Towards a Mixed Method Approach for the Multidisciplinary investigation of Management Processes

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ABSTRACT

This paper presents the development of a mixed methods approach by a multidisciplinary group of academics to understand and so model management processes with a view to enabling informed management decision making. Considering management processes as one of three categories of business processes (CIMOSA Standards Committee, 1989), the literature in this area is reviewed to identify current management modelling techniques. The researchers conclude that these do not adequately address both the 'hard' and 'soft' characteristics of management processes as well as the methodological viewpoints of the group. The development of a mixed method approach designed to address these issues is presented, along with an explanation of its application in practice. The paper concludes with a critical evaluation of the method and outlines future developmental work planned by the research group. The value in this approach is that it informs both academia and the business community by proposing a transparent and repeatable method of understanding the subjective topics of management practices and processes that is grounded in both a priori theory and practical data.

INTRODUCTION

As Andersen et al (1999) observe, "Organizational scholars seldom come to grips with nonlinear phenomena- tending instead to model complex phenomena as if they were linear in order to make them tractable, and tending to model aggregate behavior as if it is produced by individual entities which all exhibit average behavior." Considering the implications of such a view on the impact and applicability of management research outputs to the business community has led to calls for multi-disciplinary approaches to researching complex phenomena in the field of management. Hitt et al (2007) observe that "future excellent multilevel research is more likely to be conducted by multidiscipline teams of scholars who are motivated to investigate complex organizational phenomena" and "as the field of management continues to grow, it becomes increasingly important to consider and integrate the developments that are occurring outside of specialty areas and in adjacent disciplines".

Currently, an EPSRC funded project is attempting to develop a better understanding of the soft (people and organisational) and hard (process and systems) factors that make management processes more capable. To deal with this complex topic, a multidisciplinary research group has been assembled bringing together specialists from operations management, strategic management, psychology, human resource management and management science.

The starting point of this project was the CIMOSA business process model (CIMOSA Standards Committee, 1989). A process theory and modelling formalism emerged from the European Esprit project proposing a generic architecture for modelling business processes. In summary, it categorised business processes as follows:

- o *Operate Processes* are those which are directly related to satisfying the requirements of the external customer, for example the logistics supply chain from order to delivery.

- o *Support Processes* act in support of the Operate processes and include financial, personnel and facilities management.

- o *Manage Processes* are those concerned with strategy and direction setting as well as with business planning and control.

An extended analysis of this high level model (Childe et al (1994), McCallum and Bititci (2004), Bititci et al (2007)) identifies the purpose of each of these categories - operate processes create competitive advantage, support processes enable competitive advantage and manage processes sustain competitive advantage.

As competition is at the core of the success or failure of firms (Porter, 1985), it makes sense that "manage" processes, which sustain competitive advantage through directing and controlling the business, should be an important subject in which to advance understanding. Porter (1985) states that for businesses, competitive advantage grows fundamentally out of value a firm is able to create for its buyers that exceeds the firm's cost of creating it. Taking a resource based view of the firm, Barney (1991, 2001) provides evidence of the link between the strategic management of firm resources and sustained competitive advantage. Pettigrew and Whipp (1991) further inform us that "the relative slowness of the sensing and adjustment process of firms, and their failure to recognise that the bases of competition may have changed in that sector, is a key factor explaining their loss of competitive performance. Our understanding of these capabilities is limited and thus these capabilities, and the way they can generate competitive advantages, deserve a great deal of empirical attention."

Therefore it is the authors' view that management process modelling is not only a complex topic worthy of further multidisciplinary academic investigation, it is also of value and interest to the business community. Indeed, it is recognised at government level that knowledge created in this field can then be used to inform businesses given that "As part of the overall effort to upgrade UK competitiveness there is a clear role for management" (DTI Economics Paper on UK Competitiveness, 2003).

This paper describes the development of an approach to management process modelling which satisfies the methodological requirements of a range of ontological and epistemological positions within the multidisciplinary group. By outlining how a number of theoretical and practical challenges were overcome, it is intended that this paper will:-

- Offer a foundation for future endeavours seeking to investigate complex phenomena of academic and business interest by providing a compelling argument that multi-disciplinary research should consider a mixed methods approach as a viable means of maximising benefits to all stakeholders in the research process.

- Critically assess the approach developed in the context of the investigation of management processes and as such propose an agenda for further development of research into this topic

To achieve these objectives, the paper begins with a discussion of the practicalities of multi-disciplinary research and the consequences for research design. It then reviews the literature on business process modelling, concluding that current techniques do not fully capture the nature of management processes. It proposes a concurrent, nested mixed method approach to

address this issue and then traces the progress of the project from development of the research method design to the practical implementation of the approach in a set of pilot case studies. Thereafter, a discussion of the benefits and limitations of the approach adopted precedes the proposal of an agenda for development of the management process research in particular and the reapplication of the multi-disciplinary approach in general.

PARADIGMETIC ISSUES IN MULTI-DISCIPLINARY RESEARCH

One of the advantages of a multidisciplinary academic group is that ideas which may be circulating in one area come under the scrutiny and consideration of those working in other areas, and offer possibilities for mutual influence. However, there are several key debates which must be addressed before any further direction of the group can be plotted.

As already described, the purpose of the EPSRC funded project is to develop a better understanding of the soft (people and organisational) and hard (process and systems) factors that make management processes more capable. More specifically, the initial proposal stated that "Looking back over the past 10 or 15 years where the pace of technological, social, political and economical change has been high, we can typify companies into those which demonstrated that they could readily adapt and change with the changing environment and those which having identified the threats and opportunities to their business, have failed to respond to these in a positive way and as a result are much smaller no longer exist. The aim of the proposed research is to answer the question, "What makes the successful companies different?" and go on to develop a practical self-assessment tool that could be used to assess the capabilities of the manage-processes" (EPSRC grant number available on request)

It was identified through a review of the literature and a feasibility study that the gaps in knowledge were:

- Although it is believed that management processes create sustainability, what these processes are and their architecture is not explicitly understood.
- The factors, soft (people and organisational) and hard (processes and systems), that make these management processes capable are not explicitly understood.

