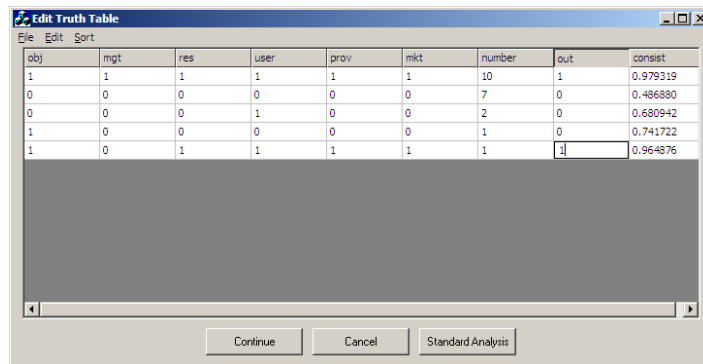
The screenshot shows the 'Edit Truth Table' window. It contains a table with 22 rows and 10 columns. The columns are: obj, mgt, res, user, prov, mkt, number, out, consist. The data is as follows:

obj	mgt	res	user	prov	mkt	number	out	consist
1	1	1	1	1	1	10		0.979319
0	0	0	0	0	0	7		0.486880
0	0	0	1	0	0	2		0.680942
1	0	0	0	0	0	1		0.741722
1	0	1	1	1	1	1		0.964876
0	0	0	0	0	1	0		0.736721
0	0	0	0	1	0	0		0.884211
0	0	0	0	1	1	0		0.890729
0	0	0	1	0	1	0		0.789062
0	0	0	1	1	0	0		0.890728
0	0	0	1	1	1	0		0.896552
0	0	1	0	0	0	0		0.795000
0	0	1	0	0	1	0		0.795511

Figure 10 FS/QCA truth table (FS/QCA v2.0)

5. Select a frequency threshold to apply. With only 22 cases the threshold was set at 1 and all rows with 0 cases were removed using the Edit, Delete Current Row to Last option. This leaves 5 rows.
6. Select a consistency threshold to determine causal combinations that are subsets of the outcome from those that are not. In general, values below 0.75 indicate substantial inconsistency. Sort on the consistency column to determine full range if appropriate.

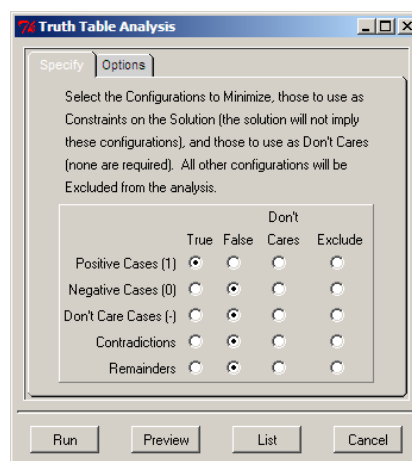
7. Input 1s and 0s into the outcome column. Enter a value of 1 where the consistency is equal or greater than the threshold value selected in the previous step. Enter a 0 where it is less.



obj	mgt	res	user	prov	mkt	number	out	consist
1	1	1	1	1	1	10	1	0.979319
0	0	0	0	0	0	7	0	0.486880
0	0	0	1	0	0	2	0	0.680942
1	0	0	0	0	0	1	0	0.741722
1	0	1	1	1	1	1	1	0.964876

Figure 11 Truth table edit for consistency (FS/QCA v2.0)

8. Click the Standard Analysis button to provide two solutions. The complex solution where remainders are set to 'false' and the parsimonious solution where remainders are set to 'don't care'. These should be viewed as the two endpoints of a complexity / parsimony continuum (Ragin and Sonnett 2006).



Specify Options

Select the Configurations to Minimize, those to use as Constraints on the Solution (the solution will not imply these configurations), and those to use as Don't Cares (none are required). All other configurations will be Excluded from the analysis.

	True	False	Don't	Exclude
Positive Cases (1)	☒	☐	☐	☐
Negative Cases (0)	☐	☒	☐	☐
Don't Care Cases (-)	☐	☒	☐	☐
Contradictions	☐	☒	☐	☐
Remainders	☐	☒	☐	☐

Run Preview List Cancel

Figure 12 FS/QCA truth table analysis (FS/QCA v2.0)

Consistency and coverage are simple descriptive measures for evaluating the strength of empirical support for theoretical arguments describing set relations. Set-theoretic *consistency* assesses the degree to which the cases sharing a given condition or combination of conditions agree in displaying the outcome in question. That is, consistency indicates how closely the subset relation is approximated. Crisp set consistency is simple to measure e.g. if 17 out of 20 cases displayed a cause or causal combination also display the outcome the proportion consistent is 0.85. Ragin recommends that scores above 0.75 are needed to be substantive.

Set theoretic *coverage*, by contrast, assesses the degree to which a cause or causal combination 'accounts for' instances of an outcome. When there are several paths to the same

outcome, the coverage of any given causal combination may be small. Thus, coverage gauges empirical relevance or importance. Coverage is distinct from consistency and the two often work against each other because high consistency may yield low coverage. It is reasonable to calculate coverage only after establishing that a set relation is consistent.

Cronqvist and Herrmann (2005) provide advice on which method to choose and argue that a researcher who wants to avoid causal explanations which cover only a limited number of cases, which are not complete or not parsimonious should choose the method according to two parameters a) size of overall dataset and b) the importance with which cluster information contained in the raw dataset needs to be preserved. They recommend that QCA or MVQCA is used for small-n situations where there the need to preserve rich, raw data is limited. The opposite holds true for FS/QCA which is best for analysing comparatively large datasets where there is a need to preserve rich cluster information.

In this research, two software applications have been used. In later stages Ragin's probabilistic FS/QCA software was used to try to overcome fragmented results produced by the Boolean synthesis used in QCA and MVQCA. In the initial phases however Tosmana software (TOols for SMAll N Analysis) was used which uses dichotomous and multichotomous coding and Boolean reduction. Tosmana (Cronqvist 2005) was meant to be implementation of multi-valued variables into QCA, but as the software developed further developments were pursued. At present, the Tosmana project is divided into three major parts. The core of the application provides the 'engine' for the synthesis of Boolean data sets for qualitative comparative analysis whilst additional features now provide help to edit and classify data and visualize output.

Tosmana is appropriate to this study in that it was the only software application which permitted the multiple value qualitative comparative analysis needed to identify combinations of causal conditions in rich case study data. Using dichotomous QCA would have been far too restrictive. Fuzzy Set QCA provided greater flexibility but sacrificed Boolean logic and, using probabilistic methods, only really works with a large number of cases.

2.4.5 The Concepts of Necessity and Sufficiency

Ragin argues that the primary goal of social science is to try to identify necessity and sufficiency in causes or combinations of causes (2000). The study of *necessity* works backwards from instances of an outcome and is a search for common antecedent conditions. The study of *sufficiency* works forwards from instances of a causal condition (or combinations of causal conditions) to see if these instances agree in displaying the outcome.

Ragin outlines the possibilities here as part of his fuzzy set analytic strategy (2000, p.96) using simple cross-tabulations (see Table 17). The test of necessity involves only the first row of the

table and the critical question is whether there are any instances where the outcome is present but the cause is absent. If there are, then the test for necessity fails.

Table 17 Necessary and sufficient cross-tabulations

NECC AND SUFF	Cause Absent	Cause Present	NECC NOT SUFF	Cause Absent	Cause Present
Outcome Present	No Cases	Cases	Outcome Present	No Cases	Cases
Outcome Absent	Not Relevant	No Cases	Outcome Absent	Not Relevant	Not Relevant

SUFF NOT NECC	Cause Absent	Cause Present	NOT SUFF NOT NECC	Cause Absent	Cause Present
Outcome Present	Not Relevant	Cases	Outcome Present	Cases (1)	Cases (2)
Outcome Absent	Not Relevant	No Cases	Outcome Absent	Cases (3)	Cases (4)

(Source Ragin 2000)

The test for sufficiency lies in the second column and the critical cell here is where the cause is present but the outcome is present. If there are instances of the cause without the outcome the test for sufficiency fails.

In complex open systems it is rarely this easy, especially with necessary causes which rarely exist or causes which only become sufficient when acting together. Fortunately the above rules apply equally for *combinations of causes*. The problem then becomes that different combinations of causes might produce the same outcome and Ragin's preferred analytic strategy therefore is to examine the sufficiency of combinations of causal conditions.

When a causal combination is *necessary* for an outcome, all instances of the outcome should exhibit the same combination of causal conditions. When a combination is *sufficient* for an outcome, all instances of the causal combination should be followed by the outcome in question. In these cases, the key cell for assessing necessity is where the outcome is present and the causal combination absent (no cases) and for sufficiency where the causal combination is present and the outcome is absent (no cases).

The above can be achieved by grading causal conditions on the extent of their membership of fuzzy sets and then manipulating them using Boolean algebra. When a causal condition is necessary but not sufficient, instances of *the outcome will form a subset of the instances of the causal condition*. This means that the Boolean value of the outcome will always be less than the Boolean value of the cause. It puts a 'ceiling' on an X-Y plot (Figure 13).

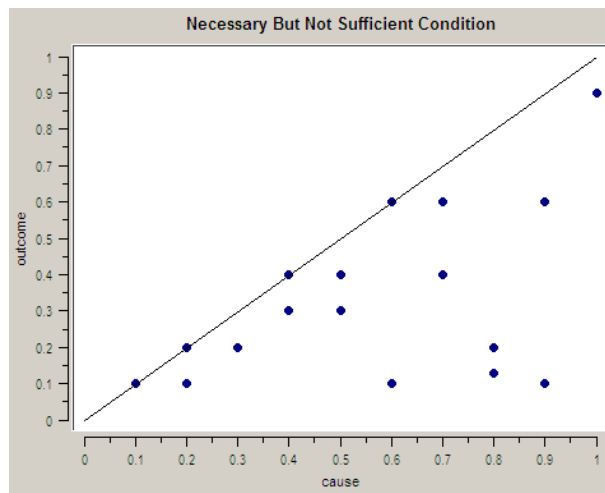


Figure 13 Necessary but not sufficient condition

The rules apply to both single multiple necessary conditions and multiple necessary conditions 'Just as a case's degree of membership in a single necessary condition sets its ceiling on its degree of membership of the outcome, degrees in membership in the intersection of jointly necessary conditions sets a combined limit' (Ragin 2000, p.223). Adding more conditions moves the plots to the left i.e. nearer the diagonal as you keep adding to the minimum. You never get to an exact diagonal due to causal complexity which makes it impossible to identify all the relevant causes, measurement error and problems with randomness.

To overcome precision problems, Ragin suggest you can add an 'adjustment factor' of one fuzzy set measurement. This effectively shifts the diagonal line up and to the left ($y_i \leq x_i + 0.1$). This is not used to simply make a better fit, but justified by appropriate interpretive analysis. Researches can then use probabilistic criteria to 'undergird' assessments of necessity and sufficiency (p.227) or measures of consistency and coverage.

When a causal condition is sufficient but not necessary, instances of the causal condition will form a subset of the instances of the outcome. The same subset principles apply i.e. if the membership scores of the cause are less than or equal to the membership scores in the outcome there is a *floor* on the outcomes (Figure 14) (Kent 2005).

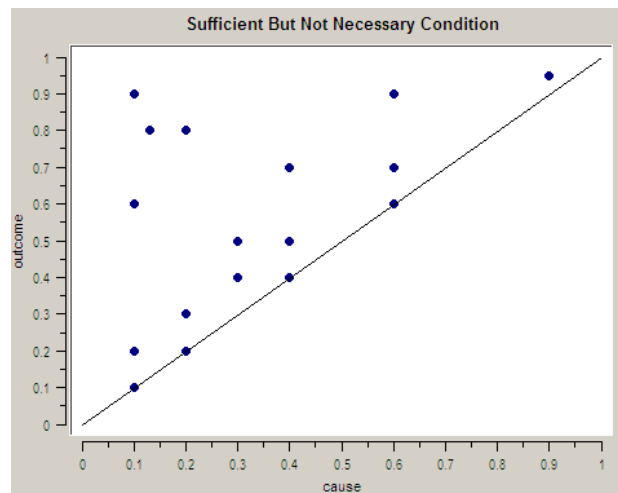


Figure 14 Sufficient but not necessary condition

Researchers can use probabilistic techniques and adjustments to compensate for errors. In crisp set analysis the researcher examines all possible selections of the independent variables then uses veristic or probability methods to justify a sufficiency verdict. Causal combinations are vital again. 'When causation is complex, causes tend to be sufficient in combinations. The best way to study causal complexity is to assess the sufficiency of combinations of causal conditions drawn from the researcher's property space for an outcome.' (Ragin 2000, p.230).

2.4.6 Distance and Time: Techniques to Manage Complexity

A frequent complaint of QCA is that of 'small number of cases, high number of variables' ((Hitt, Harrison et al. 1998, p.1). Schneider and Wagemann agree and argue that proximate and remote factors require separate analyses. 'Without any doubt, this kind of result is highly complex, making theoretically meaningful interpretations difficult' (sixteen causal paths, nine components)' (2006, p.34). The authors believe that the difference between remote and proximate factors can be generalised as delineating a continuum. First, remote factors are stable over time which is why they are also often referred to as structural factors or simply the context. Second, origin is also remote on the time and/or space dimension from the outcome explained in most cases. 'Third, as a consequence, remote factors are (almost) completely outside of the reach of the conscious influence of present actors and, thus, contexts and histories are treated as exogenously given to the actors.' (p.15) In contrast, proximate factors vary over time and are subject to changes introduced by actors - they are the products of human actions.

These ideas of proximity are developed in two-level theory (Goertz and Mahoney 2005) which 'offers explanations of outcomes by conceptualising causal variables at two levels or analysis that are systematically related to each other' (p.496). The first or basic level represents the core of the theory and focuses on the central causal conditions and main outcome under investigation. The second level focuses on causal conditions at a less central level of aggregation which 'are also causes of the main outcome under investigation but their effects

cannot be understood independently of their relationship with the causal factors at the basic level' (p.498).

Like much qualitative and comparative work, two-level theory uses variables (or conditions) and the way they are related to build theory. There are two most common forms of these structures. The first is a set of causal factors that are *individually necessary and jointly sufficient* for an outcome. The authors call this structure a *conjuncture of necessary causes* to reflect the fact that a combination of necessary causes is sufficient to produce an outcome and can be specified using logical AND. The second is a set of causal factors that are *individually sufficient but not necessary* for an outcome. This structure is called as *equifinality* meaning that various conditions are sufficient and therefore there are multiple paths to the same outcome (Ragin 1987) which can be specified as logical OR. This is also referred to as the 'INUS' approach to causation (Mackie1980). An INUS cause is neither individually necessary nor individually sufficient for an outcome. Different combinations may be sufficient and multiple causal paths may lead to the same outcome e.g. equifinality or multiple, conjunctural causation (Ragin 1987).

In two-level theory, we not only have to consider how structures relate at each level but also how second-level conditions relate to basic level conditions and Goertz and Mahoney (2005) stress the need to grasp the structure of the relationship between basic and secondary levels before the theory as a whole can be evaluated. They propose three possible theoretical relationships using the idea of necessary and sufficient conditions to understand each:

1. Ontological Relationship. Where conditions in the secondary level *define or constitute* causal variables at the basic level i.e. they are not indicators, but literally constitute basic level phenomena. Traditionally this relationship has been defined by secondary level conditions that are *necessary and sufficient* for the existence of basic level condition (p.499).
2. Substitutable Relationship. Where conditions at the secondary level are different ways by which it is possible to arrive at basic level states i.e. alternative means of achieving the same ends. A substitutable relationship refers to a set of secondary level conditions that are *individually sufficient but not necessary* for the presence of a given basic level condition.
3. Causal Relationship. Where conditions in the secondary level relate to causal conditions in the basic level (causes of causes). A causal relationship might be characterised by *either necessity or sufficiency including complex combinations of the two*.

Because two-level theories have not been systematically considered in the literature, the authors provide a system of symbols proposed to represent different relationships (Table 18).

Table 18 Relationships from the secondary level to the basic level

Relationship	AND (*)	OR (+)	Symbol	Temporal Priority
Substitutability	No	Yes	➤	No
Ontological	Yes	Yes	=====	No
Causal	Yes	Yes	➔	Yes
Conjunction of necessary causes	No	Yes	➔➔	Yes
Non-causal conjunction of necessary causes	Yes	No	➤.....	No
➔ means a causal relationship;; ===== means an ontological relationship;➤ means a substitutable relationship				
Boldface characters are used for basic level variables. Normal characters are used for secondary level variables.				

(Source Goertz and Mahoney 2005, p.507)

Two level theories hint at another key issue for QCA, that of 'time'. One of the most frequent complaints levelled at QCA is that it assumes the equivalence of conditions and does not recognise their temporal sequence. Incorporating time within QCA is gaining increasing attention (Caren and Panofsky 2005; Krook 2006; Byrne 2007; Hino 2007; Olsen 2007) and a number of proposals have been put forward.

The most prominent of these is Temporal QCA or TQCA which is an extension of QCA to deal with the temporal order of events (Caren and Panofsky 2005). To denote the temporal order of conditions the authors introduce a dash '-' instead of logical AND to mean 'THEN' e.g. X-Y means X THEN Y. Minimisation rules are then added to the basic rules applied in QCA whereby if A-B and B-A lead to the same outcome then the temporal ordering is irrelevant and it can be written as A*B (or B*A). Within a temporal block the normal QCA rules apply but reductions cannot take place across temporal blocks. Conditions can be factored as long as temporal boundaries are kept. The main limitation with TQCA is the drastic expansion in the number of possible configurations.

Ragin and Strand (2006) reply by demonstrating that TQCA can be performed through the standard QCA features by including additional conditions of temporality. Indeed they stress that TQCA's idea using event sequences was mentioned in Ragin's original work (1987, p.162) e.g. a causal condition could be coded as 'true' (present) if event A occurred before event B; a coding of 'false' (absent) in this instance would indicate that event B occurred before event A. They went on to re-run the Caren and Panofsky analysis and find that it is not fully minimised and recommend that TQCA based on Boolean software should be preferred to 'paper-and-pen' procedures with a view to avoiding human errors. They also use / to denote temporal order as – is used to signify negation in QCA.

Krook (2006) criticises TQCA on two levels. First, it employs time as 'trajectory' to capture how causal conditions emerge and interact over time. The result is a 'horizontal' notion of causal configuration which simply arrays single attributes in the order in which they appeared. Second, the dash in notation simply marks breaks in time, it doesn't theorize the explicit connections in the conditions divided by the dash i.e. TQCA pays attention to temporal – but not causal – ordering. She goes on to criticise two step and two level theories as offering a 'horizontal' notion to causal configuration.

In a paper that examines candidate gender quotas, Krook goes on to combine elements of FS/QCA and sequence analysis by focusing on iterated reforms. There are three steps here. First, construction of a truth table; second, tracking shifts in configurations employing a 'soft' form of optimal matching that maps causal conditions and outcomes as they change over time (a standard truth table with 'stronger' or weaker shown as + or - to reflect changes over time); third, analysing results holistically to identify additive sequences where attempts to reform spill into reform of other groups and extractive sequences leading to disjunctures .

Another approach is by Hino (2007) who in a recent paper proposes Time-Series QCA (TS/QCA) as a technique to analyse a dynamic process in the cross temporal dimension through QCA. This differs from TQCA in that it focuses on analysing cross-temporal variations in the data while TQCA focuses on the order and sequence of events and conditions that occurred. He identifies three variants: *pooled QCA* which involves pooling all observations (i.e. cases) across different time points and spatial units and assigns values uniformly; *fixed effects QCA* which fixes the spatial units and assigns values only across different time points within each spatial unit; and *time differencing QCA* which takes a difference between two given time points within the same spatial unit and assigns values based on an 'increase' or 'decrease'. Hino prefers the time differencing method as it can directly analyse a dynamic process of the time dimension. The dichotomisation principle is straightforward and increases accountability of threshold setting i.e. simply find the time difference ($\Delta x_1 = x_1 - x_{1-1}$).

The predictive power of QCA is also suggested to be low (Krook 2006) since sequences can be chartered systematically only after they have occurred and are highly dependent on the level and accuracy of the coding. The predictive potential is an important realist consideration and has been discussed by both Olsen and Byrne who compares QCA with regression analysis in an exercise to 'predict' outcomes in a Custody Diversions Data Set (Byrne 2006a). Byrne concludes that 'the essential difference between QCA and conventional linear modelling is that the latter fits a model to the data whereas QCA explicitly allows for and indicates that different combinations of factors will produce the same outcome' (p.2). The predictive potential for QCA is an area which requires more attention. ¹¹

¹¹ This research concludes that it is limited.

2.5 VALIDITY AND RELIABILITY

The question of validity and reliability is important, and one which was considered at every phase of the project. The question of validity in realism has been addressed specifically by Australian researchers who look at ways of providing comprehensive criteria to judge validity and reliability of qualitative research within the realism paradigm (Healy and Perry 2000). The authors treat realism as a paradigm consisting of three elements: ontology, epistemology and methodology, and provides a useful synthesis of validation approaches using the four paradigms proposed by Guba and Lincoln (1994):

1. Positivism (reality is reality, full stop)
2. Constructivism (reality is in the eye of the beholder)
3. Critical Theory (perception is reality)
4. Realism (perceptions are windows on reality)

Because a paradigm is a worldview, the quality of scientific research done within a paradigm has to be judged by its own paradigm's terms. The authors propose six criteria for the realist paradigm and these are shown as the first two columns in Table 19. The third confirms how this criteria will be met in this project.

Table 19 Quality criteria within the realist paradigm

Criterion	Measure of validity	Applied in this project
Ontological appropriateness	Research problem deals with complex social science phenomena involving reflective people.	Realist research strategies explicitly chosen to explore stratified ontology.
Contingent validity	Open 'fuzzy boundary' systems involving generative mechanisms rather than direct cause and effect.	Mechanisms in real domain specifically sought using retroductive analysis.
Epistemology	Neither value-free nor value-laden, rather value-aware.	Multiple methods chosen, researcher bias acknowledged.
Methodology	Trustworthy – the research can be audited.	Grounded theory, cross-case comparison and QCA methods.
Analytical generalisation	Theory building rather than theory testing.	Middle range theory sought confirming 'what works for whom in which circumstances'.
Construct validity	Use of prior theory, case study database, triangulation.	Prior literature included, theoretic case selection and multiple methods employed.

(Source Healy and Perry 2000, p.122)

Probably the major concern remains with the value-laden findings which are based largely from the perspective of the IT Managers involved. This later resulted in securing Willing and Able Users as an external co-operation rather than internal control condition but providing this is

acknowledged and stated is valid within critical realist research. A second issue relates to the ability to replicate findings and space prohibits full details of the QCA outputs.

Another check that the overall research design is robust is by comparing it to the 'Research Diamond' template provided during the DBA course (Figure 15).

The research problem is to explain successful information management in small business and the *ontological problem* is to find a theory which resonates with a realist worldview. This is achieved through critical realism which identifies the mechanisms and structures involved to *explain* rather than simply *describe* the phenomena in question.

Once we have established *what* we know, the next question is *how* we come to know it i.e. epistemology. Being an ontologically based philosophy, critical realism has a broad epistemology and encourages multiple methods to uncover structures and powers. This project uses comparative methods together with Boolean analysis supported by quotations and user experience.

