

Reflecting on the Strategic Use of CAQDAS to Manage and Report on the Qualitative Research Process

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*As an increasing number of researchers have been trained to use programs such as Atlas/ti, NUD*IST, Nvivo, and ETHNOGRAPH their value in analyzing qualitative data has gained greater recognition. Drawing on the experience of two PhD candidates at the University of Tasmania, this paper reflects upon some potential uses of a suite of computer software programs to make the research and analysis process more logical and transparent. In addition, this paper argues for the introduction of a Computer Aided Qualitative Data Analysis Protocol to give readers of the research report a better understanding of the analysis process undertaken by the researcher. Key Words: Computer Aided Analysis, Qualitative Data Analysis, and Qualitative Analysis Reporting*

Introduction

Over the last twenty years, electronic qualitative data analysis has attracted greater attention in the academic realm (Miles & Weitzman, 1996; Rainer & Hall, 2003). As qualitative data analysis software has been developed from the first generation of text search software, an increasing number of researchers have forgone the “highlighter and file folder” and adopted the mouse and task bar. Advancements in software suites present new opportunities to integrate and enhance the functionality of such programs beyond data analysis, and to incorporate other elements of the research process. This paper presents three critical reflections in adopting an integrated approach to qualitative computing, drawn from the experiences of two doctoral candidates at the University of Tasmania. Firstly, the developing impact of information technology (IT) on the qualitative research process will be reviewed, to trace the development of qualitative data analysis software and its applications. Secondly, the process of qualitative data analysis and the development of the research topic will then be discussed, to illustrate the potential for a broader role for IT in this stage of qualitative research. The third section of the paper will present the lessons drawn from the authors' adoption of an integrated approach to qualitative computing and will propose a “qualitative data analysis protocol” to support clear explication of the research process undertaken by the researcher.

The Developing Role of Information Technology in the Qualitative Data Analysis Process

Since the early 1980s developments in IT and computer software have improved the processes of qualitative data analysis. Developments in information and communications technology have presented new types of data, methods of data

collection, and processes of data analysis. As Gibbs, Friese, and Manabeira (2002) have observed, the development of information technology has created new sources of data (such as discussion lists, web pages, and text forums) as well as the new forms of data collection that include usage logs, digitized recordings, and e-interviews. These can present some dynamic and exciting possibilities for new research designs and foci (see Bampton & Cowton, 2002; Secrist, de Koeyer, Bell, & Fogel, 2002), and for undertaking various elements of qualitative research in new ways and through new forums.

Computer-Aided Qualitative Data Analysis

Central to these developments has been the evolving role of the microcomputer in qualitative data analysis. The enhanced capabilities and decreased cost of microcomputers have expanded their utility: Instead of being limited to clerical applications such as word processing, they can now serve as a key tool throughout the entire research process (Shermis, Stemmer, Berger, & Anderson, 1991). The area in which this changing role is perhaps most strikingly illustrated, however, is qualitative data analysis. Dedicated programs known as CAQDAS (Computer Aided Qualitative Data Analysis Software) were initially developed to enhance the accessibility of qualitative data by overcoming the physical limitations of paper data records (see Richards & Richards, 1994), and as the acceptability and legitimacy of using computers in this way has grown, the programs have been developed to more specifically accommodate the particular requirements of qualitative data and qualitative data analysis (Richards & Richards, 1998). The particular value of CAQDAS programs in qualitative data analysis is considered to be their usefulness for data management and supporting coding processes.

A key challenge of qualitative data analysis is the transformation of “hundreds of pages of field notes to a final report” (Miles & Huberman, 1994, p. 281) through a rigorous and high quality research process rather than “a disorganised stumble through a mass of data, full of ‘insightful’ observations of a mainly anecdotal nature” (Silverman, 1993, p. 43). This requires the reporting of data in as detailed, vivid, and descriptive form as possible (Orum, Feagin, & Sjorberg, 1991), and demonstrating the relationships between the data and theoretical conclusions (Thompson, 2002). An efficient and well-structured data management system is critical to tracking, accessing, and documenting the data available and the analyses applied to it (Gibbs et al., 2002; Huberman & Miles, 1998). CAQDAS programs can assist in the development of a data management system akin to Yin’s (1994) case study database by facilitating electronic storage, search, and retrieval of qualitative data. By facilitating the recording of the source details for coded data, including the date and time of the data collection, computer-aided analysis can make it easier to detail the steps in the development of the researcher’s interpretation and analysis. For the reader this can help to retrace the logical steps of that development and the basis for the researcher’s conclusions (MacLaren & Catterall, 2002). So long as the process is effectively documented, this can enhance the transparency and rigour of the analysis process, and facilitate replication of the study (Fielding & Lee, 1998).