- A model for assessing the capability and competence of these management processes does not exist.

The research group was assembled to draw together expertise in particular disciplines as well as experience and understanding in a range of research methods with a view to providing options and perspectives to appropriately address this complex proposal. At the commencement of the project, several long debates resulted in agreement amongst the academic group as to the key research objectives to be achieved, namely:-

- defining and modelling the management processes architectures

- developing an understanding of the factors influencing the nature and application of management processes in practice;

- developing and testing contextual methodologies for normative and maturity models to both aid business practitioners in sustaining competitive advantage and validate process models

How this was to be achieved was not so readily agreed though and it became clear that there were fundamental issues to be resolved within the group centred on the paradigmatic diversity and empirical complexity of management process research, as experienced by Pettigrew (1992).

Rousseau (2000) observes that "paradigmatic diversity has some advantages, but the benefits of that diversity are more likely to be realised through active paradigm competition and synthesis rather than parallel evolution and proliferation". The initial tensions were ultimately to prove beneficial to the research project as they forced the group to consider multiple

perspectives and approaches; effectively what has been referred to as the "paradigm debate" (Reichardt & Rallis, 1994) had to be addressed.

The "paradigm debate" concerns the applicability of methods to particular enquiries based on the researcher's philosophical point of view. This is illustrated well by Guba and Lincoln (1988) who identify an apparent dichotomy between traditional inquiry paradigms and naturalistic paradigms by exploring paradigm differences between postpositivist philosophical assumptions and naturalistic assumptions in terms of epistemology, ontology, axiology and methodology   As the research group comprised a number of senior academics with reputations established from opposing paradigmatic positions, the resolution of this debate required the development of an independent "group position" rooted in pragmatism.

Pragmatism is a set of ideas articulated by many people, from historical figures such as Dewey, James, and Pierce to contemporaries such as Murphy, Rorty, and West. (Creswell, Plano Clark, Gutmann, & Hanson, 2003). It draws on many ideas including using "what works," using diverse approaches, and valuing both objective and subjective knowledge (Cherryholmes, 1992). On a practical level, it was important that all the academic parties remained engaged in the research process once the initial research design was completed and from the initial discussions, it became clear that this would only happen if the various perspectives were honoured and outputs were delivered which were considered of value to each of the members of the group.

In effect, the group position represented a "corporate identity" for the multidisciplinary team. Whilst it provided a paradigmatic position for the unit on which to develop a research design, it also respected and thus preserved the distinct preferences and interests of the involved

parties. This was achieved by diverting the focus of the debate from the seemingly irreconcilable positions of individuals to the common ground of the research objectives. As suggested by Tashakkori & Teddlie, 2003, "the research question should be of primary importance - more important than either the method or the theoretical lens or paradigm, which underlies the method."

Overview of Research Method Design

Having resolved to adopt a collective approach rooted in pragmatism, the research group then proceeded to develop a research method design. Ultimately, a concurrent nested mixed method design as defined by Cresswell (2002) was identified as being the most appropriate approach to adopt. The reasons for this choice were grounded in gaps in the current business process modelling literature, the paradigmatic stance of the group and the nature of the research. A more detailed explanation of the choice is offered later in the paper.

A mixed method approach can be described as "the collection or analysis of both quantitative and qualitative data in a single study in which the data are collected concurrently or sequentially, are given a priority, and involve the integration of the data at one or more stages in the process of research" (Creswell et al, 2003, p. 212). Literature suggests a strong and appropriate association between pragmatism and a mixed methods approach (Rossman and Wilson (1985), Tashakkori & Teddlie, (2003)). It also seemed a particularly appropriate choice given the early discussions within the research group as Greene & Caracelli (1997, 2003) observe that when mixed methods use "competing paradigms intentionally, giving each one relatively equal footing and merit, a "dialectical" approach is created in which the competing paradigms give rise to contradictory ideas and contested arguments". Such oppositions reflect different ways of making knowledge claims (Cresswell et al, 2003) and

provide the opportunity for the proposal of valuable multiple perspectives of understanding of complex phenomena which are sought from multi-disciplinary research. In terms of output, a mixed methods approach provides the opportunity to create knowledge that "takes advantage of the representativeness and generalizability of quantitative findings and the in-depth, contextual nature of qualitative findings." (Greene & Caracelli, 2003).

The detailed research method design will be explored in greater detail later in the paper. To explain fully the choices made, it is first important to provide further context regarding existing business process modelling approaches.

BUSINESS PROCESS MODELLING

Degrees of familiarity with process modelling, and views of its significance vary among management researchers and those in other areas such as engineering and psychology, that have an interest in management. For researchers concerned with operations management process theory and modelling is a familiar concept and method (Childe et al 1994). The business process literature contains a plethora of research on business process modelling, including introducing a range of supporting tools such as Aris, IDEFine, Protos, Qask, Lombardi, BluePrizm, and so on. The majority of these tools include well established business process modelling techniques such as the Structured Systems Analysis and Design Method – SSADM (Gane & Sarson, 1979; Yourdon, 1989), Integrated Definition Methodology – IDEF (Mayer et al., 1994) and Strategic Options Development and Analysis – SODA (Rosenhead & Mingers, 2001).