The method chosen must however be mindful of the original problem and a key consideration here is the diversity in the small sector. This argues against both qualitative methods which seek to find commonality around a mean and very small n case study methods which have limited ability to generalise. A method which handles diversity well and copes with small n cases is QCA which overcomes the *methodological problem*.

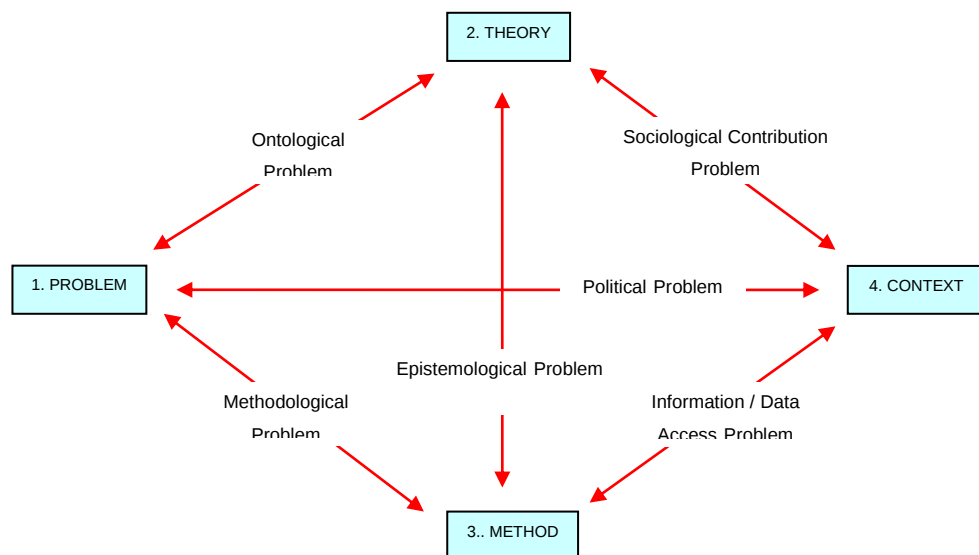


Figure 15 Research diamond
(Source Durham Business School)

Finally (but crucially in a DBA) is the question of context. Most important will be to make a contribution to practice and thereby overcome the *political problem*. This will be achieved by uncovering some of the combinations of causal conditions which produce successful and unsuccessful information management incidents to help raise performance in the critical small business sector. The relevance of this contribution will be ensured by providing limited generalizations on 'what works for whom in which circumstances' to overcome the *data access problem*.

Finally, by being one of the first papers to explicitly introduce critical realism in the small business sector it is hoped to make a sociological contribution and thereby complete all facets of the diamond.

3 RESEARCH ACTIVITY

3.1 CHAPTER SUMMARY

The original transfer document for this project proposed that the research design and process would be based loosely on that provided by Bell and Loane (2003) which proposed a three stage process: questionnaire, interviews, then qualitative comparative analysis. As befits an inductive strategy based on grounded theory, the resulting research was iterative and recursive with each phase being used to review and revise the findings from previous activities as appropriate. As a result, findings from initial interviews meant that the unit of analysis changed from *organisation* to *information management instance*. This in turn prompted the re-analysis and re-coding of those interviews based on the next and subsequent phases.

The first and second research phases borrowed ideas from Swartz and Boaden (1997) and involved distributing a questionnaire requesting respondents to grade possible IT causal factors. Initially, the case was the organisation and the researcher chose a range of organisations that he believed were successful and unsuccessful users of information management. Contradictory results and a subjective and biased definition of 'successful' meant a closer engagement with the field was needed in the second stage. This took place in late 2005 and involved interviewing the respondents to clarify their answers further. Analysis of the interviews allowed a number of themes to be identified which were subsequently analysed visually in Excel then coded dichotomously for a first attempt at QCA. Tosmana software was chosen and provided some additional insight.

Phase three saw the definition of a case change from an organisation to an information management instance once it became clear that organisations could experience both successful and unsuccessful projects. Interviews were again coded and themed and to help reduce complexity a two-stage model was hypothesized using the work of Goertz and Mahoney (2005). The model was tested in MVQCA and again provided some additional insight. Summary QCA output is provided supported by relevant text.

Phase four involved another round of interviews once it became clear that the previous data was too distant to be used effectively with set-theoretic methods. The questions were re-designed to ensure set membership was gauged for each likely condition to enable valid subsequent fuzzy set analysis. This still proved problematic, and softer 'paper and pen' methods were used to develop and refine the final model.

The fifth and final phase involved testing the 'soft' findings substantively against the cases themselves. The final research process is shown in Table 20.

Table 20 Research design and process

PHASE	ONE	TWO	THREE	FOUR	FIVE
Purpose	Pilot Study	Theory Development	Theory Development	Theory Refinement	Theory Testing
Duration	Oct 2005 to Nov 2005	Dec 2005 to Apr 2006	May 2006 to Dec 2006	Jan 2007 to Jun 2007	Jul 2007 to Sep 2007
Case Definition	Organisation	Organisation	IT Instance	IT Instance	IT Instance
Fieldwork Undertaken	21 Q.naires 11 Usable Responses	6 Interviews 11 Cases (6x1 ; 5x0)	15 Q.naires 12 Interviews 24 Cases (12x1; 12x0)	11 Q.naires 11 Interviews 22 Cases (11x1; 11x0)	22 Cases (11x1; 11x0)
Respondents <i>Red = Dropped</i> <i>Green = Added</i>	Ins Broker Hotel Surveyor Printer Charity Engineering Finance Manufacturing Show A Oil Broker Design Co	Ins Broker Design Co Surveyor Charity Engineering Printer	Ins Broker Engineering B Hotel Surveyor Retail Charity Engineering A Finance Show B Manufacturing Show A Recruitment Co	Ins Broker Engineering B Hotel Surveyor Retail Charity Engineering A Finance Show B Manufacturing Show A	Ins Broker Engineering B Hotel Surveyor Retail Charity Engineering A Finance Show B Manufacturing Show A
Methods Used	Excel Manipulation	Dichotomous MVQCA Excel Manipulation Supporting Narrative	Multichotomous MVQCA Two-Level Analysis Excel Manipulation Supporting Narrative	FS-QCA X-Y Plots Excel Manipulation Supporting Narrative	Graphical Modelling Supporting Narrative
Possible Combinations of Causal Conditions Identified	None	Owner Enthusiasm AND Business Ambition AND Competitive Forces AND Vol / Planned Interventions AND Available Resources AND Clear Benefits	Clear Objectives AND Pragmatic Management AND Ready & Willing Users AND Technical Resources AND Professional Providers AND Market Pressure	Clear Objectives AND Pragmatic Management AND Adequate Resources AND THEN Able & Willing Users OR Professional Providers OR Positive Customers	Clear Objectives AND Pragmatic Management AND Adequate Resources AND THEN Able & Willing Users OR Professional Providers OR Positive Customers
Lessons Learned	Case definition looks wrong. Interviews vital to develop narrative. Definition of success wrong (researcher playing God).	Case definition proved wrong. Definition of success revised. Number of causal factors needs reduction. Hypothesis testing difficult.	Asymmetrical results are acceptable. Two-level useful but coding subjective. Multichotomous coding produces atomistic results. Time important. Equifinality and conjunction ideas useful.	Fuzzy set wrong method for small number of cases. Narrative subsumed by numbers. QCA 'black box' not transparent. Probabilistic results unsuitable for very small n. Concepts of necessity and sufficiency useful.	Managing complexity vital (without recourse to relativism). Determinist methods resonate better with narrative. In battle of words and numbers; words win. Much QCA guilty of upward conflation?

Papers based on the findings (Parker 2005; Parker 2006) were presented during the research and a final paper is planned for presentation later this year. QCA technical input was received from Lasse Cronqvist at the 2005 ESRC Summer School at Essex University and Charles Ragin at the 2006 ESRC Research Methods conference in Oxford.

Table 21 Other research events

Date	Event
July 2005	ESRC Summer school, Essex University. Two week QCA technical course with Lasse Cronqvist and Benoit Rihoux.
October 2005	Durham Business School Doctoral Colloquium. Presentation,
November 2005	Institute of Small Business and Entrepreneurship (ISBE) International Conference, Newcastle. (Winner, ACCA best working paper from a doctoral student).
July 2006	ESRC Research Methods, Oxford University. QCA workshops with Charles Ragin.
October 2006	Durham Business School Doctoral Colloquium. Presentation.
November 2006	Institute of Small Business and Entrepreneurialism (ISBE) International Conference, Cardiff. Paper shortlisted.
October 2007	Durham Business School Doctoral Colloquium. Presentation.

3.2 PHASE ONE : PILOT STUDY

3.2.1 Pilot Study Objectives

The first 'venture into the field' was a simple pilot study whose purpose was to narrow down the lengthy list of potential conditions that might contribute to successful or unsuccessful information management instances as suggested by the literature review and the researcher's personal experience. It also hoped to test the initial definition of a 'case' and the feasibility of defining outcomes at an organisational level.

The questionnaire was designed around the 'questionnaire as a conceptual structure' ideas of Pawson and Tilley although they were looking for commonality (based upon simple mean) where this project sought diversity (based initially on simple standard deviation) across successful and unsuccessful cases. The pilot study was based on the work of Swartz and Boaden (1997) whose methods were broadly followed in this phase of the study.

3.2.2 Questionnaire Design

The questionnaire was designed to explore attitudes to the causal factors associated with information management research identified from the literature review. Questions with explanatory notes in italics where appropriate are shown below. The questionnaire is shown as appendix 1.

The questionnaire consisted of fifty questions split into two sections. The first section (nineteen questions) requested *objective* data in three areas: business (sector, turnover, headcount, years trading, etc.), people (management structure, workforce age and skills, training commitments, etc.) and investment (IT budgets, PC penetration, internal vs. external benefits, etc.).

Our Business

1. What was your turnover in the last financial year?
2. How many people are employed by your business (full time equivalent)?
3. Which business sector do you work in? *Simple list of sectors will be provided.*
4. Are you a sole trader, partnership or private limited company?
5. How many years have you been trading?
6. Do you operate from single or multiple sites?

Our People

7. How many people are there in the team that runs your business? *This may be one if owner/managed. If multiple levels (e.g. directors and managers) please state the total number.*
8. How many management levels do you have? *E.g. if managers and directors then answer equals two.*
9. What is the average age of your management team? *An approximate number will do to avoid this sensitive issue!*
10. What is the average age of your workforce? *An approximate number will do to avoid this sensitive issue!*
11. Approximately what proportion of your management team is educated to degree level?
12. Approximately what proportion of your total workforce is educated to degree level?
Roughly how many days training on average does each employee in your organization receive?

Our IT Investments

13. How much did your business spend last year in hardware, software and related services?
14. What is the total number of PCs and Laptops in your business?
15. What is the average age of the computer equipment in your business?
16. Very roughly, what proportion of your IT investment do you spend to achieve external competitive advantage? *E.g. on web sites, E-business, customer relationship management, mobile sales force, etc.*
17. Very roughly, what proportion of your IT investment do you spend to improve internal efficiency? *E.g. servers, networking, Office software, accounting applications, etc.*

The second section (twenty one questions) requested more *subjective* opinions on attitudes to IT using a Likert scale ranging from 5 (strongly agree) to 1 (strongly disagree). Questions were alternated between positive and negative statements to try to avoid 'happy form' ticking activity. These areas and the questions supporting them are based on both literature review and the researcher's personal experience.

Statements were grouped into four areas: business objectives (planning activity, growth ambitions, success factors, etc.), company culture (work-life balance, management style, etc.), external environment (level of competition, strategy chosen, etc.), attitudes to IT (admin vs. competitive advantage, asset or liability, etc.).¹²

¹² Whilst the broad definition of 'information management' is used in this thesis, the more familiar term of 'information technology' was used in survey forms and interviews to provide a term respondents would more readily identify with.

Business Objectives

18. We engage in formal business planning activity. *I.e. producing an annual business plan with financial projections.*
19. We produce monthly management accounts or other management reports to monitor our progress against these plans.
20. We produce monthly management accounts or other management reports but don't compare these to budgets or any other predictions.
21. Steady growth is not a stated objective of our business. *I.e. in terms of turnover and hopefully profits.*
22. We are trying to sell more of our existing products and services into our existing markets. *I.e. market penetration*
23. We are trying to sell existing products or services into new markets. *I.e. market development by developing new geographical markets or new market segments.*
24. We are trying to sell new products or services into our existing markets. *I.e. product development.*
25. We are not trying to grow our business, but consolidate it by improving quality, marketing or productivity.
26. We are actively trying to become more efficient. *I.e. increase turnover with the same number of employees or maintain existing turnover but using fewer people.*
27. We have not increased the number of people employed in our business in recent years.
28. Our business has not performed as well as we had hoped and planned for.

Company Culture

29. We pursue opportunities to maximize business success and personal rewards.
30. We consciously try to balance demands of work with family and other non-work commitments. *I.e. Maximising business performance isn't the 'be all and end all' and our lifestyles are important too.*
31. Our management style is informal.
32. People are our biggest asset and we do everything we can to maximize their potential to contribute to the success of our business.

External Environment

33. We operate in a highly competitive market that forces us to continuously improve our products and services.
34. We compete mainly on price.
35. We compete mainly on quality.
36. Our existing markets are declining.

37. Our customers are able to dictate the ways in which we do business with them.
38. Our suppliers are able to dictate the ways in which we do business with them.

Attitudes to IT (Outcome Variables)

39. IT is critical to our business achieving competitive advantage.
40. IT helps us to improve the efficiency of the way we work.
41. IT is simply a tool that we use like any other.
42. IT will help us transform the way we do business in the future.
43. IT makes work easier for our employees.
44. We have seen a clear return on our investment in IT.
45. Our implementation of new systems has been largely successful.
46. We continuously review IT developments to see if they can be of benefit to business.
47. IT has not helped us to increase our sales.
48. IT has not helped us to reduce our costs.
49. We have used IT specifically to improve the management and control of our business.
50. IT has contributed significantly to improving the performance of our business.

3.2.3 Survey Distribution

The questionnaire was distributed to twenty-one customers of the researcher's business. The organisations selected were all well-known to the researcher and deliberately chosen to provide an even spread of what the researcher perceived to be 'successful' and 'unsuccessful' cases. This *theoretical sampling* is a key part of grounded theory and 'fuzzy set researchers normally select cases in this fashion, utilizing their theoretical and empirical knowledge to define a comparable population.' (Katz, Vom Hau et al. 2005, p.545). Such an approach is endorsed by Miles and Huberman who chose the term 'purposive' sample (1994). *At this stage 'the case' was an organisation with which the researcher was familiar and, based on his knowledge of them, was graded as either successful or unsuccessful users of information management.*

Table 22 Summary of phase one activity

		Outcome	Letter	Email	Phone	Reply	Ackn
1	Recruitment 1	1	20/10/05	08/11/05	-	-	-
2	Oil Broking	1	20/10/05	08/11/05	-	09/11/05	09/11/05
3	Quantity Surveyor	1	20/10/05	-	-	30/10/05	30/10/05
4	Finance Co	1	20/10/05	08/11/05	-	09/11/05	09/11/05
5	Charity	1	20/10/05	-	-	30/10/05	30/10/05
6	Design Co	1	20/10/05	-	-	30/10/05	30/10/05
7	Civil Engineers	1	20/10/05	08/11/05	-	-	-
8	Cleaning Co	1	20/10/05	08/11/05	16/11/05	-	-
9	Restaurant	1	20/10/05	08/11/05	16/11/05	21/11/05	22/11/05
10	Show Organiser 1	1	20/10/05	08/11/05	16/11/05	17/11/05	18/11/05
11	Recruitment 2	1	20/10/05	08/11/05	-	-	-
12	Engineering 1	0	20/10/05	08/11/05	16/11/05	18/11/05	18/11/05
13	Printing	0	20/10/05	-	-	26/10/05	26/10/05
14	Importer	0	20/10/05	08/11/05	16/11/05	FO!	-
15	Engineering 2	0	20/10/05	08/11/05	16/11/05	FO!	-
16	Grain Supplier	0	20/10/05	08/11/05	16/11/05	FO!	-
17	Landscape Centre	0	20/10/05	-	-	30/10/05	30/10/05
18	Insurance Broker	0	20/10/05	-	-	26/10/05	26/10/05
19	Storage Co	0	20/10/05	08/11/05	16/11/05	FO!	-
20	Manufacturer	0	20/10/05	08/11/05	16/11/05	FO!	-
21	Engineering 3	0	20/10/05	08/11/05	16/11/05	FO!	-

3.2.4 Survey Results

1. Negative Likert responses were inverted to provide consistent all-positive scores.
2. Successful and unsuccessful outcomes were assigned at a company level.
3. Some of the variables were removed from the analysis as the limitations of this exercise became clear e.g. turnover levels where inappropriate banding rendered responses pointless.
4. Standard deviations of Likert responses were calculated to potentially identify the heterogeneous responses need for OCA to work effectively.

Company	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	0		
Restaurant	1	2	60	1	30	1	31	3	30	22	0	5	7	1	-	20	2	-	-	5	5	1	5	4	1	5	1	1	1	4	2	4	4	5	4	4	1	2	2	5	5	1	5	5	4	4	1	1	5	5	4	1	
Engineering I	0	2	15	1	33	1	10	2	45	40	-	3	3	1	3	40	3	5	20	5	5	3	4	5	4	3	5	5	2	4	4	5	5	4	4	5	5	4	4	3	4	1	5	4	4	3	4	2	1	4	4		
Show I	1	1	12	0	175	0	4	2	45	35	100	50	2	1	2	11	2	50	50	5	5	2	5	4	2	2	4	4	3	2	4	2	2	2	2	4	2	2	4	4	2	2	4	4	3	4	3	4	2	4			
Oil Broker	1	1	9	1	3	0	3	2	40	34	65	50	4	1	2	12	2	0	50	5	5	3	1	1	1	1	3	2	2	3	3	5	4	4	5	4	2	3	3	5	3	5	3	3	3	3	3	3	3	3	1		
Finance Co	1	2	55	0	17	1	12	2	36	27	10	10	3	1	-	67	2	10	55	5	5	1	5	5	5	1	5	1	1	1	5	3	4	3	5	2	5	2	3	2	4	5	2	3	4	4	2	3	2	3	4	4	1
Insurance Broker	1	1	1	9	0	25	0	5	2	45	30	0	10	4	0	-	13	3	0	50	4	4	4	5	5	5	1	5	3	2	4	4	2	5	5	3	4	4	5	5	5	2	5	5	5	4	1	1	4	5	0		
Printer	0	2	70	1	14	0	8	2	45	38	25	25	2	1	3	25	5	0	100	5	5	3	4	4	2	5	4	3	3	2	3	4	3	4	5	1	4	2	3	5	4	3	3	3	3	1	1	4	4	0			
Design Co	0	0	22	1	20	1	5	2	42	32	90	90	10	1	12	25	2	50	20	5	5	1	4	5	5	1	5	1	4	5	2	2	4	5	1	2	1	3	4	2	4	1	4	4	4	3	5	4	4	4	1		
Landscape Centre	0	1	16	1	10	1	5	2	35	35	0	0	1	0	1	3	3	75	25	4	4	2	4	4	4	2	4	1	2	4	4	4	4	4	4	4	4	2	4	4	2	4	2	2	2	3	2	4	0				
Quantity Surveyor	1	1	36	0	100	1	5	2	46	43	100	60	4	1	12	35	20	20	20	4	4	1	4	2	2	2	4	1	5	5	3	4	4	4	4	4	2	5	2	5	5	2	4	2	2	2	4	4	4	1			
Charity	1	1	120	0	13	0	4	2	58	-	100	50	5	1	-	30	3	5	80	5	5	3	4	4	4	3	4	2	2	3	4	4	4	5	4	2	4	3	3	3	4	4	3	4	3	3	4	3	4	4	1		
Std Dev																				0.5	0.5	1.1	1.1	1.3	1.4	0.8</																											

The results from this analysis were highly inconclusive as the contradictory results meant that the definition of a case at organisational level appeared unworkable. Too often the same score was registered for both successful and unsuccessful outcomes. More 'casing' would be needed to find an alternative.

The definition of successful outcomes at organisational level was also far too subjective (researcher playing God) and a more objective measure based on the respondents' opinions would be needed.

The number of possible factors / conditions was far too high and would have to be narrowed or grouped to be manageable. Similarly the diversity was limited making any subsequent QCA analysis difficult with limited areas yielding significant standard deviations (shown in red). Simple survey data was hopelessly inadequate to accurately interpret what was happening in the companies surveyed and deeper qualitative analysis was essential to find out what was really going on.

It was a useful 'toe in the water', but much more work needed to be done. The simple use of a questionnaire to provide very distant, quantitative evidence suggested a much closer engagement with cases was needed.

3.3 PHASE TWO: THEORY DEVELOPMENT

3.3.1 Interview Programme

The pilot study phase raised as many questions as it answered. To start understanding what was *really* going on, the next phase of research involved conducting interviews with a sample of survey respondents. Interviews were based on Pawson and Tilley's 'realist interview' structure (1997, p.164) to ensure an effective exchange of the researcher's theory and the subject's ideas (Figure 16).

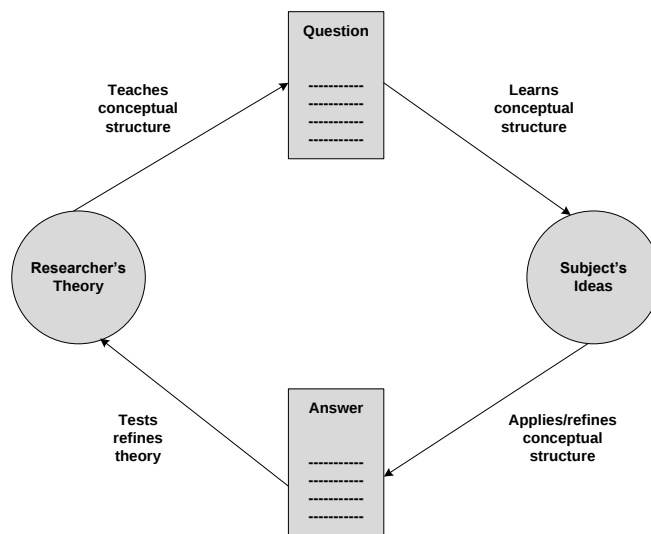


Figure 16 Basic structure of the realist interview
(Source Pawson and Tilley 1997, p.165)

Eleven organisations provided usable questionnaire responses from phase one, and from these a sample of six organisations were chosen for semi-structured interviews. These were deliberately chosen to provide a range of company types (size, structure, etc.) and people roles (MD, IT Manager, Partner, etc.). Deliberately choosing cases to provide required outcomes is criticised by KKV (1994) but strongly defended by grounded, case orientated researchers. Interviews were conducted in December 2005 and typically lasted one to two hours each. Interviews were recorded digitally and analyzed by playing back with the researcher noting themes as they arose.

The six organisations interviewed were Surveyor, Charity, Design Co, Engineering, Printing and Insurance Broker.