In addition to assisting the organisation and retrieval of data records, CAQDAS programs can also be used to support coding processes. Coding involves the disaggregation of data into text units that can then be categorised within a thematic or

descriptive classification system (Boyatzis, 1998). The use of CAQDAS programs to code material in electronic document format can enhance the efficiency and effectiveness of this process in several ways. Firstly, CAQDAS programs can streamline some of the mechanical aspects of cutting, pasting, and retrieving data records (Bryman & Burgess, 1994; Mason, 1994), freeing researchers to focus their energies on analytical procedures (Thompson, 2002). The advancement of CAQDAS in recent times has enabled researchers to undertake finer-grained coding options, such as “line by line coding” (Creswell, 1998). By supporting coding to multiple categories and greater complexity in the number and structure of code categories that researchers can create, such programs also present opportunities for deeper and more detailed exploration of the data. However, as MacLaren and Catterall (2002) suggest, researchers remain aware that these coding features may also serve to distract them away from their original research focus, and delay the completion and/or publication of their efforts. For example, researchers may find that the ease with which node categories can be created overtakes the logical premise for their creation. This can result in a node structure where comprehensiveness comes at the expense of usefulness.

Researchers can also check coding consistency (Weber, 1985), be exhaustive in their coding and check for negative cases (MacLaren & Catterall, 2002), and improve the rigor of the process by enabling the researcher to check the validity of their impressions of the data (Smith & Short, 2001). As coding progresses, memo-ing functions support the recording of theoretical ideas as well as operational memos related to coding and sorting procedures (Babbie, 2002). Contemporary CAQDAS programs also include sophisticated modeling functions for graphic display of conceptual schema and enhanced functions for supporting team projects (Bourdon, 2002). The graphics and modelling capabilities of theory-building CAQDAS programs (such as N6) enable the researcher to develop graphic illustrations of the governing structure developed through the analysis (Miles & Weitsman, 1994). This is represented as an inverted tree structure that depicts the grouping of related categories as “tree nodes” and the sub-categories as “branches” (Tesch, 1990).

While the functionality of CAQDAS programs has increased significantly since their inception, Fielding (2002) recently observed that most published accounts of their use reflect applications consistent with the manual techniques for coding, retrieval, and searching for coded segments. This suggests that qualitative researchers may still value CAQDAS programs primarily for enabling traditional processes of “coding for retrieval” to be undertaken in an electronic forum rather than exploring techniques such as “coding for query,” which can only be undertaken with computer support (Richards, 2004). However, the potential for such programs to support the use of electronic fora as a means to ensure transparency and rigor throughout the research process cannot be ignored.

Reviewing the Literature and Identifying the Research Opportunity

The impact of information technology on the earlier stages of the qualitative research process has also been dramatic, by greatly expanding the range of literature to which researchers can gain access to when investigating potential research opportunities. Electronic databases such as ABI/Inform and Sociofile (amongst a host of others) give researchers the capacity to identify salient literature from anywhere in the world, while

citation databases such as Web of Science enable researchers to track the citations of key literature, and determine the genealogy of conceptual and methodological traditions. Alert services, offered by many publishers, also notify researchers of new literature as it is published.

Technological developments have helped to equalize access to information resources, and overcome limitations of geographic distance and resource limitations (Hart, 1998). However, accessing such a comprehensive range of literature may make search and retrieval difficult without the aid of a computer (Shermis et al., 1991). As each piece of literature is identified it must be incorporated into a database and categorised in order to provide a structured and transparent record of the search, and to facilitate the organisation and retrieval of information when writing the review of background research (Hart). The usefulness of bibliographic software programs in facilitating this process has been recognised for some time (see Shermis et al.), but their compatibility with electronic literature databases now enables researchers to export citation information directly into the bibliographic program and undertake much of the first phase of the research process through electronic fora.