For social science researchers process theory and modelling generally sits alongside other potential perspectives on theory building in management research (Van de Ven 1992, Chiles

2003). Van de Ven (1992) saw that there was opportunity for creative dialogue because of ambiguity about process modelling in business and management. On the one hand, process modelling provides a means to reduce and capture what is done and how it is done. On the other hand it can, and must, acknowledge and explore developmental progression with "multiple, cumulative, conjunctive, and iterative progressions of convergent, parallel and divergent streams of activities that may unfold…over time" (Van de Ven 1992, p 172).

For those more concerned with organisation design, process modelling tends to be more associated with Business Process Re-engineering (Hammer 1990, 2007). Even though this body of literature cites several business process improvement and re-engineering case studies, almost all of these cases seem to focus on operational or support processes such as Order Fulfilment Process, Product Development Process, Sales Process, Load Approval Process, HR Recruitment Process, HR Appraisal Process and so on (Harrington, 1998; Lee and Dale 1998; O'Neill and Sohal, 1999). Very little reference is made to how management processes have been identified, modelled, measured, benchmarked and improved.

Practical process modelling for operational processes reflects the realities of a controlled and certain environment with predictable goals and outcomes. However, the management processes operate in an environment that is both complex and uncertain (Johnson and Scholes, 1999). Further complexity is also added as management tends to require an "integrated approach". Unlike operational problems, there is no one area of expertise, or one view, that can identify or work out problems or make decisions. Managers, therefore, have to cross functional and operational boundaries to cope with strategic problems and agree with other managers, who might have diverse interests and priorities (Johnson and Scholes, 1999).

In summary, the business process modelling techniques which the different members of the research group identified from their own areas seemed to be numerous, varied and well-researched for the modelling of operational processes and either inadequate or incomplete in the context of the modelling of management processes.

This is not to suggest that there have not been advances in approaches to modelling management processes. Hammer (2007) now proposes in his Process and Enterprise Maturity Model a way to remove 'emotional' and argument-inducing interference. In proposing an improvement on his original works in Business Process Re-Engineering (1990), he suggests a practitioner-orientated approach to understanding the "enablers and capabilities" of an organisation which can be mapped onto maturity level models. This approach is intended to be simple, engaging and easy to use. The specific definitions of the key terms associated with Hammer's work are not discussed in this paper. Rather, the example is included as Hammer explicitly states that his revised approach focuses on producing and using testable propositions to 'factor out emotion and avoid needless argument' (p 119).

Hammer's model (2007) led to a discussion within the multidisciplinary group centred on the value of such approaches to process modelling. Whilst high on analytical rationality, this and many of the approaches adopted for operational processes were low on, or excluded altogether, issues around emotional authenticity. Researchers and practitioners in the process modelling field take the view that to build a complete model of a business process, the process needs to be studied and modelled from a number of perspectives (Mingers & Brocklesby, 1997). An overview of the different interpretations of what these perspectives should be is shown in Table 1 below.

Insert Table 1 about here

All of the above authors seem to accept the fact that all processes have 'hard' (functional, informational, resource and organisational) as well as 'soft' (decisional, behavioural, cultural and creative) perspectives and that all these perspectives need to be understood in order to build a complete model of the process. As Pettigrew (1992) informs us, "the purpose of the process analysis is not just to describe the sequence or tell the story, but to identify patterns in the process often across several carefully chosen cases, furthermore the analysis of any single process occurs not just in a nested context but also alongside other processes. There may be a requirement to understand a network of intertwined processes".

On one level, this initially suggested to the research group that it would be appropriate to adopt qualitative methods as the means to subjectively model the highly complex "nest" of manage processes suggested by the initial studies. However, according to Silverman (1985), where an individual interpretation of a text or transcript remains a subjective act with no basis in consensus, and whilst it may subsequently prove to be insightful, it is theoretically non-allowable to use such an individual subjective account (whose status as text is no different from the text from which it derives) as the basis for nomothetic or general 'lawful-type' statements or conclusions (Silverman, 1985). Therefore, whilst individual detailed case studies based largely on management interviews would provide and rich sources of data they lacked the capacity as a sole method to inspire more structured sense making debate and generalisable theorising.

This posed a conundrum for the research group in identifying the most appropriate methods. On one hand, the research goals demanded that the group collect in depth qualitative

management practice and process data in a manner which reflected the reality of case study organisations. On the other hand, the research demanded that the output be to some degree generalisable and that any models generated and conclusions drawn be based upon repeatable analysis of the data set.

Considering the review of the business process modelling literature, it was clear that a combination of quantitative and qualitative methods was required to satisfy the requirement to collect varied types of data. Indeed, as noted by McGrath (1981) regarding a dilemmatic view of research, "in satisfying multiple conflicting desiderata, multiple approaches are required and not only serve the purposes of replication and convergence; they serve the further crucial purpose of compensating for inherent limitations that any one method, strategy or design would have if used alone". In effect the business process modelling literature review aligned with the outcome of the initial paradigm debate by suggesting that the group adopt a mixed methods approach rooted in pragmatism to robustly address the research objectives. This approach and its design is discussed in the following section.

DESIGN OF RESEARCH METHODS

In the context of the EPSRC funded management process research project, an attempt has been made to amalgamate the strong points of both quantitative and qualitative methodology by allying measurement and statistical techniques characteristic of quantitative methods with a rigorous approach to the qualitative analysis of rich text/discourse which permits better routes for the expression of individual meanings.

A review of mixed methods literature shows that in general in the social sciences at least, mixed methods research has become increasingly popular and may be considered a legitimate, stand-alone research design (Creswell, 2002, 2003; Greene, Caracelli, & Graham, 1989; Tashakkori & Teddlie, 1998, 2003).