3.3.2 Interview Analysis and Theme Identification

These interviews were far more valuable than the original survey and allowed the synthesis of a smaller number of more meaningful potential contexts. Ragin suggests that to successfully analyse results using QCA we need to reduce the list of conditions to between six and nine (2000).

Analysis of the interviews with case study respondents identified six possible themes or contexts (condition variables) as shown as Table 24. It is important to remember that for any subsequent QCA analysis conditions relating to both positive and negative outcomes are required to ensure we have counterfactuals (Ragin 1987).

Table 24 Themes identified from interview analysis

Positive	Negative
1. Owner manager enthusiastic about IT.	1. Owner manager unenthusiastic about IT.
2. Business ambitious or growing.	2. Business lifestyle or static.
3. High external competitive forces.	3. Low external competitive forces.
4. IT interventions voluntary or planned.	4. IT interventions forced or unplanned.
5. IT intervention resources available.	5. IT intervention resources not available.
6. Resulting benefits clear or quantifiable	6. Resulting benefits unclear or unquantifiable
7. Successful Outcome	7. Unsuccessful Outcome

Brief justifications for these proposed conditions are as below.

- 1. Owner Manager Enthusiasm.** Frequently quoted as a key influencer in SMEs in the literature, this certainly appeared to be the case in our interviews. This context also indirectly includes other 'people' issues such as structure, age and education of management team. An enthusiastic owner-manager may be considered a proxy for many of these other positive statements.

"One of the badges of this sector is innovation, flexibility and being able to change. It is supposed to be a feature!" Charity.

- 2. Business Ambition.** Another good indicator with proactive and reactive management at opposite ends of a continuum. Type of action seemed to make little difference in the survey (e.g. market penetration, market development, product development or diversification) and even consolidation (i.e. doing the same thing but better) can be included here. The key issue here is whether management *take action now* to influence the performance of their business *in the future*.

"Maybe one of the crucial issues may be the business actually aspiring to do something better, otherwise you're banging your head against a brick wall." Designers.

- 3. External Competitive Forces.** External influence may have a direct or indirect impact on IT decisions. Proactive management teams will evaluate this strategically and take appropriate action (e.g. anticipating new sales opportunities through E-business) whilst reactive management teams will be forced to take similar action when dictated by market pressures. It is also worth noting that organizations who do not face stiff competition might avoid the need for IT investment and therefore might have 'successful' IT outcomes with minimal investment or activity.

"There is always pressure for people to maximise their time doing things that are profitable." Surveyors.

"We saw the IT investment as a means to generate more business ... and keep existing clients happy. It wasn't until I got on the course that I realised what else it could do." Insurance Brokers.

- 4. Voluntary / Planned Interventions.** This surfaced time and time again in the interviews. Many SMEs only invested in IT when forced to through internal pressures (e.g. ran out of storage space, support withdrawn on old software, etc.) or external pressures (customer demands for Email communication, suppliers demanding EDI, etc.). It is suspected that such pressures significantly reduce the likelihood of a successful outcome.

"As far as having an action plan for IT .. it just doesn't exist. Nobody has the resources or the time to think about it or plan." Printers.

"When the old system was coming to the end, Dad just walked in and said 'we're getting this one' because it was free!" Insurance Brokers.

- 5. Available Resources.** A constant feature in the interviews was the lack of time or expertise within SMEs to investigate the effective use of IT. This meant that investment decisions were frequently rushed, made with minimal supporting information and therefore often wrong. These are similar pressures to 4. and this may be a 'rogue' condition.

"If we had the spare cash we would have avoided a low-cost solution." Design.

"We won't just upgrade PCs for the sake of it." Engineers.

- 6. Clear Benefits.** Another repeated issue was the inability for SMEs to measure the benefits of any IT intervention and therefore evaluate whether they had outweighed the costs (which are far more transparent). This too contributed to an increased likelihood of an unsuccessful evaluation as the return on investment is assumed to be negative.

"You're so bloody busy doing the day to day stuff making ends meet and trying to grow you don't have the time to sit down and analyse it – only to find out what you don't want to know!" Designers.

"Do you do any formal ROI analysis or similar?" "No!" Printers.

- 7. Successful Outcome** All were asked how they would describe a successful IT intervention and all really struggled. The overall tone was that investing in IT was inevitable and they would be happy simply if it worked as promised (a somewhat damning indictment on the IT industry!). The most positive were proactive managers who had a clear idea of what they wanted IT to do for their business and were able to gauge whether it had achieved this or not in business terms. The more negative were unplanned or involuntary IT investments that were simply seen as unavoidable costs with minimal business benefits.

"Very difficult to quantify cost of inefficiency." Designers.

"It took us a year and a half ... but we're now seeing the benefits from it. The speed of it .. I know I'm not using it to its full potentiall." Insurance Brokers.

3.3.3 Qualitative Comparative Analysis: First Attempt

It was tempting at this point to hypothesise what some typical combinations that might be emerge from the intersection of these conditions (as suggested by Pawson and Tilley) ...

Ambitious small businesses with enthusiastic owner-managers are likely to plan and budget for IT interventions to help achieve their goals. Achieving these goals will be partly attributed to IT and therefore the outcome deemed successful.

Lifestyle small businesses with enthusiastic owner-managers may do likewise and still deem the outcome successful.

Unenthusiastic owner-managers in struggling lifestyle businesses might have IT interventions forced upon them due to competitive pressures or equipment failures. Little benefit is perceived to balance the cost and the intervention is deemed unsuccessful.

Lack of time and money in a small business may result in the wrong equipment being purchased. Resulting benefits are still hard to quantify or negative and the intervention is deemed unsuccessful.

Finding evidence to support these or other possible combinations required re-coding the initial survey data using the additional interview data. All eleven cases were carefully re-coded from the survey data and dichotomous variables were coded to reduce the risk of excessive diversity (Table 25). Tosmana (Tools for Small N Analysis) (Cronqvist 2005) software using the Quine algorithm was used with such a small n (Cronqvist and Herrmann 2005).

Table 25 Dichotomous variable coding

No	Company	1	2	3	4	5	6	0
1	Restaurant	1	1	1	0	1	1	1
2	Engineering 1	0	0	1	0	0	0	0
3	Show 1	1	0	0	0	0	0	0
4	Oil Broker	1	1	1	1	1	0	1
5	Finance Co	0	1	1	1	1	1	1
6	Insurance Broker	0	0	1	0	0	0	0
7	Printer	0	0	0	0	0	0	0
8	Design Co	1	1	1	0	0	1	1
9	Landscape Centre	0	1	0	0	0	1	0
10	Quantity Surveyor	0	0	0	0	1	1	1
11	Charity	1	1	0	1	1	1	1

1. Owner Manager Profile						
2. Business Culture						
3. External Competitive Forces						
4. Plannin of IT Interventions						
5. Resource Availability						
6. Clarity of Benefits						

The software was asked to produce Truth Tables and Minimal Expressions for both positive and negative outcomes. The Truth Table is shown as Table 26 and as can be seen only revealed two combinations with more than one case (Engineering 1 and Insurance Broker).

Table 26 Initial truth table (Tosmana 1.21)

Organisation	Owner	Bus Amb	External	ITPlan	ITRes	Clarity	Outcome
Restaurant	1	1	1	0	1	1	1
Engineering 1, Ins Broker	0	0	1	0	0	0	0
Show 1, Printer	0	0	0	0	0	0	0
Oil Broker	0	1	1	1	1	0	1
Finance Co	1	1	1	1	1	1	1
Design Co	1	1	0	0	0	1	1
Landscape Centre	0	1	1	0	0	1	0
Quantity Surveyor	0	0	0	1	0	0	1
Charity	1	0	0	1	1	1	1

The method of assigning membership of sets was *direct assignment* where the researcher provides a numerical membership value based on their expertise (Verkuilen 2005). This compares to indirect assignment which is similar but where the researcher uses substantive input. Assignment through transformation is a combination of substantive and mathematical input to create a mapping 'that takes one or more previously existing variables into a scale of membership' (p.465).

Direct assignment relies heavily upon the experience of the researcher and, in dichotomous coding, is highly sensitive. Setting the threshold by where an owner is enthusiastic or non-enthusiastic is highly subjective and can only be justified by the transcribed interview sheets. Other conditions are easier to code e.g. whether IT interventions were planned or not. Perhaps most contentious and hardest to validate is the outcome which, at this stage, is also directly assigned by the researcher. As it will be seen, assignment of both outcome and causal conditions is steadily passed to the respondents to reduce subjectivity. Less impactful adjustment and calibration changes are then made to provide set consistency.

The results were analysed and parsimonious implicants derived. Analysing *successful outcomes* and *excluding logical remainders* did not produce a parsimonious result with five prime implicants resulting.

Owner{1} *	Owner(Marris) *	Owner{1} * BusAmb{1}	Owner{0} * BusAmb{0}	Owner{1} *
BusAmb{1} *	BusAmb{1} *	* External{0} *	* External{0} *	BusAmb{0} *
External{1} * ITRes{1}	External{1} * ITPlan{1}	ITPlan{0} * ITRes{0} *	ITPlan{1} * ITRes{0} *	External{0} * ITPlan{1}
* Clarity{1} +	* ITRes{1} * Clarity{0}	Clarity{1} +	Clarity{0} +	* ITRes{1} * Clarity{1}
	+			
(Restaurant +Finance Co) +	(Oil Broker) +	(Design Co) +	(Quantity Surveyor) +	(Charity)

Figure 17 MV-QCA analysis: minimizing 1, including - (Tosmana 1.21)

Analysing *unsuccessful outcomes* and *excluding logical remainders* was more parsimonious with just two prime implicants, both of which contained the majority of conditions (Figure 17).

Owner{0} * BusAmb{0} * ITPlan{0} * ITRes{0} * Clarity{0}	Owner{0} * BusAmb{1} * External{1} * ITPlan{0} *
+	ITRes{0} * Clarity{1}
(Engineering 1,Insurance Broker+Show1,Printer) +	(Landscape Centre)

Figure 18 MV-QCA analysis: minimizing 0, including - (Tosmana 1.21)

In both cases, excluding logical remainders resulted in the inclusion of so many conditions that they were essentially data descriptions rather than explanations. Figure 18 appears parsimonious only because so many of the 0 outcomes were similar – a problem of limited diversity.

Analysing *successful outcomes* and *including logical remainders* meant that positive outcomes can be explained by only two conditions i.e. Either enthusiastic owner-managers or planned interventions (Figure 19).

Owner{1} +	ITPlan{1}
(Restaurant + Finance Co +Design Co+Charity) +	(Oil Broker+Finance Co+Quantity Surveyor+Charity)

Figure 19 MV-QCA analysis: minimizing 1, including R (Tosmana 1.21)

Finally, analysing *unsuccessful outcomes* and *including logical remainders* produced an even more parsimonious result which apparently can be explained simply by a combination of unenthusiastic owner-managers and poor planning (Figure 20).

Owner{0}ITPlan{0}
(Engineering 1,Insurance Broker+Show 1, Printer+Landscape Centre)

Figure 20 MV-QCA analysis: minimizing 0, including R (Tosmana 1.21)

This is interesting as it mirrors the successful outcome and suggests that owner-manager attitude and planning are an important causal combination.¹³

3.3.4 Lessons Learned

This was a far more productive exercise than phase one and allowed the grouping of possible conditions and even some early identification of possible mechanisms affecting positive or negative outcomes. It was useful to start thinking about QCA applications too, and some early practical use of Tosmana software was welcome even if the results remain tentative.

By far the most valuable insight from this exercise however was the clear need to change the unit of analysis from an *organisational case* to an *information management instance*. Most companies confirmed that they had experienced both successful and unsuccessful information management interventions and described the factors contributing to both. This exchange of what Ragin calls 'ideas and theory' is useful and helped drive subsequent phases. Unfortunately it rendered much of the work to date as irrelevant as the outcome condition was clearly wrong and the whole definition of a case needed revision in the next phase of the research.

¹³ Such results are not always symmetrical.

3.4 PHASE THREE: THEORY DEVELOPMENT

3.4.1 Initial Ideas

The six initial interviews identified the need to analyse success based on information management instances (or projects) rather than at an organisational level. The next stage of the research sought to acquire additional 'case = instance' data using new questionnaires and interviews.

A second questionnaire was prepared, with questions this time relating to individual information management instances (see appendix 2). This second set of questions was based on the conditions identified from the phase two interviews and asked respondents to identify what they believed to be the causes of successful and unsuccessful IT projects (as opposed to the perhaps confusing term of information management instances) using a five-step Likert scale.

Questionnaires were sent to the six phase two interviewees, the remaining five of the phase one respondents not interviewed and four new respondents. Again, the four new cases were organisations known to the researcher. Fourteen responses were received of which twelve were deemed valid. At this point, Printer, Oil Broker and Design Co were dropped (shown in red on Table 20) and replaced with Engineering B, Retail, Show B and Recruitment Co (shown as Green on Table 20). During May and June 2006 all new respondents were interviewed face-to-face and phase two respondents were telephoned or interviewed again to qualify their answers to the new requirements.

At the end of this exercise, the researcher had data for twenty four cases of information management instance (half successful, half unsuccessful) relating to eighty possible conditions (or variables) across twelve organisations (see appendix 3). Systematically analysing even this small number of cases is not straightforward, and qualitative comparative analysis (QCA) techniques were again chosen to help manage this complexity.

But even with algorithms to manipulate Boolean algebra on powerful personal computers, QCA cannot cope with the possible combinations of eighty conditions with up to five variables in each condition. Even if it could, the inevitability of contradictory outcomes and lengthy, meaningless prime implicants means the exercise would be pointless. *The first priority therefore was to reduce and re-group the number of conditions and this was done in two steps:*

First, by removing 'case = company' conditions which were either duplicated by superior 'case = instance' conditions or made redundant through the change in case focus. An example of the former is 'growth an objective' which was made redundant by 'growth in sales'. An example of the latter is 'monthly management accounts' which was positive across all organizations and project outcomes.

Second, by re-grouping the remaining conditions into seven logical groups as suggested by literature and supported by interviews and previous analysis. These groups were:

1. Organisation (key descriptors such size, age, type, etc. at organizational level)
2. Objectives (business goals at organization level)
3. Management (both at company and instance level)
4. Users (mainly from IT instance)
5. Resources ('hard and 'soft' IT system aspects of IT instances)
6. Providers (people aspects of IT instances)
7. Market (external influence from customers and suppliers)

These actions reduced the number of conditions to forty-three as shown in Figure 21. This is still far too many conditions to logically analyse so the categories were grouped into basic and secondary levels using the two-level theory ideas for comparative analysis at both individual levels and between levels (Goertz and Mahoney 2005). This provided both a more manageable structure for analysis and a more intuitive visual representation.

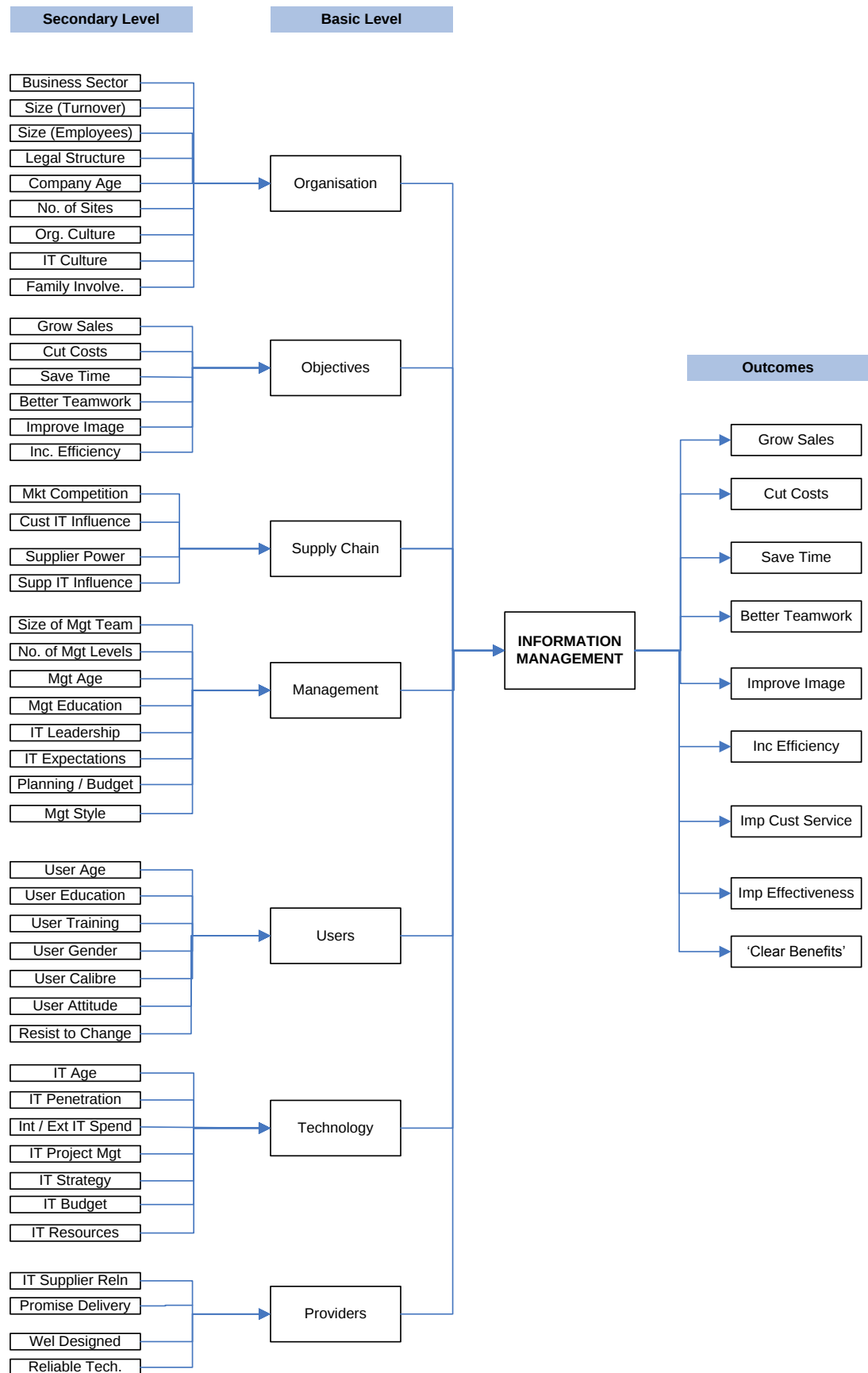


Figure 21 Initial information management model

The software created to perform the qualitative comparative analysis calculations was again Tosmana (Tools for Small N Analysis) (Cronqvist 2005). Whilst Likert scores translate directly into QCA values, nominal data such as employee numbers can be conveniently grouped into sets by using a 'Threshold Setter' to choose and evaluate appropriate ordinal thresholds. The table data was then analysed for each of the seven categories. An immediate problem was the duplication of phase two company data which was the same for both successful and unsuccessful cases which understandably produced logical contradictions. At the advice of software author Lasse Cronqvist, company variables identical for two cases were still included to see if any of these conditions *combined* with other conditions to explain success or non-success over multiple cases. Company conditions (alone or in combination with other conditions) occasionally created prime implicants but these were never in the most parsimonious solutions as they contradict with the other case of the same company with the opposite outcome.

3.4.2 Qualitative Comparative Analysis: Within Secondary Level Only

The two main Tosmana outputs of interest are again a) the list of all prime implicants and b) the most parsimonious solution. Examples of both (from Management category) are shown in Figure 22 and Table 27. MVQCA was run for all seven categories for both successful and unsuccessful outcomes and examples are summarised below using:

- (1) to signify the expressions for a successful outcome
- (0) to signify the expressions for an unsuccessful outcome

Comments and quotations from the interviews are used to support these findings.¹⁴

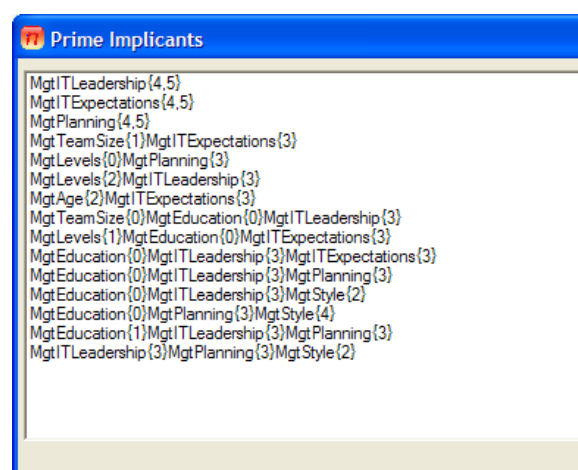


Figure 22 Typical prime implicant listing (Tosmana 1.21)

¹⁴ The use of narrative proved indispensable throughout this research.

Organisation. This might seem an odd place to start, but the definition of the case in this model is a *small business* information management instance so ensuring we have the correct organisations with which to operate is vital. This is difficult as the definition of a small business often needs to be grounded to be relevant and the conditions listed try to convey this.¹⁵

Whilst some of the conditions are clearly factual (e.g. sector or turnover) others are far more subjective. Whilst organisation culture primarily relates to lifestyle vs. growth objectives, many other 'small business mentality' issues arose during the interviews including:

Why do you and other directors sit in different parts of the office? "So we can keep an eye on the staff." Partner, Insurance Broker (showing lack of trust).

"Someone like me gets pulled in so many different directions, because there is only me here in charge. So you move from one crisis to the next ... constantly fire-fighting." Chief Accountant, Print Company (showing scarce resources).

"I'm concerned about COST – it's potentially very expensive. Also perhaps losing a bit of control - letting go of the reins. If we do it (develop new software application) development will be by me." Managing Director, Engineering Company A (showing fear of loss of control).

"When the old system was coming to the end, Dad just walked in and said 'we're getting this one' because it was free." Partner, Insurance Broker (showing family influence).

"A lot of people go 'Shit ... IT... it's going to be expensive, or I haven't got the time or it's going to be too much aggro when it doesn't work." Managing Director, Design Company (showing negative IT attitude).

The nine conditions in this category come primarily from phase two company survey i.e. sector, turnover, number of employees, incorporation, age, sites, number of sites and culture (growth or life-style) and IT culture. The one condition that was added from phase three was whether the organisation was family owned or managed as this appeared important in several interviews.

Because the conditions are the same for both successful and unsuccessful outcomes, it is impossible to minimise these further within the organisation category. It is worth noting though that some company conditions are included in prime implicants during reduction, but not the most parsimonious reduction.

¹⁵ Organisation was later rightly removed as a tautological sufficient condition.

Objectives. These too are phase two organisation conditions that were not directly queried further during the second phase. It was clear however that the some organisations had specific ideas about what they wanted their IT to do for them:

“The main advantage is internal efficiency. VAT Returns will come out at press of a button. Previously they would take a whole afternoon.” Managing Director, Retail Chain.

“We believe we can be a lot more efficient We think we can do more work with the same number of fee earners. Monitoring of what we do with what we are paid to do.” Partner, Surveyors.

What was interesting is whether information management projects which start with clear (if not measurable) objectives can then measure success better against these later. This is fine in theory, but the reality is that most small businesses have little time or inclination to systematically measure return on investment:

“I always find it difficult to quantify ‘This is going to save us this amount of money.’ We don’t sit down and work out ‘This is going to save us this amount of money’ because it is very difficult to do.” IT Manager, Manufacturing Company.