While the organisation of literature in this way can aid the researcher to systematise their literature search and enhance the recording and accuracy of citation details, the analysis of a body of literature to determine possible research opportunities involves processes similar to those of data reduction, data display, and conclusion-drawing, identified by Miles and Huberman (1994) as comprising the analysis of qualitative data. As the literature is explored, a large body of material must be reduced into summarized form while retaining substance and meaning. The development and illustration of the categorization system then supports the identification of main themes and deficiencies in current knowledge, and can provide a visual illustration of the thesis argument. As the literature is analyzed for its conceptual, epistemological, and methodological relationships with other work, the researcher draws and verifies conclusions about these relationships to identify opportunities for further study, and to provide the framework into which new findings can be integrated (Hart, 1998). Thus, the analysis of literature can in many respects be considered another form of qualitative data analysis.

The similarities between the processes of data management in qualitative data analysis and in literature management present a common imperative for effective management systems and would suggest that CAQDAS programs could be similarly applied to enhance this process. Clisbee (2003), di Gregorio (2000), and Hansen (1999) provide some support for this claim, detailing their use of QSR's NVivo software program in the literature analysis process. We present our experiences in using QSR's N6 (amongst a suite of other software programs) to manage the demands of the doctoral research process. Essentially, this paper offers a reflection on how the use of an integrated information technology system can enhance literature analysis and the broader research process, and to encourage others to consider the strategic possibilities of such an approach for the management of their own research.

Reflections on the Use of Integrated Computer Software for the Purpose of Qualitative Data Analysis

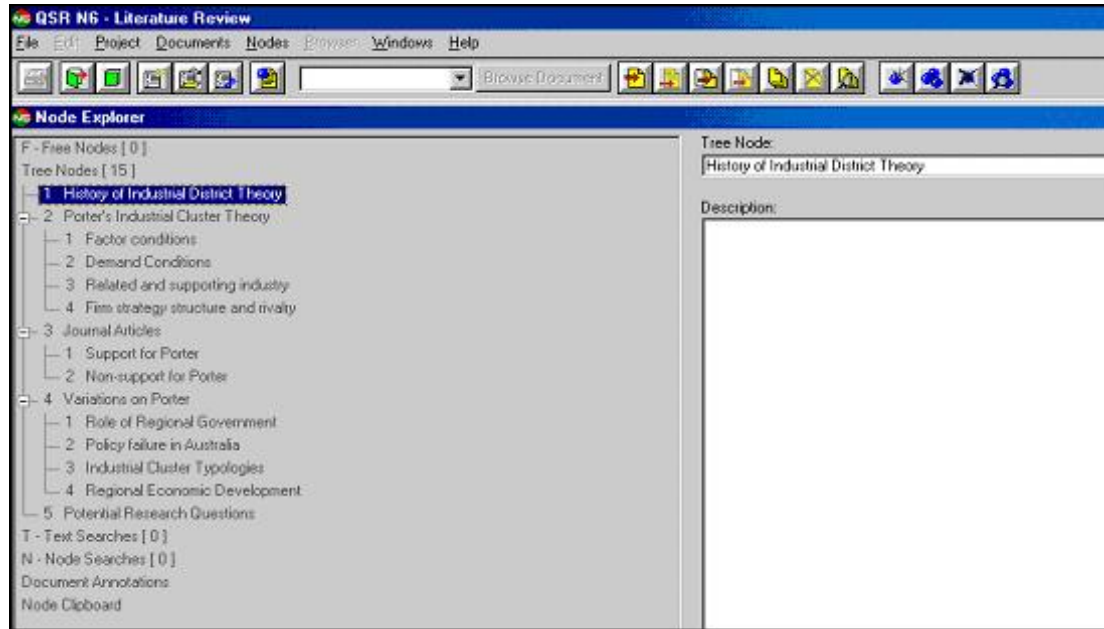
Reflection #1

Using software for more than just the management of transcribed interview data

When we first approached our research, our understanding of CAQDAS packages was framed by its “traditional” use, as a coding device for transcribed interview data: That is, we perceived its function to lie only in the post primary-data collection stage of the research process. Fortunately, our exposure to this electronic method of analysis occurred early in our doctoral training, and allowed us to redefine its role in the entire research process. The first redefinition of its role came during the literature gathering and review process. We approached our review of the literature in the traditional manner: that is, with numerous coloured highlighter pens, sticky note pads, and manila folders. After a time, we discovered the conceptual difficulty of keeping track of our readings, remembering the sources of key ideas, and the important task of interrelating the findings and implications of one paper with that of others. In order to overcome this “difficulty” we decided to use the coding facility within the NUD*IST software package to codify concepts, their interrelation, and their evolution within the literature over time. This process would prove to make our research analysis much easier and more structured than we feel we could have achieved through the “traditional” approach.