Of initial concern to the group was the triangulation of research data. The term triangulation is borrowed from navigation where it refers to the use of multiple reference points to confirm the accuracy of measurement of an object's position. This serves as a useful analogy to guide those designing research where, as noted by Yin (2003), the use of multiple sources of evidence in case study provides the opportunity for "converging lines of enquiry". As commented by Jick (1979) this might allow the researcher to "uncover some unique variance which otherwise may have been neglected by a single method".

In the context of the investigation of the complex topic of management processes, such triangulation was deemed of critical importance by the research group. However, recent commentary on adopting a mixed methods approach suggests that the approach goes beyond merely satisfying the requirements of triangulation. In reviewing the mixed methods approach of Andrew Pettigrew, Van De Ven (2002) observes "each of Pettigrew's research projects employs multiple methods (e.g., inductive and deductive, qualitative and quantitative, explanatory and predictive modelling). The relative emphasis and mix of methods varies from study to study and appears to be grounded in the particular context and purpose of each study. While this triangulation of methods increases reliability and validity, more importantly, it maximizes learning. Presumably, each strategy reflects the unique hunches and interests of different members of the research team. Sharing the approaches and findings of these strategies greatly enhances learning among co-investigators. Each strategy

also represents a different thought trial to frame and understand the subject matter. As Karl Weick (1989) argues, undertaking multiple independent thought trials facilitates good theory building."

Further commentary by Creswell et al (2003) that there are four main additional options beyond triangulation available to the researcher employing mixed methods. These are:-

- Complementarity - using the results of one method to explain or elaborate on the results of another

- Development - using results from one method to help develop or inform the other method

- Initiation - using results from one method as a point of departure for another method

- Expansion – broaden the potential range of inquiry for the research by using different methods for different inquiry components

Having identified that each of these options would likely yield benefits given the multi-perspective demographic of the group and the relatively under-researched status of the management processes topic, the views of Mertens (2003) and Punch (1998) informed the development of a preliminary research design. Mertens and Punch both suggested that a mixed method approach could allow researchers to:-

- better understand a research problem by converging numeric trends from quantitative data and specific details from qualitative data

- identify variables/constructs that may be measured subsequently through the use of existing instruments or the development of new ones

- obtain statistical, quantitative data and results from a sample of a population and use them to identify individuals who may expand on the results through qualitative data and results

- convey the needs of individuals or groups of individuals who are marginalized or underrepresented.

This clearly aligned with the collective needs of the group and provided a strong and robust theoretical basis for proceeding with mixed methods. Furthermore, literature had informed the group of the steps which should be taken for data collection and analysis. However there still existed tension on two levels. Firstly as to the starting point of the research operations management academics preferred a grounded approach focussed on inductive theory building and testing from practice, whereas management scientists took the view that normative models deduced from literature for each process should be the initial step. Secondly, although case study research was agreed to be the most applicable method for data collection (Yin, 2003; Voss et al, 2002; Eisenhardt, 1989), there remained tensions regarding data analysis and interpretation methods.

It is worth noting that, as identified by a number of authors, (Creswell, 1999; Greene & Caracelli, 1997; Morgan, 1998; Tashakkori & Teddlie, 1998) designing a mixed methods study involves at least three additional steps in comparison to single method research design. These are deciding whether to use an explicit theoretical lens, identifying the data collection procedures, and identifying the data analysis and integration procedures

Consistent with the corporate identify of the group, no explicit theoretical lens was adopted in the design of the data collection methods whilst at the same time the individuals within the group reserved the right to apply their own paradigmatic preferences to data analysis. The

data collection and integration procedures identified as most appropriate were consistent with a concurrent, nested approach as defined by Creswell (2002).

To address the remaining tensions within the group, two streams of research were defined and conducted simultaneously:

- Deductive stream focussing on literature review - a top-down approach

- Inductive stream focussing on case studies - a bottom-up approach

The design and implementation of these two streams are now considered in turn in the following sections.

Deductive Stream

As a separate phase of the same research project, work has been completed to define management processes from a priori theory. As described in detail in Bititci et al (2007), a detailed review of the literature on business process definition, classification, modelling and archetypes as well as that on strategy and strategic management led to the proposal of five management processes; *Set Direction*; *Scan Environment*; *Manage Strategy*, *Manage Change* and *Manage Performance.*

A structured literature review approach was adopted for each of the five management processes (Tranfield et al, 2003), with key words identified and exclusion criteria defined. The focus of the literature review was on the constituent activities of the processes and best practices associated with these activities. Using the definitions of the processes proposed by Bititci et al (2007) as a starting point, searches were conducted in specific management

databases such as Business Source Premier, Web of Knowledge, Emerald Insight and ABI/Inform.

Taking the 'manage change' process as an example to demonstrate the approach, key word searches using "organi?ational change" identified more than 20000 articles across Emerald, ABI Inform and Web of Knowledge databases. An initial review of these articles showed them to include specific types of change rather than the process itself e.g. *organisational change through the adoption of ISO9001* and *the effect of change on employee motivation*. Consequently a further survey of the literature was conducted by narrowing down this search to include only those articles that took a higher-level perspective on the process of organisational change, the steps involved in the implementation of change and best practices. "Change management" string was also used in the search and relevant articles identified using the same criteria as above. Similar techniques were applied to all five processes, resulting in a 'normative model' for each. The models consist of a number of activities and the corresponding best practices, an extract of which is shown in Table 2 below.

Insert Table 2 about here

Inductive Stream

As explained earlier, the concurrent nested approach (Cresswell, 2002) was deemed to be most appropriate for meeting the research objectives of the project. As Figure 1 below shows, equal priority is given to qualitative and quantitative data collected, and the two are contrasted and compared in the data analysis phase.