“You’re so bloody busy doing the day to day stuff making ends meet and trying to grow you don’t have the time to sit down and analyse it – only to find out what you don’t want to know!” Managing Director, Design Company.

Some however quickly see benefits:

“To be honest, since we moved here and improved the systems we’ve done away with two staff. I’ve just saved myself £16,000 in wages.” Partner, Insurance Broker.

“We no longer have people spending hours per day sorting out paper documents, hole punching, filing, etc. Then spend thousands of pounds storing them and never looking at them.” IT Manager, Finance Company.

Conditions for the relevant phase two objectives (growth, efficiency and effectiveness) are also the same for both outcomes and therefore of limited use for QCA purposes. Some light is however shed on this issue when outcome conditions are analysed later, where it is suggested that improvements in efficiency are the most likely result of successful IT instances.

Management. Management is a mixture of phase case = organisation and case = instance conditions. It is interesting to see that common organisation conditions combined with variable project conditions in some of the parsimonious expressions. Minimising the tables for management conditions (including remainders) produced:

- (1) Realistic expectations exceeded OR well planned projects

Both these conditions suggest that careful consideration in advance of what an IT instance can do for an organisation contribute greatly to a significant outcome. Whilst respondents seem to appreciate that good project planning is important, few managed to practice it:

"We're not an organisation who keeps abreast of developments. We don't spend the time sitting down and identifying what IT can do for us. Perhaps we should!"
Chief Exec, Show Organiser 2.

"Should have spent a lot more time with us beforehand finding out what we wanted first. We might not then be in this god-awful mess we're in now!" Finance Director, Hotel & Restaurant.

It was interesting therefore to see that poor project planning did not feature as a prime reason for unsuccessful projects. Both expressions for unsuccessful outcomes did however include unrealistic initial expectations not being met.

- (0) Unrealistic expectations not met OR a small mgt team with few IT expectations
(0) Unrealistic expectations not met OR an older mgt team with few IT expectations

A typical example from interviews was:

"I thought it would be more than just traffic lights. Imagine a pin ball machine, things happening, spinning round, etc!" IT Manager, Finance Company (describing a failed digital dashboard solution).

It is important to realise this is not an outcome condition i.e. post-IT project, but the explicit acknowledgement by respondents that the 'bar was set too high' prior to the project actually commencing. Interestingly, those with neutral opinions (expectations = 3) suggest failing projects may be explained by smaller or older management teams. The reasons for this are unclear.

The overwhelming finding from the QCA exercise was that good planning and having realistic expectations (subsequently exceeded) are the two conditions which combine to provide

successful - or pragmatic - management. It was interesting to see that the much quoted 'Chief Executive Influence' found in studies of larger organisations was only apparent in one case:

"We've spent more money (on IT) in first year (since old MD left) than in previous three. We've used it differently too. Where the old MD used to like faxes going out, he used to like paper memos, I turned round and said I want you to do it all with Email." Managing Director, Engineering Company B.

Users. Other than user education, all user conditions are phase three and relate to IT instances. Age, education, gender, calibre and resistance to change were all cited as causes and calculated to be prime implicants, but user training or user attitude have the most coverage.

(1) Good user training OR a positive user attitude

Interviews confirmed that most organisations realised the importance of training but given resource constraints identified elsewhere were often unable to deliver it:

"Training is very important. We spend a lot of time and effort on training and development." Managing Director, Engineering Company B.

"In the past the partners hadn't learned the system. We did this time so we could cope if the staff dropped us in it." Partner, Insurance Broker.

Positive user attitude was less obvious in the interviews.

"They are ready to embrace change and are highly motivated to do that for the benefit of their clientele." Chief Exec, Charity.

The minimal expression for an unsuccessful outcome was unequivocal i.e. responsibility for unsuccessful projects lies primarily with poor training.

(0) Poor user training

There may be a link here with lack of resources (which was often cited) during interviews and this needs to be explored further. The overall tone was overwhelmingly one of 'we know it's important but ...'

"You can spend a good proportion of your time fire-fighting, dealing with your current work. Like Outlook – we're only scratching the surface. It's difficult to free someone up when you're busy. It's always a problem to find the time to go training,

then again when they come back and have other work to do.” Chief Exec, Show Organiser 2.

“At present, both (software products) are incredibly unsuccessful, and the biggest reason for both of those is that no-one understands how to use them and that comes down to training.” Project Manager, Recruitment Agency.

User attitude was of lower profile but still important.

“If we’re honest what holds us up now is operator driven, not system driven.” Due to number of staff or calibre? “Probably a bit of both really.” Chief Exec, Show Organiser 2.

“If the staff had the nous to work the system properly we’d avoid a lot of our problems.” Finance Director, Hotel & Restaurant.

Although not registering in the minimised prime implicants, both age and gender contributed to negative attitude and resistance to change too:

“A lot of the reps are quite old and anti-computers and would be dead against it (changing from manual order books). They’d like to do it the way they’ve always done.” Chief Accountant, Print Company.

“Two older guys don’t want the training or want to be seen training. Two guys are young and keen. The girls – no problem! They just look at you and say thanks very much! I’ve always noticed this difference (in gender attitude).” Manager, Recruitment Agency.

Technology. The technology category includes both ‘hard’ and ‘soft’ elements of information technology e.g. IT equipment and IT strategy. Minimised combinations of possible causes here include:

- (1) Good project management OR clear IT strategy in place
- (1) Good project management OR sufficient time / resources
- (1) Clear IT strategy in place OR adequate money or budget
- (1) Adequate money / budget OR sufficient time / resources

Whilst this clearly suggests that four conditions (project management, strategy, money and time) are all important, the combinations do not prove very enlightening. This can partly be explained by looking at the truth table which shows that every case is unique - a problem in

multichotomous Boolean reduction where the number of possible combinations is significantly higher than dichotomous.

None of the 'hard' technology aspects (e.g. equipment age or penetration) gained much coverage in QCA and it was four 'softer' aspects that, in various combinations, proved most prevalent in our survey. Both good IT project management and clear IT strategy in place resonate with the good planning identified in the management category. The most stressed conditions in the interviews were however the availability of adequate money and time and these both came out in the secondary level analysis.

"It went right because we took time out of a busy schedule here to sit down and actually say what we want out of the system." Managing Director, Retail Chain.

The unsuccessful outcomes resonate with the positive analysis by highlighting similar conditions but in different combinations.

- (0) Weak project management OR no IT strategy OR inadequate money / budget
- (0) Weak project management OR no IT strategy OR insufficient time/ resources
- (0) No IT strategy or inadequate money / budget OR insufficient time/ resources

The overwhelming tone again was 'we know what to do if only we had time / money'. Time was especially important in service organisations where it was very closely associated with money :

"I tell you what, the single biggest thing for us of whether we have success or failure of any IT thing is whether we ourselves have the time to put into it to get the thing started." Partner, Surveyors.

"As far as having an action plan for IT .. it just doesn't exist. Nobody has the resources or the time to think about it or plan." Chief Accountant, Print Company.

Providers. The role of the companies which provide IT products and services to small business is seldom mentioned in the literature. This is surprising as small businesses rarely have their own internal dedicated IT resources and rely heavily on external advice and support to successfully manage their information.

Table 27 Typical truth table and minimised expressions (Tosmana 1.21)

Company	Mgt Levels	Mgt Age	Mgt Educn	Mgt IT Leadership	Mgt IT Expectations	Mgt Planning	Mgt Style	Outcome
Manf (1)	1	3	0	3	5	5	4	1
Manf (0)	1	3	0	3	1	1	4	0
Show A (1)	1	3	3	3	5	4	2	1
Show A (0)	1	3	3	3	1	2	2	0
Finance (1)	1	2	0	3	3	5	4	1
Finance (0)	1	2	0	3	2	2	4	0
Ins Broker (1)	1	3	0	3	5	3	2	1
Ins Broker (0)	1	3	0	1	1	3	2	0
Surveyor (1)	1	3	3	3	5	4	4	1
Surveyor (0)	1	3	3	3	3	3	4	0
Charity (1)	1	4	3	4	4	5	4	1
Charity (0)	1	4	3	3	3	2	4	0
Recruitment (1)	2	3	1	3	5	3	4	1
Recruitment (0)	2	3	1	1	3	3	4	0
Engineering A (1)	0	3	0	5	5	3	4	1
Engineering A (0)	0	3	0	1	3	1	4	0
Engineering B (1),Retail (1)	1	3	1	5	5	5	4	1
Engineering B (0)	1	3	1	3	3	1	4	0
Retail (0)	1	3	1	2	2	1	4	0
Hotel (1)	2	2	1	5	5	4	4	1
Hotel (0)	2	2	1	2	1	1	4	0
Show B (1)	1	3	2	5	5	5	4	1
Show B (0)	1	3	2	3	3	3	4	0

Results: (all)

MgtITExpectations{4,5} +	MgtPlanning{4,5}
(Manf (1)+Show A (1)+Ins Broker (1)+Surveyor (1)+Charity (1)+Recruitment (1)+Engineering A (1)+Engineering B (1),Retail (1)+Hotel (1)+Show B (1))	(Manf (1)+Show A (1)+Finance (1)+Surveyor (1)+Charity (1)+Engineering B (1),Retail (1)+Hotel (1)+Show B (1))

Four conditions were examined and here was again symmetry in responses over both successful and unsuccessful outcomes. It was the ability for IT providers to design new systems well and then deliver their promises which proved most important in both outcomes.

- (1) IT supplier delivering promises
- (1) Well designed new systems

Interviews supported these findings.

*"It went right because of the actual assistance we got from (list of IT providers)"
Managing Director, Retail Chain.*

"We work through small, independent, local firms. Having the backup from the partners who were quite happy to work together - not the 'it's not my problem' problem. We had this in our previous system." Managing Director, Retail Chain.

Unsuccessful outcomes mirrored the above.

- (0) IT supplier failing to deliver promises
- (0) Poorly designed new systems

"There is a simple, single one (example of undelivered promises) that sticks out like a sore thumb. It's the provision of management information. We still very much lack management information." Did the supplier let you down? "Yes. The concept was great but we were sold something that couldn't be delivered. There wasn't a piece of software out there that could do it." IT Manager, Finance Company.

"It didn't help when the person who wrote it buggered off to Greece for three weeks shortly after we bought it. They've been very naughty really, they've three or four people there who we were led to believe could help but when you ring them up and he's not there they always have to get back to you. It's very frustrating." Finance Director, Restaurant & Hotel.

Market. The Market category includes competition levels and support or pressure from customers or suppliers. It is interesting category as with three company case conditions and only one IT instance condition there are a number of logical contradictions in the analysis. Excluding these contradictory cases (full discussion prohibited by space) yields:

- (1) Support from customers
- (0) Resistance from customers OR (resistance from customers AND low competition)
- (0) Resistance from customers OR (resistance from customers AND low pressure from customers to adopt)

These fragmented results suggest little commonality between respondent organisations and this confirms the lack of importance attributed to this category suggested both by the interviews and literature review. The solitary mention of market pressure on IT was ...

“Customers wanted the ability to buy tickets over the internet and it (web site) has exceeded our expectations.” Finance Manager, Show Organiser A.

... which suggests that whilst small businesses undoubtedly work in competitive markets, they are unable or unwilling to explicitly invest in IT to help them compete.

Outcomes. Although not strictly part of the research brief, the second phase of the survey also prompted respondents to identify why IT instances (cases) were successful by asking them to rate any benefits delivered. Examining the truth table suggests little consensus (i.e. multiple cases with identical combinations) and the list of prime implicants included all nine conditions, but minimisation revealed that two conditions contributed most:

- (1) Clear benefits
- (1) Improvements in efficiency

- (0) No clear benefits
- (0) No improvements in efficiency

The ‘clear benefits’ question is perhaps vague but was deliberately asked as, from the researcher’s experience, the failure to anticipate and therefore often appreciate IT benefits is one of the main reasons for perceived IT project failure. These findings tend to support this theory. Of the other benefits, it was improvements in efficiency which cover most set space and suggests SMEs are still using IT for internal uses rather than gaining external competitive advantage.

3.4.3 Two-Level Model: Between Levels

Armed with this framework, it is possible to revisit and refine our earlier model as below.¹⁶ At this stage of the evaluation cycle it was necessary to hypothesize as to what the secondary level relationships might be (Pawson and Tilley 1997) and the evidence to date suggested:

Small Business Profile. Conjunction of necessary causes. The secondary level displays combinations of conditions which are individually necessary and jointly sufficient to define what makes up a small business. The relationship to the basic level is ontological as ‘this is what small businesses are’ and is a useful reminder that these are not causal conditions that small businesses can change quickly or easily.

¹⁶ The category titles have now been made less passive to reflect findings and be more meaningful.

Clear Objectives. Equifinality. Any condition appears sufficient to provide an organisation with clear objectives. Relationship between levels is substitutable i.e. any of the secondary levels could contribute to clear objectives.

Pragmatic Management. Equifinality. Combinations of realistic expectations and good planning are sufficient to produce pragmatic managers. Relationship to basic level is causal.

Ready Users. Equifinality. A combination of willing users (i.e. with a positive attitude) seem able to overcome inadequate training. Good training helps overcome negative attitudes. Relationship to basic level is causal.

Adequate Resources. Equifinality. Combinations of skills, strategy, time and resource conditions are sufficient to produce adequate technical resources at the basic level. Strategies change to reflect budgets; budgets and resources are restricted but adequate if planned properly. Relationship to basic level is causal.

Professional Providers. Equifinality. Either condition appears sufficient to define a professional provider. Even if the system is not well designed initially, the provider will correct this to deliver their promise. Relationship to basic level is causal.

Market Pressure. Conjunction of necessary causes. Customers are only able to create market pressure in a competitive market. Relationship to basic level is ontological to reflect 'that's the way the market is' and small business can do nothing to change it (unlike big business).

These categories and the relationships between secondary level and basic level are shown in Figure 23 and Figure 24 (over).

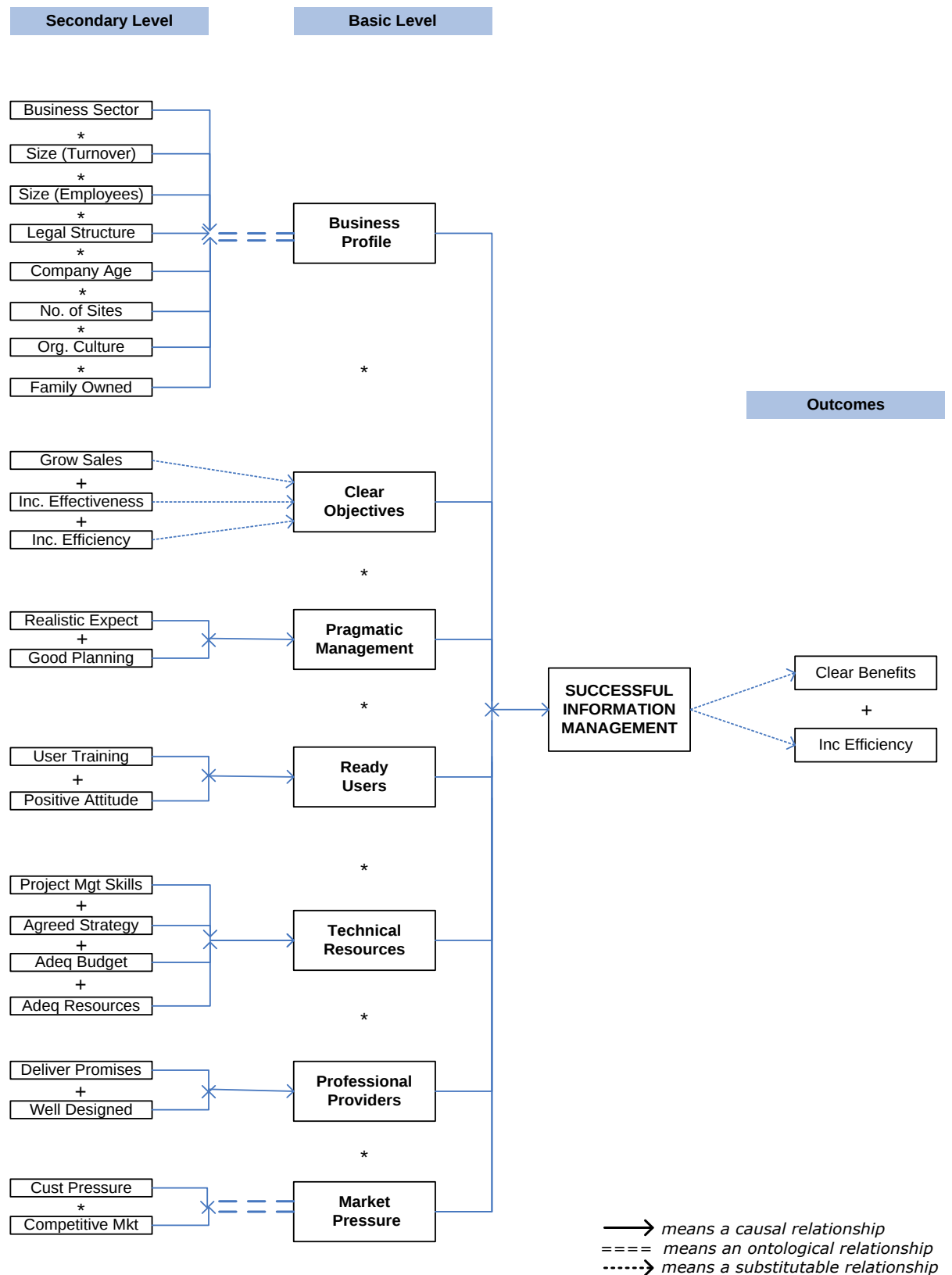


Figure 23 Two-Level model for successful outcomes

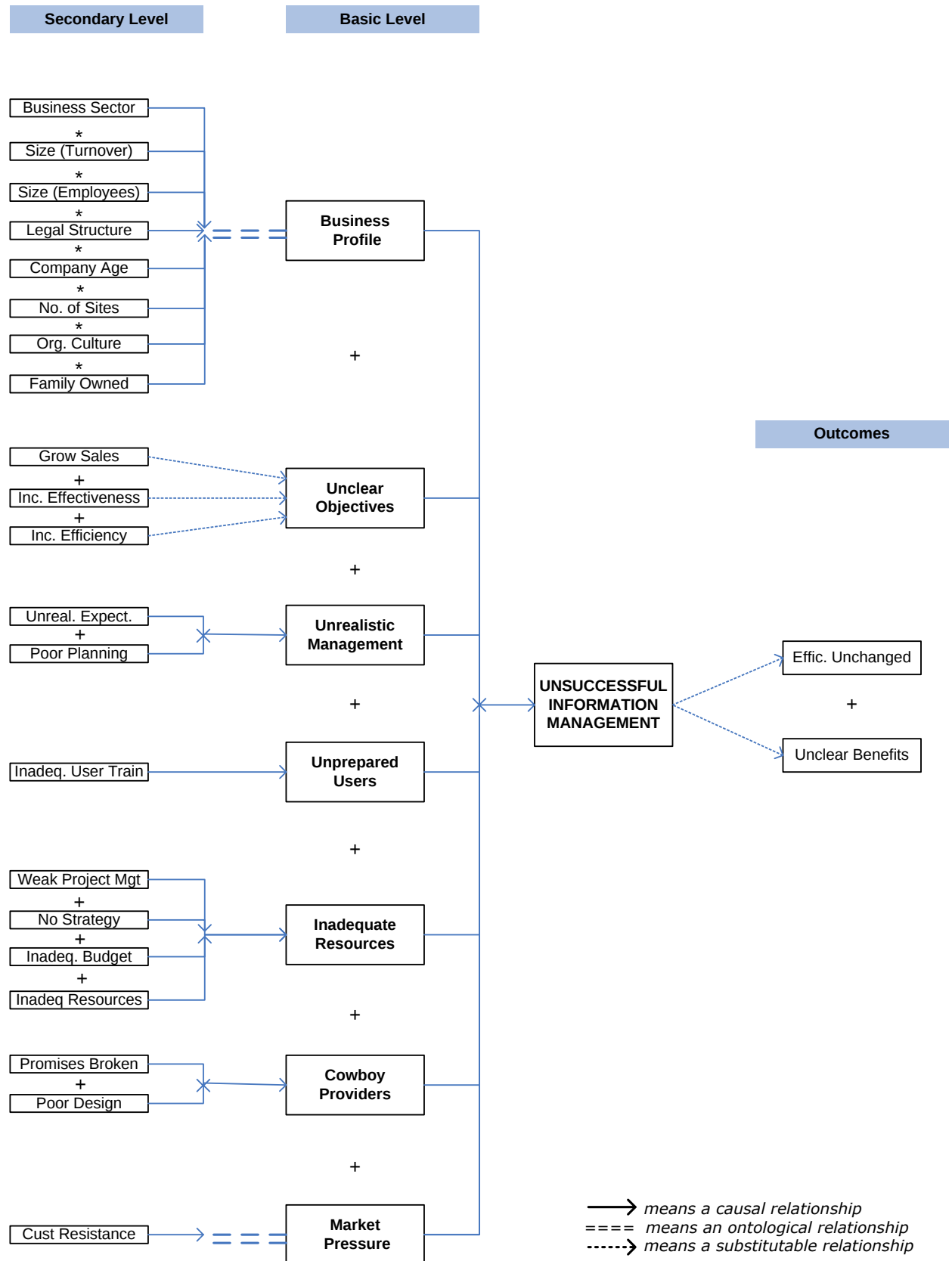


Figure 24 Two-Level model for unsuccessful outcomes

3.4.4 Two-Level Model: Within Basic Level Only

So far, the model had concentrated on analysing secondary level conditions and their likely relationship with basic level categories. The next stage was to examine the relationship *between* the basic level categories. This was done by using the suggested logical operators in the secondary level to produce reduced basic level values. If the relationship at the secondary level was logical ANDs, the minimum value would be assigned to the basic level; if the secondary relationship was ORs the maximum secondary value would be assigned.

Running QCA on the resulting basic level variables wasn't very helpful. Excluding logical remainders produced a fragmented response that simply described the data whilst including remainders produced a result which suggests that a successful outcome is explained by professional providers only as both a necessary and sufficient condition. Again, this finding was felt to be too parsimonious and did not accurately reflect the complexity of the data.

These points were put to the software author Lasse Cronqvist who replied by Email:

'If you want to use MVQCA with your data you should reduce the number of steps in each condition, as you will not receive any results using such fine-grained data without including logical remainders, as the cases are singularised and no reductions can be made.'

The MVQCA results were also discussed and that using a crisp outcome, *including remainders*, reducing for successful or unsuccessful produced one solution (Professional Providers) which appeared too parsimonious.

'Well, this might look too parsimonious. But if you look on the data, you will see that $OUT=1$ if $prov \geq 4$ and $OUT=0$ if $prov < 4$, so in fact, 'professional providers' seem to be sufficient to explain the outcome in the cases included in the data set.'

The results of crisp outcome, exclude remainders, reduce for successful or unsuccessful producing each case unique except one common (contradictory) configuration was also explored.

'This is due to the high number of possible configurations due to the Likert scale used. MVQCA can use such a high complexity, but the number of reductions possible is very low if the data is singularized this way'.