Firstly, it allowed us to link together passages and ideas from papers in an easily retrievable format, that is, as a category node in the NUD*IST database. By ensuring coded sections from articles were chronologically ordered, the tracking of their evolution was made far easier as the evidence was stored in a logical and focused manner. When papers were subsequently entered out of chronological order, the facilities within the NUD*IST program allowed them to be re-ordered with ease. Given that many universities have access to online academic databases, the “cutting and pasting” of an article’s content to analysis software has become more efficient than printing it out and highlighting text manually. In instances where there was only a hard copy of the article, we used the traditional highlighting technique, but also entered the most useful quotes into the NUD*IST software manually. A memo within the NUD*IST database directed us to the archived hard copies. Figure 1 indicates how one of the authors used the coding function of the NUD*IST program to code their journal article reviews during the literature review process.

Figure 1: The NUD*IST node tree from the coding of the literature review material.



Secondly, the process allowed us to more easily monitor the development of the theoretical frameworks under consideration, and more easily identify the potential “gaps in the literature”. The direct result of the literature-review coding process was the creation of a series of categories that contained focused information pertinent to our research and its subsequent design. As the literature-review node structure was refined, we were able to identify key areas of research opportunity. The advantage of this approach to the literature-review process was the additional familiarity we were able to generate with the literature through multiple exposures to its content, and the ability to logically define valid research questions. For example, for one author’s doctoral research into industrial cluster development, the issue of “the role of government” was of central importance. During the literature review process, literature on “industrial cluster” and role of government” literature was examined. After the coding of the literature review was completed, it was apparent that the concept of “government social responsibility” was missing from the industry cluster literature stream altogether, and was subsequently included as an additional research question to be addressed by the study. As such, the coding of the literature review, and the processes that it entailed, helped us to become more familiar with the literature through the implementation of the analytical thought process largely associated with the data analysis process. Documenting the coding of the literature also allowed us to demonstrate our thought processes to our supervisors, and gave them additional insight into the specifics of our particular research projects.

Thirdly, the process allowed us to generate ideas for additional/simultaneous research article publications, as the coding identified “additional gaps” outside the scope of the doctoral research project. Given the process identified in the second point above, other related areas of academic interest are likely to be identified more readily by the researcher for future projects. Our experience of this outcome was quite enlightening, with both authors able to identify numerous potential research journal articles that could

emanate from the effective planning of a single doctoral research project. We found that by carefully constructing our survey and interview questionnaires, we were able to collect data for these “additional gaps” easily and without the need for additional primary data collection to occur. This outcome of the “electronic literature review” process was largely unexpected, but very welcome, given the pressure on academics in the current environment to “publish or perish”.

Fourthly, the process allowed us to formally structure our literature review chapter before writing the first draft of the thesis report. Essentially, the node-tree that was constructed during the literature coding process allowed us to logically introduce the concepts pertinent to our study in the literature review chapter. The nodes themselves served at times to provide the headings and subheadings required in the literature review chapter, whilst the content of the node served as the specific subject matter to be discussed in that heading or subheading. By using this method of electronic literature coding, we found that the write up of our literature reviews were logical, and in fact far easier than we expected.

The process also served another purpose that would be beneficial later in our research. The training that we received in using NUD*IST was put into practice early, therefore reinforcing our learning quickly. This helped us to become far more familiar with the report outputs and the shortcuts of the data analysis program, experience that would allow us to tackle the primary-interview data with much more confidence and competence the “second time around”.