Insert Figure 1 about here

The inductive stream is based on the assumption that practitioners are able to express in retrospect their activities. As argued by Giddens and Pierson (1998) people are knowledgeable and reflexive, and they tend to provide a better description of what they actually do than what researchers expect them to do (Paroutis and Pettigrew, 2007). Primarily using interviews and documentary evidence to analyse organisational activities is a method used by Orlikowski (2002) and is considered appropriate for the context of this project.

As an initial pilot study, ten Scottish manufacturing SMEs (small to medium size enterprises) were selected as cases through convenience sampling (industrial links with academic team members). A case study protocol was designed by the research group to ensure consistency of approach across the ten organisations sampled (a copy of which is available on request). Semi-structured interviews were carried out by two members of the research team and were digitally recorded. The protocol stated that at least three management level employees were interviewed in an effort to triangulate the information provided; however on average six members of each organisation's management team were interviewed individually, each lasting approximately one hour. The interviews were intended to allow free flowing conversation between the manager and researcher about their roles and responsibilities within the organisation and the activities in which they were engaged. In the majority of cases the researchers were only required to ask the question "tell me what you do" with a few clarification questions as necessary. When free flowing conversation did cease, the protocol provided a list of open 'prompt' questions such as "what does success for the business look like?" and "how are long term objectives set?". Following the interviews a detailed report was prepared by the researchers outlining the management activities of the company categorised into the five 'manage' processes discussed earlier, the strengths and weaknesses

of these practices and recommendations for improvement. These reports were verified by the interviewees before being finalised and distributed amongst the research group. As well as providing the collaborating organisations with a third party view of their management activities, these reports gave the research group an initial source of data on management activities for each organisation.

In order to perform within-case and cross-case analyses of the data, a technique used in the field of applied psychology was adopted. The basic approach derives from hermeneutics, but sees 'meaning' as residing in a *demonstrable and measurable consensus in subjective interpretations.* The philosophy underlying this assertion that the meaning of a text (utterance) lies in its consensus effects has roots in pragmatism (Dewey, 1933) and in functionality (Wittgenstein, 1958) and is discussed at length in Davies et al (2003) and the arguments will not be rehearsed again here. The practical implications however have resulted in an approach whereby over time, and using a recursive methodology, a sample of texts to be 'understood' is used as a starting point from within which a group of coders identify 'stories' in the text which are then used in the development of a taxonomy. Subsequent stories are then coded independently into the taxonomy. If the taxonomy fails to provide categorisations for entire future stories, the taxonomy is itself incomplete or inadequate; and if the taxonomy provides categories for all stories, but inter-rater reliability is low (according to some statistical; criterion), the taxonomy is ambiguous, or the raters have different biases and require further training; or both.

This approach has been successfully applied in the management of various industrial safety systems. In a previous study (Ross et al, 1999) problems in the nuclear industry with the coding of incident reports into a standard set of codes were traced in large part to failures

within the event check-list itself rather than simply to individual coder bias. This resulted in low (circa 30%) inter-rater and intra-rater reliabilities. Faced with this problem, a need was identified to improve matters. After a lengthy period of study, a set of criteria (requirements) was derived for the production of a principled taxonomy, and these are discussed at length in Davies et al (2003) and in Wallace and Ross (2006). Paramount amongst these are a)mutual exclusivity of categories b)hierarchical organisation of categories and c) the avoidance of 'bucket' (highly general) categories and categories which remain unused. Systems developed from these criteria include the SECAS system (developed for analysis of events in a nuclear plant), early versions of the CIRAS system (for analysis of incidents on the UK railways) and a current system developed for events on nuclear submarines (covered by the official secrets act). In all these cases, natural text is analysed using high-reliability taxonomies and small teams of coders whose performance is checked at regular intervals for inter-rater and intra-rater reliability.

It remains only to add that, given training and adequate instruction, different people using such systems will arrive at the same conclusions about the meaning of a text or discourse; that is, their subjective interpretations will produce a consensus and thereby fulfil one of the central requirements for any scientific endeavour, namely independent reproducibility. This approach thus suggests a reproducible procedure from which *consensus in subjectivity* emerges and can be expressed in terms of an appropriate statistical measure of reliability. The specific development of the taxonomy to capture management activities is detailed below.

Taxonomy Development and Refinement

It was fundamental to the validity of the inductive stream of data that the research group refrained from influencing any results with the deductive information gathered. So, rather

than using the management activities identified in theory, the interview data itself was used to develop the taxonomy.

One of the ten pilot case studies was chosen randomly and the interview recordings transcribed. The discourse was analysed using NVivo software to identify and categorise management activities and from this an initial taxonomy was constructed. This taxonomy, although based solely on the data from the case study, did not adequately cover all activities observed across the other cases and it was the wish of the research group to capture more than just the isolated management activities, since the aim of the research was to identify management processes. The initial effort was expanded and refined based upon knowledge of and experiences with three other case studies and was decided to include within the taxonomy categories relating to characteristics of the company (i.e. number of employees, location, age and so on), the perceived performance of the organisation within its sector (detailed in protocol) and the intended outcome of the activity. In this way, 'stories' around the management activities within each company could be represented and so enable individual activities to be linked together to form processes. This structure is illustrated in Figure 2 below.

Insert Figure 2 about here

Various iterations were made to the taxonomy to group the activities into aggregate categories, resulting in a number of levels with increasing generality (Strauss & Corbin, 1990). These levels are illustrated in Figure 3 below.