Finally it was suggested that the results could probably be improved by reducing the variety in values possibly even to dichotomous but that this seemed somewhat self-defeating.

'May be you should try to use three stepped conditions in MVQCA instead of seven stepped ones. This might increase the use of the MVQCA analysis.'

The frustrating inability to find meaningful QCA results contrasted with the narrative, supporting literature and researcher experience which all tended to suggest that successful information management in small business *is a conjuncture of necessary causes* (i.e. joined by logical ANDs) that are individually necessary and jointly sufficient to produce a successful outcome. Similarly, the relationship between basic level categories in unsuccessful cases *is suspected of being one of equifinality* i.e. any category is sufficient to bring about an unsuccessful outcome. This 'many routes to failure' contrasts sharply with the 'few routes to success' and may help explain why information management instances are so prone to problems.

At this point, these findings and propositions were presented at the Durham Doctoral colloquium in October 2006 and ISBE International Conference in November 2006. The next phase after the colloquium and conference was to develop the proposed two-level model further using the earlier data collected in phase two and phase three questionnaires and interviews.

3.4.5 Lessons Learned

This phase provided an interesting venture into the world of small business information management using analytic tools new to the field such as QCA and Two-Level theory in support of more established survey and interview methods. In doing so, it has brought some structure to an otherwise fragmented field and started to provide information useful to practitioners as ultimately befits a DBA thesis.

The battle of 'words and numbers' was being lost to the latter however. Whilst multichotomous coding was useful at the secondary level, it produced either fragmented or over-simplified results at the basic level. Another problem was the aggregation of data across levels meant that a lot of the meaning and rich narrative was being lost in Excel functions. The importance of time as another complicating factor also became apparent as did the concept of proximity / distance to help manage the complexity encountered.

3.5 PHASE FOUR: THEORY REFINEMENT

3.5.1 From Portrait to Landscape

The next phase of the research aimed to develop the two-level model especially in the critical areas of basic level logical structures and temporal conditions. The 'Portrait to Landscape' title refers to the subsequent shift from a *long* list of possible causal conditions (Figure 33) to the eventual *wide* statement of more focussed causal groups acting across time (Figure 35).

The same twelve organisations and twenty four cases were used in this phase.

3.5.2 Brick Wall Time (Again)

The main need was to analyse the relationship within the six main basic level conditions and it was decided to use fuzzy set methods and software (as opposed to the multi value methods used previously) hoping that a solution which avoided deterministic extremes could be derived.

Results at this stage supported the accusation that one of the weaknesses of QCA is its tendency to determinism with a condition always being associated with a given outcome (Edwards 2005, p.10). Using MVQCA which uses the strict routines to find most likely causes (prime implicants) meant that results tended to be either too vague or too parsimonious. It was hoped that moving from crisp to fuzzy sets together with probabilistic methods in FS/QCA may help reduce this problem in subsequent phases. It would also allow us to compare and contrast the methods and to make better use of the significantly greater amount of supporting literature.

Problems were immediately encountered as the FS/QCA method seemed to have switched from the inclusion method preferred in earlier versions to the truth table method which had become the only method available as the current software version in mid 2006. The *inclusion method* (which was run on an older version of FS/QCA) suggested there were no necessary causes of any reasonable significance (0.8, $p < 0.05$) and a few fairly meaningless sufficient combinations. The new truth table version was even less useful, due partly to the need to move cross-over values (4 or 0.5) to being either more in or more out and avoiding full set memberships too. Such deliberate data manipulation seems unnecessary and therefore this route was not preferred even though it might be more appropriate than inclusion methods for very small n (Cronqvist and Herrmann, 2005).

Further tortuous analyses revealed that the data from 'Case = IT Instance' proved of little use for this purpose. This was because the two cases in each organisation were too *distant* to compare sensibly using set theoretical methods i.e. it was impossible to compare individual causal conditions (e.g. user attitude) for membership of the same set (Schneider 2003) as these were not relevant in all the organisations. There was no option but to 'return to the field' to

obtain more carefully considered and carefully calibrated responses to the main basic level conditions.

3.5.3 Back To The Field

All twelve organisations were contacted again and interviews arranged throughout January 2007. One of the respondents (Recruitment Agency) had been posted to Italy and another had retired (Charity) but a colleague was willing and able to expand on their earlier responses. This meant the number of organisations interviewed was eleven yielding 22 cases (11 successful, 11 unsuccessful). The respondents were reminded of the information management projects previously submitted (appendix 4) and asked to:

1. Score each project (successful and unsuccessful) on a scale of 1 to 7 where 7 is very successful and 1 is very unsuccessful.
2. Score each of the six main causal conditions please on the extent to which they contributed to the success of the project on a scale of 1 to 7 where 1 was a significant negative contribution, 7 was a significant positive contribution and 4 was no contribution either way. *These equate to fully out, fully in and the cross-over point of the membership of the appropriate fuzzy set.*

Qualitative breakpoints were based on theoretical and substantive criteria. Ragin stresses the fidelity of membership scores to concepts is very important and that 'qualitative anchors' must be used to establish a close relationship between raw measures and fuzzy set membership. He again stresses that fuzzy sets are fundamentally *interpretive* tools (my emphasis) in that they 'operationalise theoretical concepts in a way that enhances the dialogue between ideas and evidence' (Ragin 2000, p.162).

The eleven interviews were all conducted and transcribed (key phrases only) during January and early February 2007 and the raw scores entered into a spreadsheet (Table 28) with additional columns as explained below. Data displays in matrix form are strongly advocated by Miles and Huberman who argue strongly that they are important tools for cross-case analysis (p.435). Detailed tables underpinning the analyses are shown in appendices 5 to 10.

Table 28 Phase four data - adjusted and calibrated - individual cause analysis

Company	Internal Control			External Cooperation			Outcome
	Obj	Mgt	Res	User	Prov	Cust	
Ins Broker (1)	0.83	0.83	0.83	0.83	0.67	0.67	1
Ins Broker (0)	0.67	0.33	0.17	0.67	0.5	0.5	0.33
Engineering B (1)	0.83	0.67	0.83	0.67	0.83	0.5	0.67
Engineering B (0)	0.67	0.67	0.67	0.33	0	0.5	0.33
Hotel (1)	0.67	0.67	0.67	0.5	0.67	0.5	0.67
Hotel (0)	0.33	0.33	0.17	0.17	0	0.33	0
Surveyors (1)	0.83	0.5	0.5	0.67	0.83	0.67	0.67
Surveyors (0)	0.17	0.17	0.5	0.67	0	0.33	0.17
Retail (1)	0.83	0.67	0.83	0.67	0.83	0.5	0.83
Retail (0)	0.17	0.33	0.67	0.5	0	0.5	0.17
Charity (1)	0.83	0.67	0.83	0.83	1	0.67	0.83
Charity (0)	0.17	0.33	0.33	0.17	0	0.5	0
Engineering A (1)	1	0.67	0.67	0.83	0.67	0.67	0.83
Engineering A (0)	0.67	0.67	0.67	0.33	0.33	0.17	0.33
Finance (1)	0.67	0.83	1	0.83	1	0.5	0.83
Finance (0)	0.33	0.17	1	0.5	0.33	0.5	0.33
Show B (1)	0.83	0.5	0.67	0.67	0.83	0.67	0.67
Show B (0)	0.17	0.5	0.33	0.5	0.17	0.5	0.33
Manf (1)	1	0.83	0.67	0.67	0.83	0.5	0.83
Manf (0)	0.67	0.17	0.17	0	0.33	0.5	0.17
Show A (1)	0.83	0.67	0.67	0.67	0.83	1	0.83
Show A (0)	0.33	0.17	0.67	0.5	0.17	0.5	0.33

Red = Adjusted / Calibrated

The next step was to adjust and calibrate project scores where appropriate. *Adjustment* refers to changing scores within a case where the initial mark seemed incompatible with more considered textual discussions. *Calibration* (i.e. matching category content with a conceptual understanding of the case) involved the changing of scores across cases to make them more comparable with the other cases from a set membership perspective. All such changes are explained in the case descriptions shown in appendices 11 to 21.

Ragin (2000, p.34) stresses the need to carefully calibrate responses to ensure they maintain set integrity. This was achieved in this phase of the project by carefully exploring the reasoning behind each response. The only need to change responses was during the transition from Inferential Method to Truth Table when the relatively large numbers of cross-over scores (0.5)

rendered results meaningless. The results were then keyed into FS/QCA and analysed using fuzzy set methods.

3.5.4 'Hard' Analysis – FS/QCA Using Probabilistic (Inclusion) Method

The original model used by Ragin in 'Fuzzy Set Social Science' is probabilistic and avoids strict Boolean logic for simpler methods based on fuzzy set coverage. Using this method produced the results shown in Figure 25.

Model: OUT = OBJ + MGT + RES + USER + PROV + MKT

Cases Read: 22
Valid: 22 100.0%
Missing: 0 0.0%

*** NECESSARY CAUSE ANALYSIS ***

Number of Cases Tested (Outcome > 0): 20 (90.9% of Total)

Method: Probabilistic
Test Proportion: 0.80
*p < 0.05

Variable	N Cause ≥ Outcome	Observed Proportion	Binomial p
obj	9	0.45	0.411
OBJ	17	0.85	
mgt	9	0.45	
MGT	11	0.55	
res	8	0.40	
RES	14	0.70	
user	9	0.45	
USER	14	0.70	
prov	9	0.45	
PROV	13	0.65	
mkt	9	0.45	
MKT	11	0.55	

0 Necessary Cause(s) Included in the Analysis

*** SUFFICIENT CAUSE ANALYSIS ***

Method: Probabilistic
Test Proportion: 0.80
p < 0.05

*** FUZZY-SET SOLUTION ***

MGT*PROV + obj*RES*PROV + mgt*RES*PROV + obj*USER*PROV + RES*user*PROV + RES*USER*PROV + RES*PROV*mkt + RES*PROV*MKT

Coverage Measure: 0.823

Figure 25 Output 1 (FS/QCA)

Fuzzy Set Output 1 shows that no causes pass the test for necessity at a 0.8 proportion with *p < 0.05. CLEAR OBJECTIVES passed the proportion test with 85% but with a binomial of 0.41 this result was far from significant. Eight causal combinations passed the test for sufficiency, all of which included the PROFESSIONAL PROVIDER condition as suggested in the earlier analysis. Interestingly (and perhaps misleadingly) CLEAR OBJECTIVES was not included in

any sufficient combination as it was absorbed by other terms. An example of too parsimonious a solution perhaps? Coverage of these combinations at 0.82 was good.

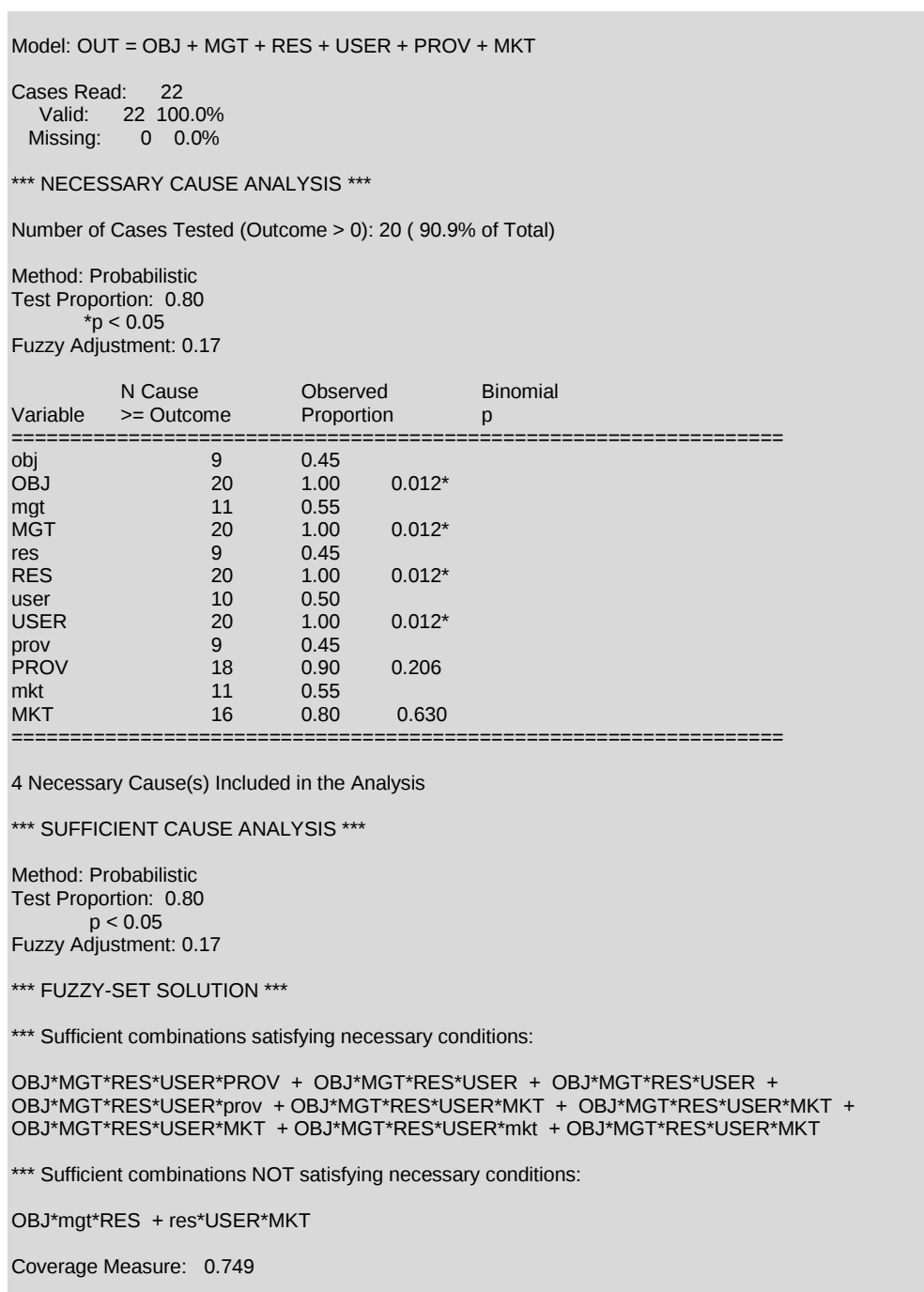


Figure 26 Output 2 (FS/QCA)

Fuzzy Set Output 2 (Figure 26) adds a one step (0.17) fuzzy adjustment factor which, as suggested from the graphical evidence, was enough to create four necessary conditions: CLEAR OBJECTIVES, PRAGMATIC MANAGEMENT, ADEQUATE RESOURCES and ABLE & WILLING USERS. This time there were nine possible sufficient combinations, all of which included CLEAR OBJECTIVES but only one included PROFESSIONAL PROVIDERS.

```

Model: OUT = OBJ + MGT + RES + USER + PROV + MKT

Cases Read: 22
Valid: 22 100.0%
Missing: 0 0.0%

*** NECESSARY CAUSE ANALYSIS ***

Number of Cases Tested (Outcome > 0): 20 ( 90.9% of Total)

Method: Probabilistic
Test Proportion: 0.70
*p < 0.10

Variable      N Cause      Observed      Binomial
              >= Outcome  Proportion    p
=====
obj            9         0.45
OBJ            17         0.85    0.107
mgt            9         0.45
MGT           11         0.55
res            8         0.40
RES           14         0.70    0.608
user           9         0.45
USER          14         0.70    0.608
prov           9         0.45
PROV          13         0.65
mkt            9         0.45
MKT           11         0.55
=====

0 Necessary Cause(s) Included in the Analysis

*** SUFFICIENT CAUSE ANALYSIS ***

Method: Probabilistic
Test Proportion: 0.70
p < 0.10

*** FUZZY-SET SOLUTION ***

OBJ*USER + obj*PROV + mgt*PROV + MGT*PROV + RES*PROV + user*PROV + USER*PROV +
PROV*mkt + PROV*MKT + OBJ*MGT*res + OBJ*mgt*RES + OBJ*mgt*user + MGT*RES*USER +
OBJ*MGT*MKT + OBJ*RES*MKT

Coverage Measure: 0.805

```

Figure 27 Output 3 (FS/QCA)

Fuzzy Set Output 3 (Figure 27) removes the adjustment factor, but relaxes the test proportion to 0.7 and the alpha to 0.10. There are still no necessary causes although three meet the proportion criteria. Fourteen combinations now meet the sufficiency criteria.

3.5.5 'Hard' Analysis – FS/QCA Using Veristic (Truth Table) Method

The results from running the most parsimonious and least parsimonious analyses are shown as Figure 28. They are of little value with the most parsimonious (Reminders set to False) simply showing all terms bar Pragmatic Management as joined with logical ORs; the most complex (Reminders set to Don't Care) is similar but joined with logical ANDs.

```

Model: OUT = OBJ + MGT + RES + USER + PROV + MKT

Rows Read: 5
Valid: 5 100.0%
Missing: 0 0.0%
0 Cases: 3 60.0%
1 Cases: 2 40.0%
- Cases: 0 0.0%

Algorithm: Quine-McCluskey
True: 1
0 Matrix: 0-CL

*** TRUTH TABLE SUMMARY ***

    Configs  %
=====
0 Terms:    3 60.0
1 Terms:    2 40.0
- Terms:    0 0.0
C Terms:    0 0.0
=====
Total:      5 100.0
Dropped:    0 0.0

** TRUTH TABLE SOLUTION **

              raw coverage    unique coverage    consistency
              -----
OBJ*RES*USER*PROV*MKT          0.767505          0.767505          0.980505

solution coverage: 0.767505
solution consistency: 0.980505

```

Figure 28 Output 4 (FS/QCA)

Unfortunately this method does not seem to suit our data set and requires significant modification to work including adjusting all cross-over of 4 (0.5) to either more out or more in and removal of all fully out and fully in cases. Even when done, *little of any meaning could be discerned and it can only be concluded that this tool is inappropriate for such rich data.*

This conclusion resonates with a rare paper looking at QCA and a hermeneutic approach to help analyse teenager behaviour (Rantala and Hellstrom 2001). This concludes that 'QCA is most commonly used in macrosocial studies to investigate under which conditions a state of affairs is realised' (p.87). They go on 'in all applications of QCA, the received equations or statements are useless unless they can be meaningfully interpreted in relation to the cases.' (p.97). The authors confirm that QCA can be used to search for patterns and like this research uses the technique of linking results directly to transcribed interviews to hopefully good effect.

3.5.6 'Soft' Analysis – Individual Causal Conditions

Faced with such findings, a 'softer' approach was taken using some of the ideas behind QCA to see if this would provide a less rigid framework in support of our empirical findings. The adjusted and calibrated results were again loaded into FS/QCA and the Fuzzy Set X-Y Plot tool used to provide a simple visual indication of necessity and sufficiency – a technique used

successfully by both Jackson (2005) who used QCA in explore employee representation on the Board and Kent (2005) who confirms that 'FS/QCA straddles qualitative and quantitative analysis and sits midway between exploratory and hypothesis-testing research' (p.226).

First, causes were plotted against the outcome, then against each other for a simple cross-tab analysis. The results (where strong causal relationships are suggested) are shown in Figure 29 are summarised in Table 29 (over).

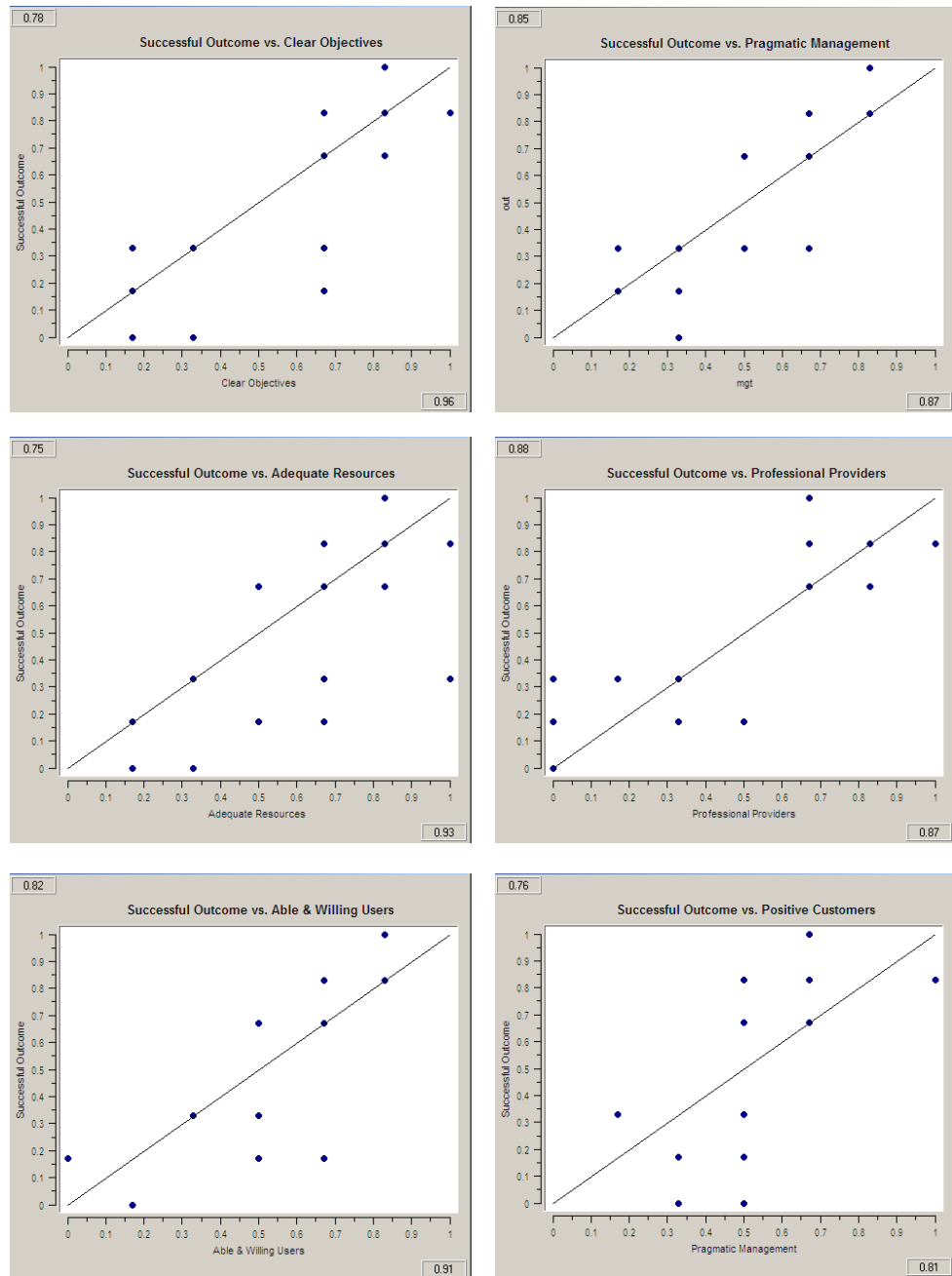


Figure 29 Causal conditions plotted against outcome

Table 29 X-Y plot results for individual causal conditions against successful outcome

Plot	Results
Objectives -> Outcome	Suggests strong necessary cause. Within one fuzzy set score in three cases.
Management -> Outcome	Suggests strong necessary cause. Within one fuzzy set score in four cases.
Resources -> Outcome	Suggests strong necessary cause. Within one fuzzy set score in three cases.
Providers -> Outcome	Suggests strong sufficient cause. Within one fuzzy set score in four cases.
Users -> Outcome	Suggests strong necessary cause. Within one fuzzy set score in four cases.
Customers -> Outcome	No clear pattern.

It was interesting to see that five out of the six causal conditions suggested a strong causal relationship of some kind which goes some way to validate the earlier phase 1 and phase 2 work. Clear Objectives, Pragmatic Management, Adequate Resources and Able & Willing users all appeared to be necessary causes whilst Professional Providers appeared to be the only possible sufficient condition. Causal conditions were also plotted against other causal conditions to see whether other relationships existed and the more interesting results are shown in Figure 30 and Table 30 below.

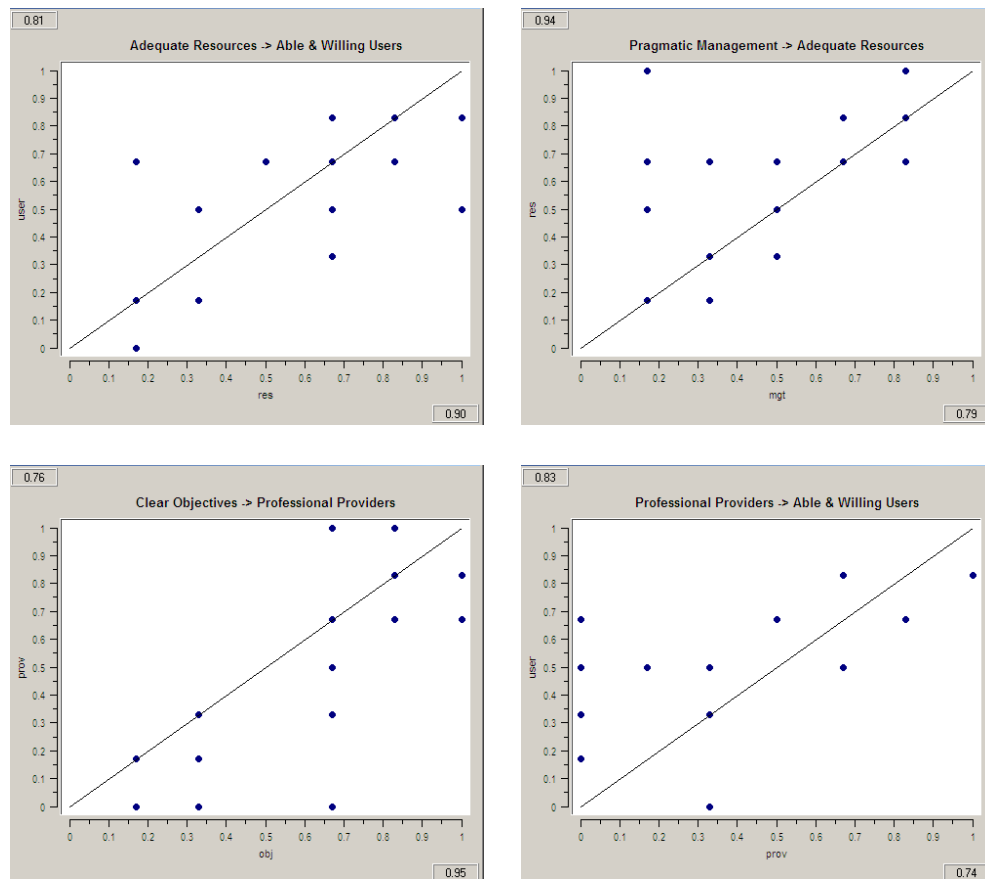


Figure 30 Causal conditions plotted against other causal conditions

Table 30 X-Y plot results for individual causal conditions against other causal conditions

Plot	Results
Objectives -> Management	Suggests weak necessary cause.
Objectives -> Resources	No clear pattern.
Objectives -> Users	No clear pattern.
Objectives -> Providers	Suggests strong necessary cause. Within one score in two cases.
Objectives -> Customers	No clear pattern
Management -> Resources	Suggests strong sufficient cause. Within one score in three cases.
Management -> Providers	Suggests weak necessary cause.
Management -> Users	No clear pattern.
Management -> Customers	No clear pattern.
Resources -> Providers	No clear pattern.
Resources -> Users	Suggests strong necessary cause. Within one score in three cases.
Resources -> Customers	No clear pattern
Providers -> Users	Suggests strong necessary cause. Within one score in three cases.
Providers -> Customers	No clear pattern.
Users -> Customers	No clear pattern

The majority of casual conditions appear to have little or no relationship with other causal conditions. The plots suggest however that Clear Objectives are necessary to secure Professional Providers which may mean some suppliers were blamed unfairly in unsuccessful projects when the real culprit may have been managers not knowing what it was they wanted. Pragmatic Management also seemed necessary to secure Adequate Resources. Furthermore Adequate Resources also seemed to lead to Able & Willing Users as did Professional Providers. *All these make sense and merit further investigation.*

3.5.7 'Soft' Analysis – Groups Of Causal Conditions

The next level of analysis was to 'let the data do the talking' and by listening to the recorded interviews and analysing the coded transcripts it became very clear that the theme that arose most frequently was that of 'control'. There appeared to be two quite distinct groups of causal factors: internal ones that the respondents as owners / managers / directors could theoretically *control* and external ones that they could merely hope to *cooperate* with. These resonated with the internal and external barriers identified by Sarosa and Zowghi and shown in Figure 31.

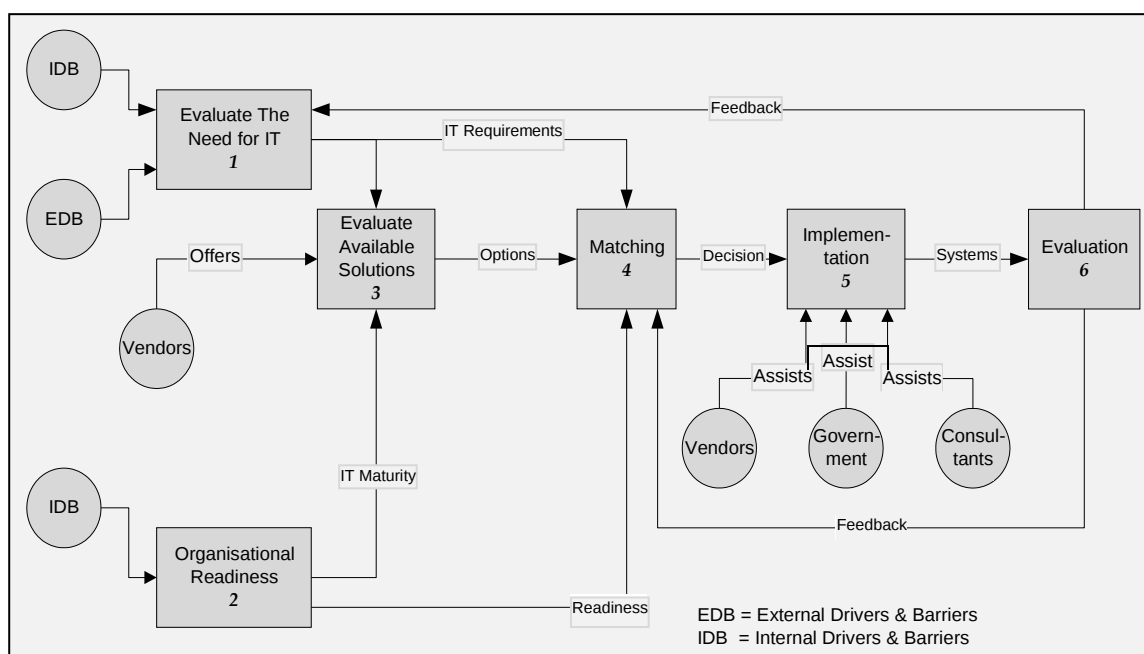


Figure 31 Process model for SMEs' IT adoption
(Source Sarosa and Zowghi 2003)

These themes also usefully borrowed from a paper which suggested that control and cooperation provide two key constituents of a critical realist metatheory of management (Tsoukas 2000). The logical grouping for the two themes is shown in Table 31. Perhaps the only unusual allocation is Able & Willing Users to the external cooperation theme but User Attitude shone through in all phases both in terms of its importance and the relative inability of managers to influence it.

Table 31 Possible internal and external causal groupings

Internal Control	External Cooperation
Clear Objectives	Able & Willing Users
Pragmatic Management	Professional Providers
Adequate Resources	Positive Customers

Earlier QCA results, existing literature and the narrative that arose from the cases suggested that successful outcomes were achieved when :

- ALL internal controls were necessary, and
- At least ONE external influence was sufficient, and
- Control was in place BEFORE external bodies were involved.

Necessity within combinations of causal conditions implies logical ANDs to yield the intersection of set memberships; sufficiency implies logical ORs to show the union of set memberships. The relationship hypothesized can be stated in Boolean algebra as:

(Objectives * Management * Resources) THEN (Users + Providers + Customers) -> Success

These hypotheses were examined further using XY Plots as shown in Figure 32 and Table 32.

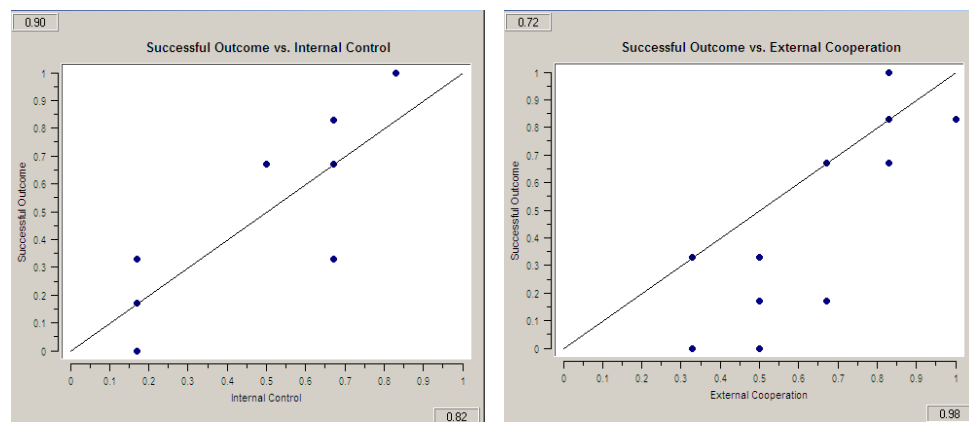


Figure 32 Internal and external grouping x-y plots

Table 32 X-Y plot results for internal control group against external cooperation

Plot	Results
Internal Control -> Outcome	Suggests strong relationship.
External Cooperation -> Outcome	Suggests strong necessary cause. Within one fuzzy set score in one case

The combined causal groups were achieved using simple MIN() and MAX () functions in Excel. These replicate the fuzzy set operations for logical AND and logical OR within fuzzy sets as discussed by Ragin (2000). The results are persuasive and the fit between the combination of the causal conditions suggested from the cases and the outcomes is within one fuzzy set

membership scale or less. In some papers this is deemed sufficient evidence (Goertz and Mahoney 2005, Jackson 2005).

Table 33 Phase four data - causal group analysis

Company	Min (AND) Internal	Max (OR) External	Min (AND) Both	Max (OR) Both	Outcome	Diff Min Both	Diff Max Both
Ins Broker (1)	0.83	0.83	0.83	0.83	1	0.17	0.17
Ins Broker (0)	0.17	0.67	0.17	0.67	0.33	0.16	-0.34
Engineering B (1)	0.67	0.83	0.67	0.83	0.67	0	-0.16
Engineering B (0)	0.67	0.5	0.5	0.67	0.33	-0.17	-0.34
Hotel (1)	0.67	0.67	0.67	0.67	0.67	0	0
Hotel (0)	0.17	0.33	0.17	0.33	0	-0.17	-0.33
Surveyors (1)	0.5	0.83	0.5	0.83	0.67	0.17	-0.16
Surveyors (0)	0.17	0.67	0.17	0.67	0.17	0	-0.5
Retail (1)	0.67	0.83	0.67	0.83	0.83	0.16	0
Retail (0)	0.17	0.5	0.17	0.5	0.17	0	-0.33
Charity (1)	0.67	1	0.67	1	0.83	0.16	-0.17
Charity (0)	0.17	0.5	0.17	0.5	0	-0.17	-0.5
Engineering A (1)	0.67	0.83	0.67	0.83	0.83	0.16	0
Engineering A (0)	0.67	0.33	0.33	0.67	0.33	0	-0.34
Finance (1)	0.67	1	0.67	1	0.83	0.16	-0.17
Finance (0)	0.17	0.5	0.17	0.5	0.33	0.16	-0.17
Show B (1)	0.5	0.83	0.5	0.83	0.67	0.17	-0.16
Show B (0)	0.17	0.5	0.17	0.5	0.33	0.16	-0.17
Manf (1)	0.67	0.83	0.67	0.83	0.83	0.16	0
Manf (0)	0.17	0.5	0.17	0.5	0.17	0	-0.33
Show A (1)	0.67	1	0.67	1	0.83	0.16	-0.17
Show A (0)	0.17	0.5	0.17	0.5	0.33	0.16	-0.17
Sum of Diffs						1.6	-4.34

Table 33 shows that the combination of conditions which best fits both successful and unsuccessful outcomes is the minimum of the internal control factors (AND) and the maximum of the external cooperation factors (OR) then finding the minimum of the two (AND replacing THEN). The sum of the differences with the outcome is just 1.6 and a useful measure of fit.

3.5.8 The Revised Model

Lack of meaningful output either with or without the recommended adjustments from the fuzzy set truth table method meant that the final revised model is that verified from the interpretation of the interviews, graphically from X-Y plots and simple set theoretical relationships.

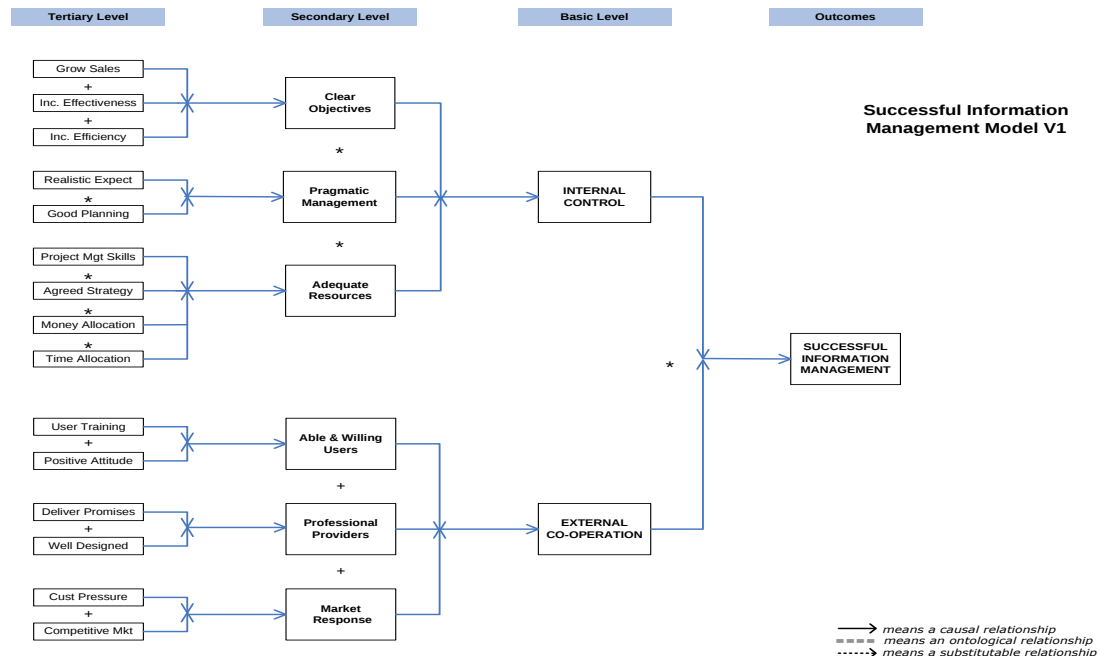


Figure 33 Revised model – version 1

The original model (Figure 33) is based on the schema provided by Goertz and Mahoney (2005) and used in the previous paper presented at ISBE 2006. This has since been through numerous iterations to a) accurately reflect the evidence relating to sufficiency and necessity of individual and combined causal conditions and b) provide a visual model that would be easily understood by non-academics for subsequent contribution to practice.

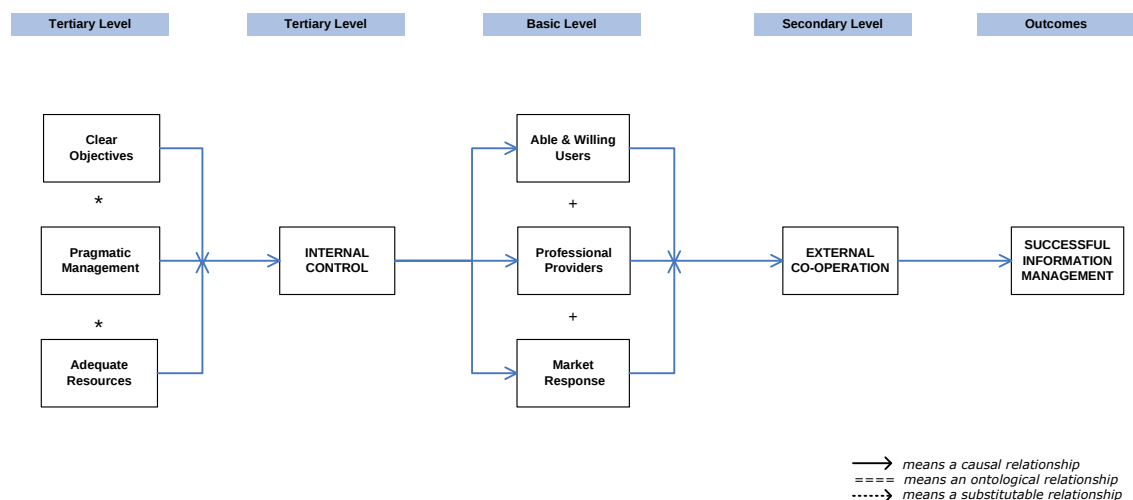


Figure 34 Revised model – version 2

There were several iterations before this but the first model which most accurately reflects the relationship is shown in Figure 34. This shows the secondary and basic level conditions and the relationship both within levels and between levels. What it fails to do adequately is show the temporal aspect between secondary and basic levels. An implicit temporal element is inadequate here when there is clearly a big THEN between internal control and external cooperation causal conditions shown using the ' / ' as preferred by Ragin.

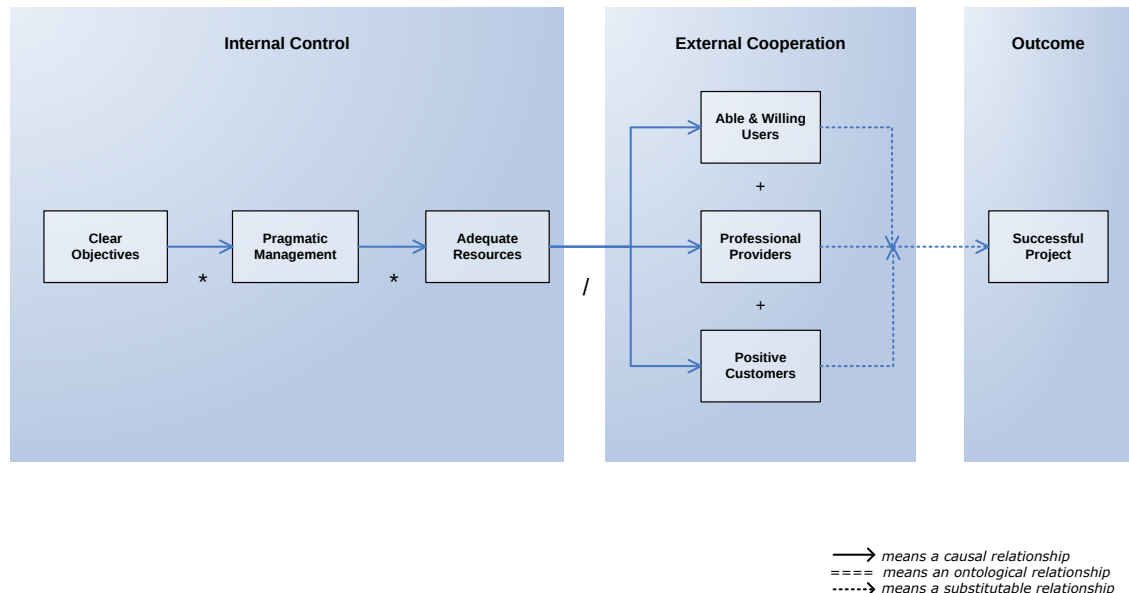


Figure 35 Revised model – version 3

The model which finally emerged is shown in Figure 35. This amends the Goertz and Mahoney model to show the two causal groups (internal control and external cooperation) and the six causal conditions within them. The reasons for this layout are:

Causal Conditions. Within the internal control condition group these are shown horizontally to help show that they are nearly always necessary conditions joined by logical ANDs. Aligning them horizontally is useful in practice to show these as *hurdles* which must *all* be overcome to ensure a successful outcome. Within the external cooperation group conditions are shown vertically to help show they are nearly always individually necessary but jointly sufficient conditions joined by logical ORs. Aligning them vertically helps explain to practitioners that these are channels *any* one of which can be taken to ensure a successful outcome.

Causal Groups. These are aligned horizontally to show that internal control logically precedes external cooperation. These two groups are joined by a *causal relationship line* and logical AND to show that they are both necessary condition groups i.e. supersets of the outcome. The dotted line from external cooperation again uses the Goertz and Mahoney standard to show that the routes to the successful outcome are substitutable.

3.5.9 Lessons Learned

This was a critical and frequently painful six months which revealed that fuzzy set methods are difficult to apply to small numbers of cases even if Bayesian probability techniques are employed. The output quickly becomes meaningless and even if interpretable very difficult to re-apply back to the narrative in rich, living case data.

The concepts of necessity and sufficiency were of great relevance however, especially when allied with graphical plots and simple Excel based set manipulation. These in turn were best presented as simple graphical models to understand the relationships between the combinations of causal factors. The final step was to test the model substantively by applying it back to the cases.

3.6 PHASE FIVE: THEORY TESTING

3.6.1 Logical Testing: Managing Time in QCA

It would doubtless increase research validity if the final model could be tested using formal QCA techniques which verified the combinatorial logic proposed. Any such technique would however need to allow for the issue of 'time' which has clear implications for the cases studied in this research. A useful summary of current methods to integrate time-series components into QCA is provided by Hino (2007) in Table 34.

Table 34 Mapping various QCAs

		Methods	
		Boolean	Fuzzy Set
Techniques	Static	CS/QCA MVQCA	FS/QCA
	Dynamic	TQCA TS/QCA	TQCA (Ragin) TS/QCA

Source Hino (2007)

Unfortunately neither of the dynamic Temporal QCA (TQCA) nor Time Series (TS/QCA) methods can be applied to our case data as currently structured and there was neither the time (nor inclination) to conduct a fourth set of interviews. Hino's TS/QCA is a technique to 'systematically transform time-series data into the QCA format' (2007, slide 11). It differs from TQCA in that TS/QCA focuses on analysing cross temporal variations of the data, while TQCA focuses on the order and sequence of events that occurred. Whilst TQCA appears more relevant, the drastic expansion in the number of possible configurations limits Boolean TQCA whilst TQCA based on Fuzzy Sets has been rejected for the small-n problems discussed earlier.