Insert Figure 3 about here

The next stage in the development was to test the reliability between researchers involved in coding the interview data. Three researchers listened to interviews from one case study company individually and coded the management activities and outcomes according to the taxonomy. These were then compared for agreements at each of the levels of the taxonomy hierarchy. Based on the adopted definition of a process (Bititci et al, 2007), the combination of activities and an outcome describe what that process is, so these categories were the main focus of the data interrogation. It was found that, for the activity category, agreement was high at levels one and two (above 80% between the three coders) however at level three the percentage dropped to below 50% which was unacceptable (Banerjee et al, 1999). Discussions among the researchers and the wider project team identified that the problem lay in the larger number of options available to choose at this level, and varied interpretations as to the meanings of some terms. Similar issues arose when looking at the combined activity and outcome agreements amongst the coders.

Taking advice from precedence in taxonomy development as discussed earlier, having a large number of options available for coders to choose between actually reduces the usefulness of the approach, since it is used as a tool for identifying patterns and trends at a general level (Davies et al, 2003). Following this, the taxonomy was simplified with fewer choices made available at the lower levels, and a coding booklet was developed setting out precise definitions for each term in the taxonomy. A further inter-coder reliability test was conducted with a different set of case study data and the agreements rose above 75% at all levels.

Having achieved high levels of reliability with the taxonomy structure, the research team opted to use Statistical Package for Social Sciences (SPSS) as the software tool for capturing

and interrogating the information. Along with the coding booklet of definitions, a case study guidebook was developed to layout in detail the process of gathering management activity information from the point of arranging interviews with the company to entering the coded data into SPSS. With the system in place, a total of 40 case studies (conducted in manufacturing SMEs to allow for cross case comparison (Miles and Huberman, 1994) were completed over a two year period and the data entered into the SPSS database.

Initial Data Analysis

The research group was keen to bring the two research streams together and so it was decided to code the activities deduced from literature into the taxonomy which had been developed through the case study work. Rather than fitting inductive data into the normative models, this approach ensured that existing theory did not unduly influence the model emerging from the case studies. Coding both data sets using the same taxonomy also allows a direct comparison between what is happening in practice and what literature suggests should be done, effectively conducting a gap analysis between the two.

Analysis work is ongoing and building on mixed method approach a number of techniques are being applied using the original interview recordings e.g. cognitive mapping (Ackerman, Eden and Brown, 2005) as well as statistical analyses using SPSS. This work will be presented in subsequent publications.

Outputs

Having applied the methodology in ten organisations, refined the coding taxonomy and developed normative models from literature, the research team has produced a transparent process for gathering and synthesising data from different sources to allow for analysis that

provides both a high-level broad view of management activities and more detailed information on company specific practices and behaviours – i.e. it encompassed both the hard and soft approaches to process modelling as discussed earlier. There is a clear protocol to guide the researcher through each stage of the process from approaching a company to request their participation, through conducting interviews, coding the data and entering it into the SPSS database. Through inter-coder agreement testing the interpretation of narrative accounts of management activities has been proven to be as objective as is reasonable to expect.

DISCUSSIONS

As with all research projects, the choice of data collection methods is core to the robustness of the outputs achieved and the implications for all stakeholders in the process. As previously discussed, the approach adopted by the research team emerged from the tensions within the multi-disciplinary group. There was a risk that by attempting to combine methodologies and satisfy participants of different ontological stances, the output of the research would be compromised in terms of repeatability or richness. Consequently, the initial priority for the research team was to develop a hybrid approach to data collection and synthesis which was considered of value to all.

Specifically, there was common agreement amongst the academic team that model building should be grounded in data. As previously described the taxonomy which formed the basis of the coding exercise and initial model building emerged from the pilot case study data. It was developed and refined according to best practice from applied psychology in a manner that, whilst not preferred by all of the academic team, was accepted by all as repeatable and

defensible, particularly given the effort dedicated to achieving recommended levels of inter-rater reliability. The output of the exercise therefore was to establish a model building "research engine" which academics from all involved disciplines determined to be useful and providing both quantitative and qualitative building blocks.

As the system is applied in different ways by the academic team, initial models of management processes have begun to emerge from the pilot case study data. In order to validate these models, feeding the activities identified from literature and from further relevant case studies into the research engine has provided sufficient further data to refine and validate models. For example, those of a positivist disposition were able to apply analytical tools such as cluster analysis to the quantitative data in order to validate high level generalisable models from the full range of case study companies whereas from a sectoral subset of the case study report more detailed contextual models were created by the interpretivist members of the academic team.

In effect, this approach to investigating management processes created a "one stop shop" for the multi-disciplinary team. In addressing the initial conflicts, the approach adopted created an efficient research process for gathering and organising both quantitative and qualitative information on management processes. At the end of the project, the original tensions still existed in the team about what is of value in model building – there were still those in favour of detailed contextual models of processes and others in favour of high level generalisable models. However, as stated there was agreement that the multi-method approach was robust and that the foundation data was defensible and reliable.

A further outcome for the academic team is that having established this robust mixed method approach to gathering and presenting management activity data suitable for use by researchers of varied ontological and epistemological stances, the associated systems and protocols are ready for reapplication. In reality, eighteen months of debate, design and refinement were invested in finalising the approach. The approach to modelling processes was tested and proven in the context of management processes, but equally this could readily be applied for modelling other informational processes or phenomena of a subjective nature.

The business practitioner stakeholders involved in the research project reported the mixed approach to be informative and transparent in terms of both execution and output. From an interviewee perspective, all those involved were free to express their views in a natural way and through the detailed case study reports were able to confirm that their opinions were accurately represented. The feedback of the company report served an important initial purpose in modelling the practices and processes of the participating organisation in a context specific, qualitative manner. In itself, it also highlighted areas of strength and weakness for the management team and was widely reported as being useful to management understanding and decision making.

For one pilot case study organisation, the data collection phase and resulting company report provided an understanding of their management approach which proved sufficient for them to revise their organisational structure and invest in assistance from consultants to improve their management processes. The cumulative feedback from the participants was that the main reasons the report had proved so compelling were (1) it had been grounded in multiple data sources ranging from financial performance data to qualitative descriptions of processes within the organisation – the different functional managers and managerial levels could all

see their version of the truth represented in it as well as the generally held (published) beliefs about the performance of the business (2) it presented an analysis which was understandable at a generalisable level and equally had offered contextual arguments – the constructs derived from theory were deemed valuable and illuminating on their own and the illustrations from the business itself made change and improvement seem realistic and tangible.

Furthermore, as literature sources and all case study companies were coded against the emergent taxonomy, participating companies could request a gap analysis of their approach against theoretical or observed best practice for any of their observed management processes. The research engine system can quickly prepare such a report and, with the accompanying protocols, a compelling and convincing analysis can be presented to the organisation. Without the varied input of the multi-disciplinary team, the company output would likely have been limited to one perspective.

In October 2007, the research engine and early output models were presented to the Scottish Manufacturing Advisory Service (SMAS), a Scottish Executive funded team of sixteen ex-industry practitioners dedicated to helping Scottish manufacturing companies improve their competitiveness and sustain their organisations. In the ensuing discussion of the research project, useful ideas were offered to the research group from the experience of the SMAS practitioners as to how to effectively disseminate findings to the business community. Importantly, the collective feedback of the practitioners also acknowledged the appropriateness of approach, usefulness of output and potential benefit and applicability to the SMAS client base (c. 12000 companies in Scotland) of the research to date.

The authors believe that the mixed methods approach adopted not only facilitated effective multi-disciplinary academic co-operation and robust knowledge creation, it also enabled the delivery of a research output of value to the business community.

Limitations of Approach

On the inductive side of the research, the work is limited by the inherent weaknesses of using interviews to amass data on management practices. It could be argued that the semi-structured approach, although allowing for free flowing dialogue between interviewee and researcher, did influence the topics discussed. The unnatural setting of an interview may also have affected the responses of interviewees who perhaps did not give an accurate description of events in the company.

Based on good case study practice as recommended by a number of authors (Yin, 2003; Voss et al, 2002; Eisenhardt, 1989, Patton 1987) several actions were incorporated into the research protocol to account for or minimise the impact of these potential limitations. Firstly, at each interview two members of the academic team were present (investigator triangulation) and at least three members of the organisation were interviewed (data triangulation) providing the opportunity to understand the same events and activities from multiple perspectives. Recording the interviews also allowed the mixed perspectives of the whole team to discuss and debate any points of contention from source (theory triangulation), rather than from a researcher's second-hand perspective. Interview data was accompanied by other forms of information from direct observation to secondary data such as management documentation, performance reports, financial results etc. (method triangulation). Finally, providing the qualitative company report to all participants established a feedback loop to correct any mis-interpretations or omissions from the research team.

The focus to date on SMEs in the manufacturing industry has both advantages and disadvantages. In generating theory, it has allowed for contextual assessment of findings by implicitly limiting a large number of company variables. Pettigrew (1992) informs us that "Explanations of the changing relative performance of firms should be linked to higher levels of analysis (sector changes and alterations in national and international political and economic context) and lower levels of analysis (the drivers and inhibitors of change characteristic of different firms' culture, history and political structures)." In effect, choosing companies with similar characteristics made this important element of the research process more efficient. In a practical sense, it also built a more convincing case for participation with potential case study companies – they could see how generalisable models emerging from similar companies could apply to them. However, as for the wider applicability of emergent theory it could be argued that the output is limited to companies with similar characteristics to those studied. It is the opinion of the research team though that the methodology presented here is independent of the size of organisation or the sector in which it operates and the group is currently undertaking further research to establish whether or not this is the case.

Considering the deductive stream, the literature reviews conducted to develop normative models were limited to terms associated with the five proposed management processes. Given the size of the body of literature associated with "management", this was a practical necessity. Analysis of the inductive data may indicate that other management processes exist and so new literature models may emerge. This is being addressed by the research team through the use of gap analysis. As the inductive and deductive data are coded against the same taxonomy, it is possible to compare the findings of the two streams in terms of either activity or outcome. Where a process is implied by case study data which has not been

covered by the literature review of the team, efforts can be directed accordingly to investigate whether this is a real gap in literature (and hence a point of interest for further research) or whether the initial boundaries of the research team were incorrect.

Future Research Agenda

Having developed and tested the methodology and gathered the data for the study, the final phase of the research project is to analyse the data and draw conclusions from it. The specific research agenda is as follows:

- Perform a range of statistical analyses on the data within SPSS to identify patterns of activities relative to a number of company characteristics (size, age, performance etc)

- Investigate the interactions between each individual process to build a holistic picture of management processes and their architecture.

- Use comparison between inductive data and deductive normative models to identify gaps in literature review and refine normative models

- Further develop normative models into maturity models to provide a tool for companies to assess their capabilities for each management process

- Test the research engine in a wider range of organisations to understand and confirm the generalisability of both the mixed methods approach and the theory created to date.

- Work with the SMAS organisation to identify potential further outputs from the research engine of use in practice to organisations.

CONCLUSIONS

In summary, this paper intended to describe the work completed by a multi-disciplinary academic team seeking to model management processes from theory and practice and in doing so proposed the following points:-

- Management theory is highly subjective and to date, limited tools have been used to model management processes

- There exists tools and techniques from different disciplines within social sciences which interrogate large amounts of qualitative data to identify patterns and trends, elements of which are of practical use in modelling management processes

- We have, through the course of a multi-disciplinary research project, developed an approach to management process modelling which synthesises qualitative and quantitative data in a repeatable and robust manner

- It contributes to academia as it creates transparent management theory and the approach can be widely reapplied. It is also of practical value to organisations as a tool for modelling and better understanding their own processes.