3.6.2 Substantive Testing: Applying the Model to the Cases

The testing procedure is therefore based on that proposed by Krook (2006) which does not perform Boolean analysis but 'soft' form of analysis to detect and present temporal changes across configurations. This was done graphically using a combination colour-coded graphics and textual narrative to provide a concise yet highly informative case description.

All twenty-two cases are shown in appendices 11 to appendices 21 *and it is argued that the theory and subsequent model do provide a good fit to explain the events leading to successful and unsuccessful outcomes.*

4 RESEARCH CONCLUSIONS

4.1 CHAPTER SUMMARY

The purpose of this of this chapter is to conclude how research findings have contributed to both practice and knowledge as per DBA requirements.

Contribution to knowledge was surprising. QCA was originally chosen as a method that would support critical realist theory. At the end it critical realist theory which was used to support and explain QCA methods and (non-) findings. This included not only possible upward conflation from a QCA research community locked into remote, macrosocial issues but also structural elaboration / reproduction, adding ontological depth to empirical findings and reaching dualist compromises without recourse to relativism. The common 'many variables, few cases' QCA problem was highlighted and the need for pictures (graphics) and language (quotes) to support QCA findings is strongly advised. Indeed, QCA ended up informing the development of both matrix and network designs advocated by Miles and Huberman instead of the other way round.

The major addition to the literature made by this research is the explicit attempt to examine causes both individually and in causal groups to better understand the way causes combine to provide outcomes (and non-outcomes). This is also the first paper to explicitly use the ideas of critical realism to try explain these findings, and the focus on ontological rather than epistemological validity has greatly simplified and strengthened the findings.

Contribution to practice comes from distilling the myriad of potential conditions suggested by previous literature into six basic-level causal conditions. More importantly, it suggests how combinations of these causal conditions work together in causal groups to produce successful and unsuccessful outcomes. The findings also stress the importance of proximity and time to help reduce complexity and the useful concepts of necessity and sufficiency to a wider audience. Of lesser importance is the confirmation that grounded definitions of success and behavioural definitions of information management are preferable to traditional and technical definitions respectively.

The chapter ends with a critical review of the project and some ideas for future research. The nagging regret outstanding is that QCA fails to address the (literal) complexity of cases using either deterministic or probabilistic worldviews and that more holistic methods from complexity theory may provide a superior approach. This is a big project and in the meantime the dissection of 'Insurance Broker' is next on the research agenda.

4.2 CONTRIBUTION TO KNOWLEDGE

4.2.1 Critical Realism Helps Inform QCA Methods and Explain QCA Findings

It is worth remembering that QCA originated from, and has been refined almost exclusively by, a research community focused on the analysis of large, macrosocial issues in the world of politics and other social science. What QCA has successfully achieved is to permit the re-interpretation of issues such as the start of world wars (Goertz and Levy 2005), the consolidation of democracy (Schneider and Wagemann 2006) and the effectiveness of health care policy (Kitchener, Beynon et al. 2002). Even work closer to home in the field of management has worked with distant, aggregate statistics well suited to Boolean manipulations (Kogut, MacDuffie et al. 2004; Jackson 2005; Kent 2005).

In many respects this work can be likened to a tool in the hands of a pathologist seeking to explain the demise of cold, unresponsive cadaver. *But this project was no autopsy.* The subjects were very much alive and able to give the most subtle of nuances to their responses. In such microsocial cases reducing this incredibly rich evidence to numbers and then conducting complex manipulations on them is possible but can quickly lose meaning.

This project suggests therefore that QCA is less well suited when working with rich, textual narratives produced *in vivo* by small, microsocial cases. Whilst the ‘many variables, few cases’ problem is acknowledged in the QCA community (Hitt, Harrison et al. 1998; Ragin 2000, p.321) it has proven to be a lot more difficult to simplify these when the researcher is so close to the data. Calibrating for consistent set membership is one thing; adjusting non-committal cross-over scores as part of a fuzzy set analysis is quite another. You can almost hear the patient awaking from anaesthetic and shouting ‘But that is *not* what I meant!’

It would east to shrug this off as a technical issue inherent in QCA but the real problem is deeper. It suddenly became clear that the vast majority of previous QCA work has focussed on *structure* whilst this research, heavily based on inductive grounded theory, has focused much more on *agency* (Jones and Hughes 2004). Mutch has a lot to say here about collective agents versus individual actors (2002, p.355) and what is clear is that the impact of *people* hasn’t featured greatly in previous QCA work apart from one or two exceptions (Rantala and Hellstrom 2001; Hage 2005). At a more fundamental level Archer might suggest that previous work has been guilty of *upward conflation* i.e. equating structure with facts and making little allowance for the action of agents (1995,8).

Adding the complexity of collective agents inevitably means ‘we are in trouble when we arrive at the second stage of QCA with a basket full of causal attributes that we hope to explore.’ (Coverdill and Finlay 1995, p.475). That the logic of QCA encourages the use of a small

number of causal variables is well known (Kitchener, Beynon et al. 2002) but drastically reducing these means 'the analysis then becomes more an imaginative exercise than an analysis of evidence' (p. 473). The sensitivity of the final QCA results to the variables included in the analysis is high and it is easy to drop apparently important ideas in the search for small variables.

Advice to use 'higher-order' constructs (Ragin 2006), two levels (Goertz and Mahoney 2005) or two steps (Schneider 2003) is technically valid but operationally difficult when so close to the subject. Although the combinatorial complexity of recommended QCA thresholds (nine conditions, seven set membership scores) is significant, it struggled to capture the subtleties and shades of the verbal contributions and participant observations obtained throughout the project.

Ideas from realist theory can again help here. Schneider's proximity ideas (2006) clearly resonate with Sayer's ideas (2000) of structure and the early separation of *structural elements* with internal, necessary relationships and *structure occupants* with external, contingent relationships would have helped the research greatly. Figure 36 suggests this and is based on Sayer's property rental example (p.93).

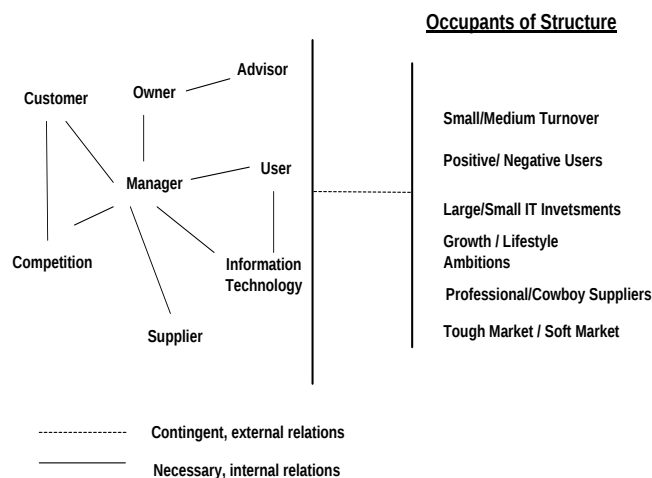


Figure 36 Project structure and relations
(Based on Sayer 2000, p.93)

To be fair, this would not be disputed by Ragin who repeatedly stresses the need for interchange between ideas and evidence and that QCA supports not supplants other research methods. It also begs the question of which other tools might be more suitable and whilst QCA methods may become complicated, for others the overall idea of fuzzy sets has advantages. 'The fuzzy set approach makes also a positive difference for studies where the ratio of conditions to cases is so unfavourable that the more sophisticated methods for the reduction of causal expressions can hardly be employed.' (Hage 2005, p.29)

4.2.2 Inductive, Methodological Plurality Vital to Critical Realist Research

The inductive, iterative ideas borrowed from grounded theory proved perhaps the only way in which the ultimate model could have emerged. Deductive approaches allied to quantitative methods would not only have required a model to have been proposed but then data would have had to be found to fit that model *alone*.

The multi-methodology ideas put forward in support of the pluralist, triangulated research permitted from an epistemological-agnostic critical realist theoretical perspective also supported previous literature (Swartz and Boaden 1997; Southern and Tilley 2000; Mingers 2001). A feature of the research has been the way in which the research has switched between nomothetic and ideographic notions of causality (with depressingly monotony) and the methods have consistently supported this flexibility.

4.2.3 Critical Realist Ideas Help Explain QCA Structural Changes Over Time

It was well into the project before 'time' was identified as an issue. In hindsight this is surprising given that there is implicitly a time delay - no matter how small - between a cause and its effect. Incorporating time is now a subject of considerable interest in the QCA research community with a number of papers addressing the issue (Caren and Panofsky 2005; Hino 2007; Olsen 2007) although Ragin has been quick to point out that temporal sequencing was addressed in his original book (Ragin and Strand 2006).

Time was an issue *within* every case due to the temporal sequencing of internal control THEN external cooperation. In a few organisations there were also clearly linked temporal issues *between* their successful and unsuccessful cases. A good example is Insurance Broker who had the same driving mechanisms in both successful and unsuccessful cases i.e. a need to cut costs and high availability of good IT. In the first case however the power of both mechanisms was negated by reactive management and family autocracy. In the second case five years later, the *tendency* for cost and IT potential causal powers were in still place, but proactive management and family meritocracy added to these to provide an extremely successful outcome in actual and empirical domains.

An interesting point raised here by the partner interviewed was that the original, failed project was such a disaster that it actually provoked the change in management style and authority needed to provide the structural conditions necessary for the successful outcome. Having critical realism as our 'philosophical under labourer / midwife' come to our aid again here, and this structural conditioning resonates with the work of Archer (1995) by providing supporting evidence for subsequent *structural elaboration* or morphogenesis at a microsocial level. Borrowing the ideas from Archer (p.193) allows us to show this as Figure 37.

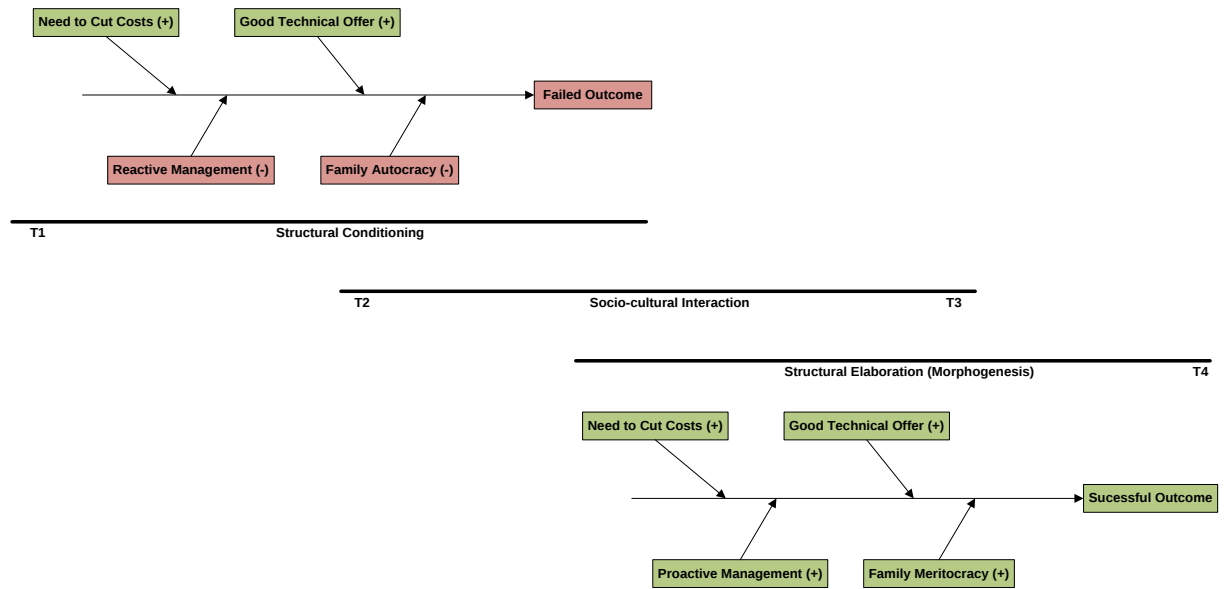


Figure 37 Evidence of morphogenesis in Insurance Broker
(Based on Archer 1995, p.193)

There was also evidence in another organisation (Show B) where the cultural integration *reproduced* structures over time (morphostatis) and it was the actions of agents which contributed to the change in outcome (Figure 38).

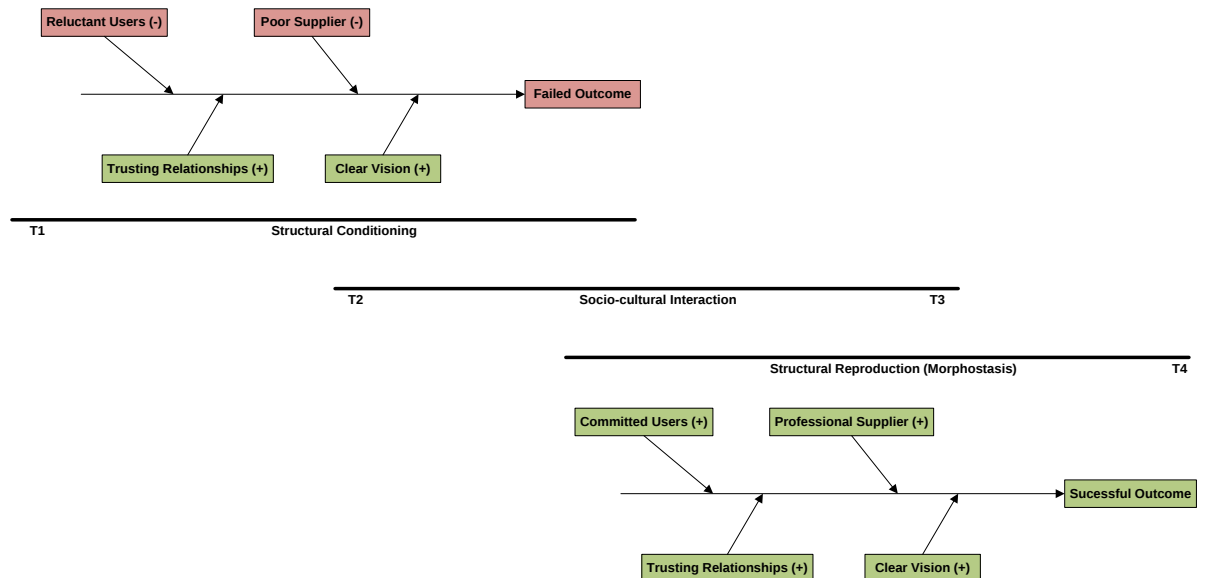


Figure 38 Evidence of morphostatis in Show B
(Based on Archer 1995, p. 193)

The importance of time in critical realist explanations is stressed too by Mutch (1999) who also uses Archer's analytical dualism i.e. the interplay between agency and structure to explain how

people managing IT inherit the situations in which they find themselves but have the choice as to how they react to these and whether they will change or reinforce them. He too produces a model of the process of information creation based on Archer's morphogenesis ideas and confirms that Archer argues that the approach is just as fitting for smaller-scale situations as 'the great sweeps of history' (p. 331).

4.2.4 Critical Realism Adds Ontological Depth to QCA Empirical Findings

The explicit use of (critical) realist research strategies proved a useful and ontologically sound basis on which to go beyond simple empirical QCA findings. The brief use of retrodution to try to explain activities in the deeper domains has enabled regularities to be identified and limited generalisation permitted on the basis of what works for whom in which circumstances. This has been achieved using combinations of causes without recourse to statistical significance or other quantitative norms yet these ideas allow patterns to be explained without the relativism and reductionism of purely nominalist approaches. As such, critical realism as a possible useful 'third way' helped greatly through its ability to rationalise an objective ontology with subjective epistemology (Morton 2003).

It was also clear that structural issues were important and embedded, intransitive issues such as power, control, trust and 'promises broken' appeared regularly (Insurance Broker, Show A, Show B). The several respondents could regard an information management project as being unsuccessful through something as intransitive as 'abuse of trust' has major implications for the IT evaluation field. The research was therefore successful in showing how the exercised technical powers and liabilities of information management objects could be reinforced or negated by other objects with their own powers and liabilities.

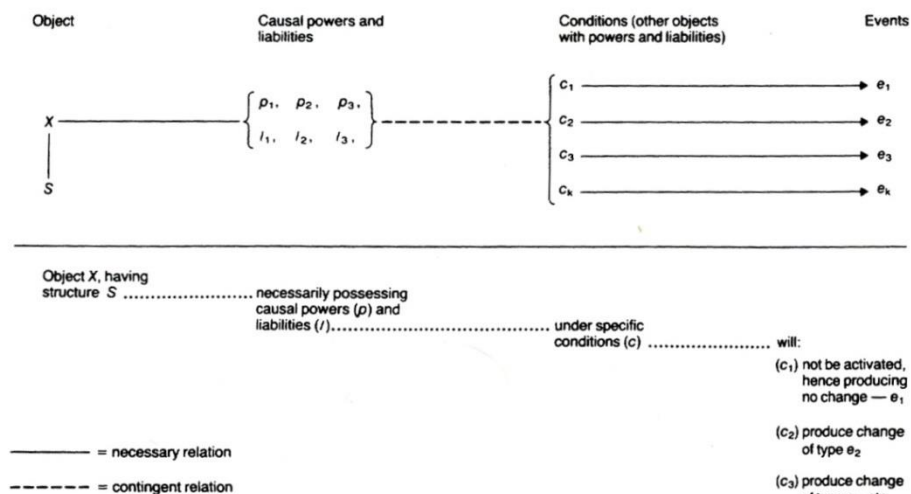


Figure 39 The structures of causal explanations
(Sayer 2000, p.109)

We can rely on Sayer to help here and Figure 39 sums this up nicely. The deterministic view that all information management is inherently good is clearly challenged in complex, open systems. *It is not that the technology won't work it's just that its ability to do so might be negated or enhanced by complex, contingent causality.* This research has shown this to be the case both individually and, critically, in causal combinations. Although only hinting at the complexity involved (we can never know everything) the findings provide new and valuable insights into this area. Mutch concurs and believes 'an approach based on critical realism has the potential to not only give us a better account of information at work, but also forging a better integration between the worlds of organization and information theory.' (1999, p.331).

4.2.5 Critical Realism Explains Dualism Without Recourse To Relativism

Realist ontological ideas have helped rationalise dualist extremes in both the management of information and the definition of success. For example, there was evidence that when information management instances were based on clear objectives (a necessary internal control causal condition) outcomes tended to be successful which clearly resonates with the hard school concept of information systems being used to 'aid decision making in pursuit of goals' (Checkland and Howells 1998, p.48). There was however also evidence to support Callaghan's argument to investigate 'socio-political forces rather than any inherent character of technology' (p. 290) and phenomenological issues such as family relations lend weight to the 'soft' interpretive school of information management theory.

Whilst a purely constructivist interpretation (Walsham 1993) may therefore appear more attractive, the clear evidence of *patterns of causal conditions* requires explanation. If information systems are simply nominalist 'forms or social systems realizing human intentions' (Iivari, Hirschheim et al. 1998) then regularities should not occur. They do however, in both extensive, quantitative research finding commonality around means (Thong 1999) and in intensive, qualitative research finding simple taxonomic groups (Smith 1999).

Where this research adds to the literature is its use of critical realist ideas to try to rationalise these apparently conflicting findings using a highly plausible ontological and epistemological perspective. Both 'hard' and 'soft' views are valid when ambition and trust are considered as transfactual powers in the real domain. That these emerge as business goals and broken promises in the actual domain and are witnessed as increased efficiency and sacked suppliers in the empirical domain testifies not to paradigm incommensurability but to effective abstraction and retrodution as part an intensive realist research strategy.

4.2.6 A Picture Speaks a Thousand Words

The section title may appear a cliché, but is carefully chosen to reflect the finding that visual images are a powerful way to portray the rich, complex, language-based evidence spoken by subjects in qualitative case research. The use of dialogue in the form of verbal quotes in

support of codings was invaluable throughout the research and even a theorist like Sayer is quick to remind us of the importance of language in realist research (2000, pp19-22). This seems forgotten by much of the QCA community who, working with macrosocial structures, are happy to work in Boolean expressions and lists of prime implicants (Schneider and Grofman 2006). Indeed, the need to use a variety of visual methods to try to qualitatively represent quantitative data remains as important now as when advocated by Miles and Huberman who stress that displaying data in a matrix or network display greatly adds to the iterative momentum (1984, p.240). A very useful paper by Schneider and Grofman (2006) helps clarify a number of ways that the outputs of QCA can be represented including truth table, solution formula, parameters of fit, x-y plots, Venn diagrams, tables and dendograms and the situations when each should be used.

One visual technique which doesn't seem used in this field is that of 'Fishbone' diagrams first pioneered by Kaoru Ishikawa in the 1960s. Their use to show cause and effect is nothing new to the world of business¹⁷ and a similar technique permits a quick and easy way to create and manipulate visual ideas about causality in our research. There is a startling similarity with these ideas and those put forward by Pawson and Tilley when showing explanatory micro and macro mechanisms (p.67). Adopting their simple standard of micro mechanisms (M⁺) above the regularity and macro mechanisms (M⁻) below the regularity provides a quick and easy standard to create and manipulate visual ideas about causality (Figure 40).

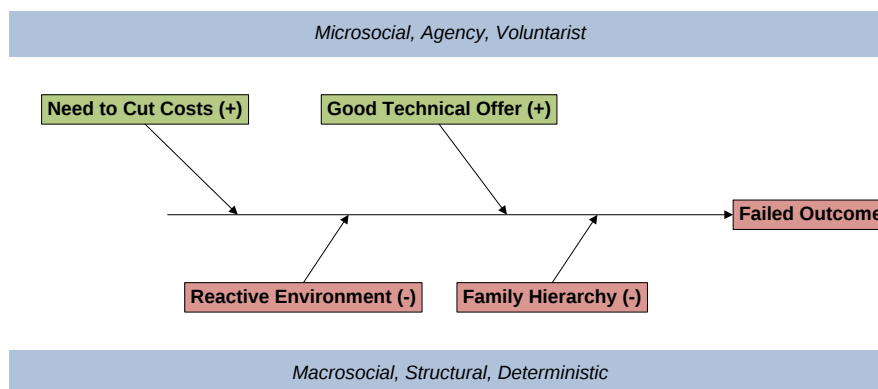


Figure 40 Simple causal path using Fishbone structure
(Developed from Pawson & Tilley 1997, p.67)

The final model (Figure 41) is also structured horizontally to show the importance of time and uses colour coding to show degrees of success or lack of success (see appendices 11 to 21). The further description of conjunctions of necessary causes being hurdles and equifinality being a choice of tunnels also helps translate these ideas into a model businesses can understand. Much of the previous QCA work has been aimed at an academic audience and the difficulty of translating words into meaning has been addressed by Morgan (1997) and others.

¹⁷ Fishbone diagram is a standard template in Visio, Microsoft's powerful drawing tool

4.2.7 Critical Realism Helps Explain and Support Behavioural Theories Of The Firm

Adopting success based on 'IT in use' meant that a grounded definition based on the respondents themselves has had to be justified. Another addition to the literature has therefore been the use Simon's ideas of bounded rationality and satisfying behaviour to allow *users* to define successful IT outcomes (1957). This contrasts with most other research which uses traditional theories of the firm and maximisation goals to judge success based on growth in employment (Smith 1999), profitability (Dans, 2001) or return on investment (Dixon, Thompson et al. 2002).

All of the organisations (bar Engineering 1 and Engineering 2, errant case investigation needed) admitted to *not* having clear objectives which not only helped explain unsuccessful projects but also undermined claims from the rational decision making camp. Reviewing the quotes from respondents and the findings of QCA clearly supports the ideas that power, prestige and other managerial satisficing issues were far more important than traditional maximising ones. Again, sacrificing nomothetic laws need not resort in ideographic chaos as the identification of empirical patterns confirms the tendency for common ambitions to emerge from deeper domains.

4.2.8 QCA Provides a Valid Method For Critical Realist Theory

One of the criticisms of critical realism is the continuing shortage of substantive published studies that have adopted an explicitly CR methodology and Blundel (2006) suggests that part of the reason for this is the longstanding debate between variable-centred methods and those who argue for mechanism-based theorizing and have 'produced an abundance of detailed descriptive narratives but few explanatory mechanisms of any generality' (Hedström and Swedberg 1998).

Although the application of QCA during this project has not been as successful as hoped for, the basis on which it works i.e. by identifying the causes or configuration of causes that produce an outcome, resonates exceptionally well with critical realist theory and the abstraction and retrodution research strategies that underpin it.

4.2.9 The QCA 'Black Box' Remains Only Partially Opened

QCA is often put forward as a method which enables the researcher to 'peer into the black box' to understand the workings within. This project suggests that QCA is *not* as transparent as its advocates propose and even with significant effort the results from QCA programs are difficult to interpret (for example see Figure 25 to Figure 28). The concern that the researcher may be thick is a valid one but fortunately Coverdill agrees that 'QCA is emphatically not a form of analysis wherein the 'facts' shine through no matter which way one gazes.' (p. 475, original emphasis). These concerns have not been helped by a fundamental change in technique in the FS/QCA camp moving to truth-table based methods in the latter part of 2006.

Where QCA really has helped this research is by applying simple ideas of set membership, necessity and sufficiency, temporality, proximity and graphical imagery to provide a framework to help understand complex qualitative evidence. *It is argued that this is deemed an adequate and appropriate level of mechanisation when supported by other qualitative evidence.* Coverdill concurs this time and concludes that QCA can be a useful complement to other forms of qualitative analysis because it forces users to think analytically rather than descriptively about evidence. 'To be used in QCA, evidence needs to be grouped and given conceptual labels. Theory building hinges on conceptual development and analytic thought; QCA requires and develops those capacities' (1995, p.476). Kitchener, Beynon et al. agree and 'if used to supplement primary methods of qualitative analysis, QCA may provide a valuable tool for public service research' (2002, p.502).

4.2.10 New Causal Mechanisms Identified

Analysis of the models, QCA output and interview themes provides the below list of possible causal mechanisms. That this list is far from exhaustive and that the causes impact individually and in causal groups and in different degrees at different times gives a hint of the complexity involved. What is interesting is that intransitive behavioural issues such as lack of trust or loss of control have not featured significantly in previous research in this area.

Table 35 Possible causal mechanisms

Possible cause	Cases observed
Unrealistic expectations	Insurance Broker, Hotel, Surveyor, Finance Co, Show B, Manufacturer
Organizational learning	Insurance Broker, Restaurant, Show B
Top management input	Hotel, Show B, Manufacturer, Charity
Customer focus	Insurance Broker, Show B
Broken promises	Retail, Hotel, Surveyor, Finance co, Show B, Restaurant, Charity
Project mgt experience	Engineering B, Engineering A
Loss of control	Retail, Engineering B
Improved planning	Insurance broker, Restaurant, Show A
Technical complexity	Hotel, Charity, Finance Co, Show A
Willing users	Insurance Broker, Hotel, Finance Co, Show A, Show B, Manufacturing
Able users	Engineering B, Recruitment, Surveyors, Show B, Manufacturing
Costs not benefit focus	Insurance Broker, Hotel, Manufacturing
Lack of objectives	Surveyor, Charity, Manufacturing, Show A
Lack of time	Surveyor, Show A
Resistance to change	Show B, Surveyor
Technology failure	Retail, Hotel, Surveyor
Customer pressure	Insurance Broker, Surveyor, Show B, Show A
Supplier pressure	Retail, Charity, Engineering A, Finance Co
Keeping people informed	Retail, Engineering A, Show B, Show A
Supplier Trust	Retail, Charity, Show B, Show A, Engineering A
Constraint to growth	Engineering A, Show B, Finance Co
Informed decisions	Engineering A, Show B

4.3 CONTRIBUTION TO PRACTICE

4.3.1 A Simple – But Not Simplistic – Model For Small Business Managers

At first glance, the final model will appear familiar to many in the IT industry who will scoff at the fact that it took two years to arrive at what they have known for years. A key IT sales need is to identify the 'MAN' i.e. the person with the 'Money, Authority and Need' which mirrors the resources, planning and objectives conditions in our internal control group. The accusation of self-evident findings may also be levelled but many issues have been clarified or strengthened.

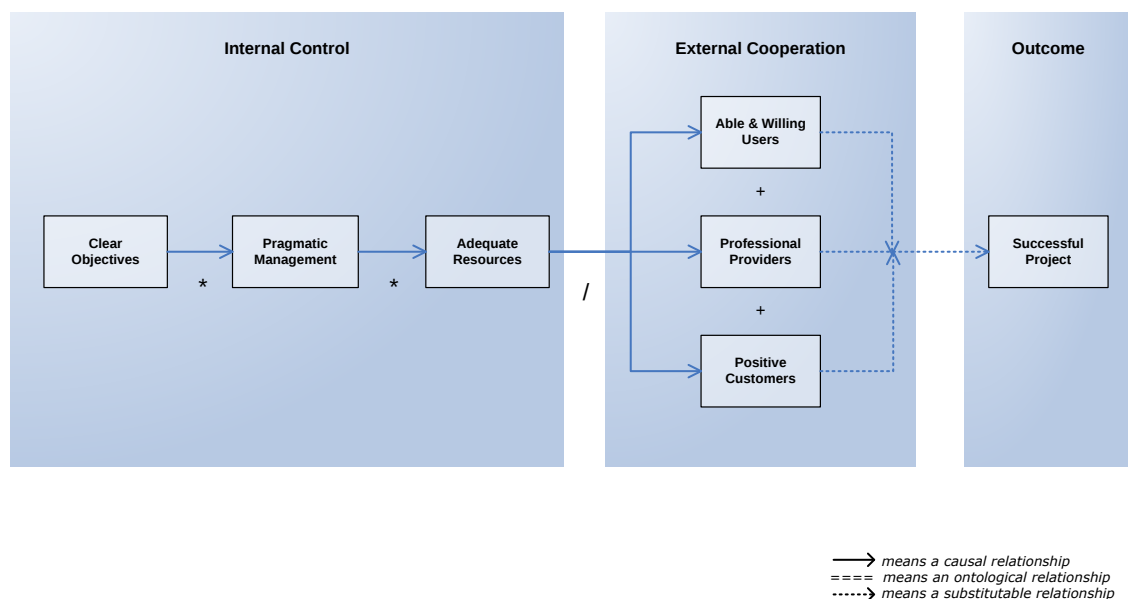


Figure 41 Final model

The need for clear objectives, pragmatic management and adequate resources to ALL be in place as a causal group has not been identified as a combination of necessary causes for project success in previous work. This finding has been obscured in the averaging process conducted by many previous papers (Thong and Yap 1996) which use frequentist statistics to suggest that success may still be possible even if some of these conditions are missing, or all are in place but only partially effective i.e. the old problems of linearity and additivity.

The ability for the major components of the external co-operation causal group to compensate for each other via logical ORs (equifinality) was also novel. The placement of able & willing users in the external group differs from previous models but reflects the managerial focus of the respondents and the genuine feeling that users was something they had little control over.¹⁸ The dominant condition in the external group was professional suppliers which was the nearest to becoming sufficient in its own right but demoted from this elevated status by subconscious

¹⁸ I know the feeling.

researcher bias in case selection. Another interesting finding here was that the need for external professional support did *not* diminish as organisations grew and recruited their own IT managers as they either needed additional support or additional expertise for increasingly critical and/or complex systems.

The model supports findings from previous research. Competitive pressure was only briefly mentioned by two cases (Finance Co and Show Organiser A) but strong external support and expertise was mentioned by all. Internally, lack of planning, objectives and resources again strongly resonated with the literature. Blackburn and McLure's (1998) taxonomy (Enthusiast, Pragmatist and Artisan) helped provide the pragmatic management element but their other findings were not widely supported. This may be due to this project's focus on IT managers rather than owner managers but may also be due to structural shifts in the past nine years i.e. information technology in small organisations is now inevitable rather than optional.

Time is important substantively as well as theoretically. The need for internal control to be established *before* external cooperation is sought using the 'THEN' operand again sounds obvious but was a surprisingly common reason for failure in many cases where external pressure from unprofessional suppliers (Show B, Engineering A) or customers (Show A) led frequently to 'promises being broken'. The message to suppliers is 'don't promise what you can't deliver'; the message to small organisations is avoid complex or unproven information management products wherever possible to minimise the risk of project failure.

Our time-based, two stage model both supports and adds another dimension to the four major types of IT failure proposed by Lyytinen and Hirschheim (1987) and shown in Table 36. Correspondence failure and process failure both confirm the need for *internal control* whilst interaction failure and expectation failure confirm the need for subsequent *external cooperation*.

Table 36 Enhanced IT failure model

Internal Control	External Cooperation
Correspondence failure: Where IT/IS does not match planned objectives.	Interaction Failure: Where the IT/IS is not used due to negative user attitudes
Process failure: Where IT/IS implementation is not completed within planned time or cost.	Expectation Failure: Where the IT/IS does not match user expectations

(Developed from Lyytinen and Hirschheim 1987)

The ability for the model to *predict* the outcome of information management projects in small business has yet to be tested and may form a post-submission phase to this research. The model – and all its caveats regarding open systems and hidden tendencies within structures – is being included in the pre-sales process within the researcher's business and a simple evaluation programme planned based upon that advocated by Pawson and Tilley (1997).

The level of abstraction reached in the model is effectively middle-range i.e. an empirically grounded activity with a limited claim to generalisation: 'Theories that lie between the minor but necessary working hypotheses that evolve in abundance during day-to-day research and the all-inclusive systematic efforts to develop a unified theory that will explain all the observed uniformities of social behaviour, social organization and social change' (Merton 1968, p.39). This places the model mid-way in Pawson and Tilley's level of abstraction (Figure 42)

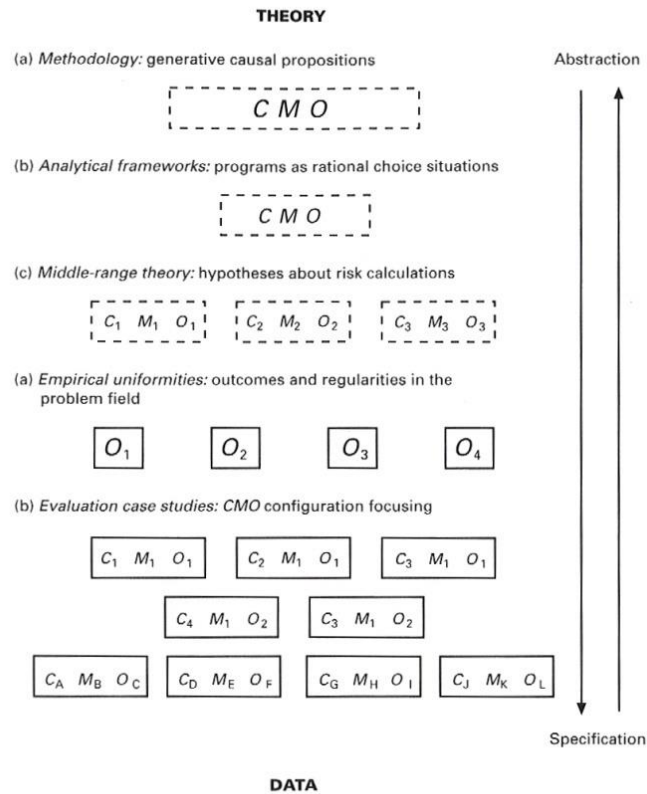


Figure 42 The elements of realist cumulation
(Source Pawson and Tilley 1997, p.121)

4.3.2 Determinist IT Theories Severely Questioned

The previously deterministic opinion that 'all IT is good IT' has pervaded not only much of the academic literature (Cook and Russell 1972; West 1975; DeLone 1981) but much of the IT industry, government and business management thinking. The idea that IT's powers can be at best neutralised and at worse turned into liabilities due to complex and contingent mechanisms in deeper domains is rarely considered but must be accepted by those involved if continuing costly IT failures are to be avoided. Even if necessary relationships from internal structures could be fully explained, the existence of open systems means information management success can never be guaranteed - a key feature of the 'embeddedness' (Bhaskar 1978).

4.3.3 Rational Decision Making is Rare in Small Business

The research also confirmed that small business and those who run them are not always rational. Maximisation as a business objective was rarely encountered and satisficing more the norm. This has important implications for small business researchers who still tend to use traditional measures of success especially in quantitative based projects. The diversity so prevalent in the small business sector makes this assumption far from conclusive. These findings may appear obvious to those who work in the sector but are consistently ignored by suppliers and government agencies.

4.4 CRITICAL REVIEW OF THE RESEARCH

4.4.1 And Now, The End Is Near

The final questions which naturally arise at the end of this lengthy but (mainly) enjoyable exercise are twofold: a) what does the benefit of hindsight suggest should have been done differently and b) where should any future research go to build on these findings.

Some observations are self-evident: although a lot of the critical realist ideas were read, re-read and re-read again before starting the research it took a long time to sink in.¹⁹ Similar comments apply to QCA methods: the lesson is that you can't *really* appreciate these concepts until you try them.

Planning fieldwork better was a costly lesson learned. Although inductive and grounded and therefore subject to change a big question – who defines success? – was not addressed properly and needed a complete re-visit in the second stage of the project. Initial questionnaire design was also weak and could have avoided a second re-write in phase four if questions were grouped specifically to test for set membership.

Internal validity could have been improved by triangulating findings further. At present this is limited as case evidence is only provided by one respondent, supporting documents and the researcher's deep knowledge of the organisation in question. It is QCA 'best practice' to include all output to support replication and hence reliability but space and focus have prevented this.

4.4.2 Grappling with Worldviews

Another issue was far more fundamental. The dualisms introduced way back in Table 10 The subjective - objective dimension and Table 11 Methodological implications of different epistemologies re-occurred persistently throughout this study. Although the ideographic versus nomothetic methodology divide was the most quoted in the thesis, the biggest dilemma has been in reconciling *deterministic* with *probabilistic* causality.

Goertz and Starr (2003) explain that determinism represents an understanding of the nature of the world and a fully deterministic approach assumes all occurrences in the world are product of non-random prior occurrences which, given the right variables, methods and measurement devices, mean the world is entirely predictable. By contrast, a fully probabilistic approach assumes that all occurrences in the world are at least the product of inherently stochastic or random processes that cannot even in principle be identified.

¹⁹ I thought I'd grasped it until the 530 page Dictionary of Critical Realism (Hartwig 2007) came out earlier this year.

Although the approaches pose a sharp dichotomy, scholars don't necessarily embrace one approach completely. Some believe the world is probabilistic and that only selected cases can be modelled deterministically; comparative conditions are *always* necessary or *always* sufficient (Mahoney and Goertz 2004). For others that the world is deterministic, but our inability to identify and correctly measure all relevant variables forces us to act as if it were probabilistic. Here conditions are qualified and may be *almost always* necessary or *usually* sufficient (King, Keohane et al. 1994).

What we are of course talking about here is ontology and it has been surprising at the lack of attention this rather important issue receives in the texts. This dichotomy in worldviews creates a 'tipping point' between deterministic and probabilistic methods in QCA and whilst the move to the probabilistic methods favoured by fuzzy set techniques is probably inevitable in larger *n* to describe the 'effects of causes', using such techniques in small *n* to find 'causes of effects' provided this researcher with major concerns (even though Bayesian probability is robust with as few as five cases). Whilst making arithmetic sense, Ragin's coverage and consistency statistics seem ill at ease with the rich data provided in our cases.

Not that deterministic results in multi-value QCA are without fault. Mahoney and Goertz (2005) point out that necessity and sufficiency are not always good ways to think about causation. There are for example, a potentially infinite number of *trivial necessary causes* in any case e.g. companies need to be trading to have successful outcomes. This is not shown in previous research however and QCA helps remove these through reduction which eliminates common conditions in both successful and unsuccessful outcomes. *Tautological sufficient causes* are another problem when the researcher identifies a set of factors that are contained within the very definition of the outcome being considered. When this happens there is no temporal separation between cause and outcome (e.g. war and death) but in our cases many of the small business factors which were ontological were highlighted as such in our two-level model.

Another risk is that if causes follow linear patterns they may be subsequently ignored and Lieberman's (1994) famous example of drink-driving shows this weakness. With the method of agreement, an analyst looking at three cases of road accidents will eliminate drink-driving as a cause if it is present in only two cases. Similarly with the method of difference, drink-driving will be eliminated if it is present in cases of both accidents and non-accidents. What is actually shown is that drink-driving is neither a necessary nor a sufficient condition for a motor accident and the answer is to explore drink-driving in combination with other variables to reveal that it is a (usually) sufficient cause in a specific combination of cases.

Perhaps the biggest concern is that the results generated by these methods can change substantially if omitted explanatory variables are included in the model. Whilst this charge can be levelled at all methods of causal assessment (including statistical analyses) in QCA omitted conditions may not only be important in their own right, but may have led to other conditions not

being eliminated if important in combinations. Not only is the size of theoretical sampling important but the identification of relevant factors within cases crucial.

It is also worth reminding ourselves of the steps necessary in QCA to arrive at parsimonious solutions. In MVQC, contradictions, missing outcomes and logical remainders can all be included for reduction. In FS-QCA, you can again include remainders and contradictions, have arbitrary consistency cut-offs, move results from the set cross-over point and finally gauge causality on statistical probability. At the end one is left thinking that data that should be 'left to do the talking' has been quietly smothered.²⁰

There remains therefore a sense of unease about the *ontological reliability* of the findings and the ability of QCA to provide even limited generalisations in small n case research. I am not alone in this confusion. Byrne (2006) makes a distinction between ways of describing reality and ways of representing causality in reality and lists Multiple Causal Configurations as a *quantitative* mode of causal representation (Table 13). Colleague and realist-conspirator Wendy Olsen however defines 'QCA as much more than a black-box truth-table calculation tool' and argues that 'QCA supports profoundly *qualitative* work' (Olsen 2007, p.45). The battle of numbers and words yet again.

4.4.3 Working With Limited Resources

An inductive study such as this is always prone to what in our industry is called 'scope creep' i.e. the tendency to move away from the original plan into new, interesting and hopefully relevant areas. This has been the case in this project too, although it is difficult to see how the final conclusions could have been reached by any other method. This approach – currently almost unique in small business information management research – is in many respects a strength of the thesis.

It is however also a weakness as the strict time and word limits of the Durham DBA prevent a more robust defence of the findings. The accumulation of content from taught modules formally 'transferred' to the research phase also means the thesis is somewhat imbalanced with excessive early explanatory / literature review content for an unknown target audience. Space may instead have been better spent including content from a bulging research diary to bolster fragile validity and reliability.

Although the final models fit the (by now very familiar) cases, their application to new organisations has yet to be tested. Likewise, any sensitivity analysis (the study of how the variation in the output of a model can be apportioned, qualitatively or quantitatively, to different sources of variation) was similarly 'timed-out'. How one could conduct such an analysis on a

²⁰ With a pillow in FS-QCA.

model based on the logical combination of causal factors based on the ideas of necessity and sufficiency is not immediately clear but worthy of consideration. The most immediate response is to return yet again to Pawson and Tilley (1997) who similarly bemoan the fact that 'Sadly, most evaluation studies seem to be one-off affairs' (p.114). They go on to quote Cook:

"The immense diversity of social life ... make it difficult, if not impossible, to derive conclusive knowledge from one single study, no matter how well designed or intelligently analysed. The causal processes that appear so essential in one time or place may prove less important in another." (Cook, Appleton et al. 1992 p. vii, in Pawson & Tilley 1997, p.115)

Their answer is to advocate realistic cumulation based on the 'realist explanatory triad' of an ever-deepening understanding of mechanisms, contexts and outcome patterns. Cumulation is not a question of producing a series of studies with 'reliable, replicable and universal applicability' but rather about improvements in theory – the aim being to produce the middle-range theory shown in Figure 42. The use of small n studies is not a limitation when part of a realist cumulation.

Model sensitivity may be analysed and its consistency tested by further empirical research using the methods used in this project and by 'weaving the results of other forms of empirical research into the evaluation cycle' (p.116). That these could not be fully explored in this project is regrettable, but as per supervisor instruction and initial statement of intent this thesis is predominantly aimed at method development which may go some way to mitigation.

4.4.4 Ideas for Future Research

Our the next step will be to develop the somewhat token attempts at retrodution proposed in our 'contribution to knowledge' section. The models used to substantively test the cases are very much 'models of' the cases rather than 'models for' the subsequent deep retroductive analysis required of the critical realist research strategies outlined by Sanghera, Sayer and others (page 42). Or as Stake (1995) would put it, our cases are still intrinsic rather than instrumental.

Blundel (2006) bemoans the desperate shortage of in-depth small business research using critical realist methods so the next research project is to conduct one case study in significant depth using a retroductive research strategy to develop critical realist ideas further. Our Insurance Broker awaits and will doubtless produce the material required.

Further substantive realist cumulation of the model will come from its application in the researchers business which is also scheduled.

5 APPENDICES

Appendix 1	Questionnaire: Original, case = organisation
Appendix 2	Questionnaire: Revised, case = IT Instance
Appendix 3	Data Matrix: Case = IT Instance (Combination of Phase Two and Three)
Appendix 4	Questionnaire: Revised in support of set membership structured interviews
Appendix 5	Data Matrix: Secondary to Basic Level – Unsuccessful Raw
Appendix 6	Data Matrix: Secondary to Basic Level – Successful Raw
Appendix 7	Data Matrix: Secondary to Basic Level – Unsuccessful Fuzzy
Appendix 8	Data Matrix: Secondary to Basic Level – Successful Fuzzy
Appendix 9	Data Matrix: Secondary to Basic Level – Unsuccessful Summary
Appendix 10	Data Matrix: Secondary to Basic Level – Successful Summary
Appendix 11	Model: Insurance Broker
Appendix 12	Model: Engineering B
Appendix 13	Model: Hotel
Appendix 14	Model: Surveyor
Appendix 15	Model: Retail
Appendix 16	Model: Charity
Appendix 17	Model: Engineering A
Appendix 18	Model: Finance
Appendix 19	Model: Show B
Appendix 20	Model: Manufacturing
Appendix 21	Model: Show A

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