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TABLE 1
Perspectives on process modelling

(Bal, 1998)	CIMOSA Anon (1989)	(Roberts, 2004)	(Scozzi et al., 2005)	(Caldwell & Platts, 2005)
• Functional • Informational • Resource • Organisational • Decisional • Behavioural	• Function • Information • Resource • Organisation	• Routines • Architecture • People • Culture	• Sequence of tasks • Communication and information flow • Decisions • Strategic & Political process • Creative process	• Structured • Soft

TABLE 2
Sample from manage change normative model

| Activity	Best Practice
Understand the forces of resistance (Lewin 1951; Buchanan and Hucyzynski 2004; Bedeian 1980; Eccles 1994; Paton and McCalman 2000)	Readiness for change assessment is carried out (Buchanan and Hucyzynski, 2004).
Reduce the forces of resistance/remove obstacles to the vision (Lewin 1951; Kotter 1995)	The resistance is managed using various techniques – participation and involvement, facilitation and support, negotiation and agreement, manipulation and coercion (Kotter and Schleslinger, 1979). Gain the support of the *critical* mass of people to bring about the change (Beckhard and Harris, 1987). Participatory management (Coch and French, 1948) Tailor the approach to the frame of reference of the individual participants e.g. the hammer, the carrot, the challenge or the prestige (Mento et al., 2002)
Show a problem exists/ create dissatisfaction with the current situation (Lewin 1951; Kanter et al 1992; Barczak et al 1987; Garvin 2000)	Create a "burning platform"/sense of urgency (Kotter, 1995; Garvin, 2000) The dominating ideology is challenged (Pettigrew, 1987) The leader encourages people to take the individual steps that will enable attainment of the ultimate goal by either highlighting the danger of remaining in the present or the benefits of attaining the future state (Elrod and Tippett, 2002).

FIGURE 1
Case study approach
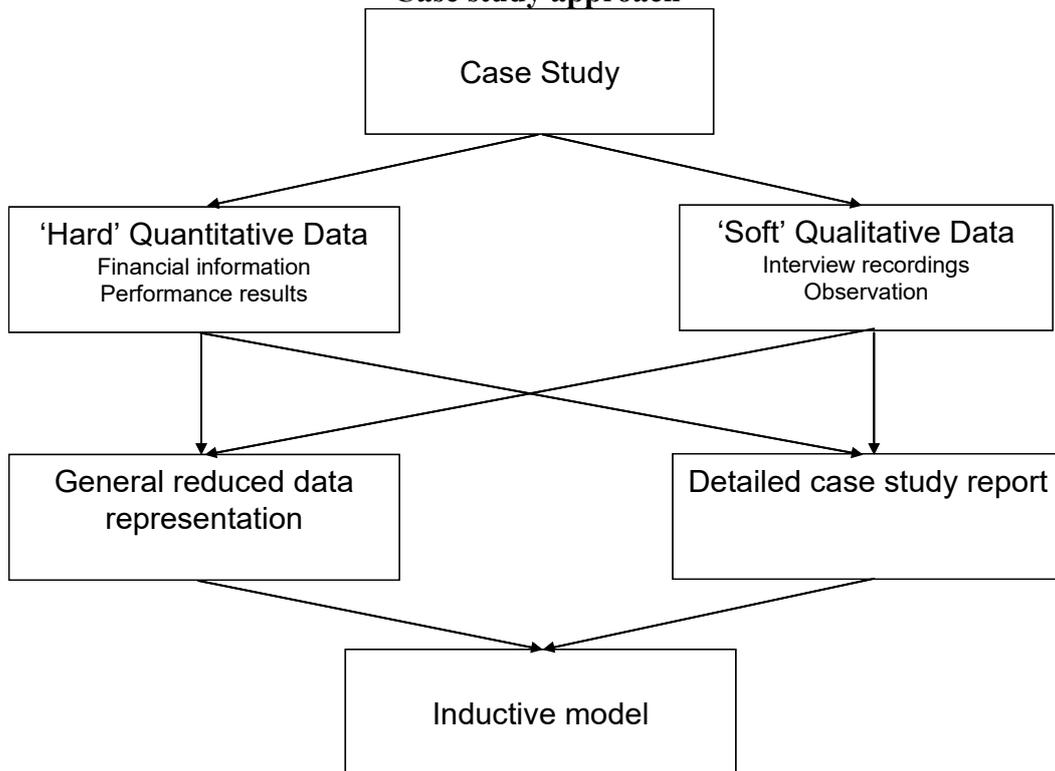
FIGURE 2
Taxonomy structure
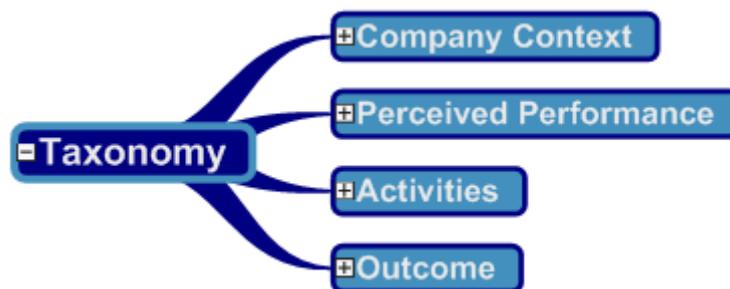
FIGURE 3
Hierarchy of taxonomy for activities