Reflection #2

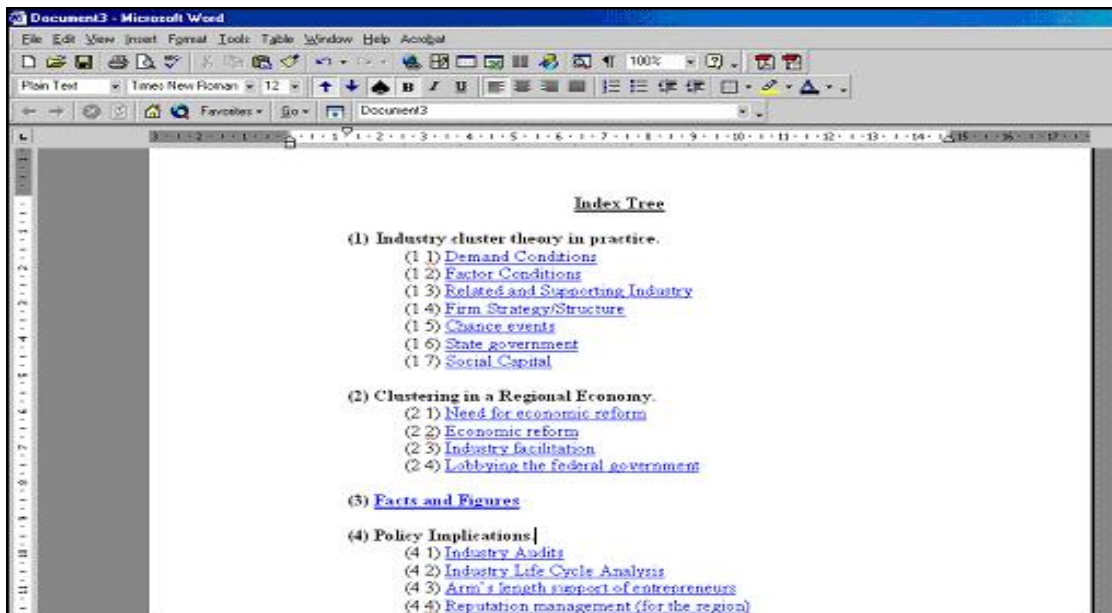
Integrating the various software programs for increased efficiency and analysis

One advantage of using multiple software programs during the research process is the ability to “cut and paste” data between software applications. This process creates efficiencies unavailable to the “traditional” hard copy methods of data analysis and allows for greater levels of output and analysis. For the research process in particular, the use of multiple software programs involved much more than the simple efficiencies associated with “cutting and pasting” data between applications. The use of multiple software packages also aided the analysis and protection of the research data in three main ways. Firstly, the use of multiple software programs aided backup of each of the authors NUD*IST work. One of the authors experienced corruption of their NUD*IST database program, an issue that arises in many database programs from time to time in the computer environment. Unfortunately, there was no additional backup of the database material itself, and all work done to that point in time was lost. Subsequently, we decided that a non-database copy of our NUD*IST (and other) data must be created to protect our research. In order to achieve this, we simply copied the structure of the NUD*IST database using a series of MS WordTM documents saved with the same node titles. This process required that each category node, and its contents, were copied from the NUD*IST output files to a series of blank MS WordTM documents. Each category node, therefore, was replicated in a format that was compatible with any machine with the MS Office package, and we did not need to rely solely on the NUD*IST program interface to access it. The additional work involved in this process was negligible, with the “copy and

paste” function used to copy the data between applications. It should be noted here that although word-processing programs often include some common features found in NUD*IST (and other CAQDAS programs – such as “find” and “word search”), they are as of yet incapable of performing the fundamentally important coding and retrieval functions offered by specialised data analysis software. As such, we strongly recommend the use of word-processing software as data back-up programs rather than qualitative data analysis software at this point in time.

As illustrated in Figure 2, the MS Word™ replica enables the user to create printer friendly versions of the data, one of the major advantages of the MS Office suite over the current set of qualitative data management programs. The use of MS Word™ can also include the creation of a set of hyper-linked documents as an index for navigation between nodes in their different document files. The index page (or “contents page”) provides a summary of the category nodes that exist in the research project that can be hyperlinked to the corresponding document in your set of MS Word backup files. Figure 2 illustrates the hyperlink document that one researcher created as an index or “table of contents” for the remainder of the backup files created.

Figure 2: The index (Table of Contents) MS Word™ document with hyperlinks.

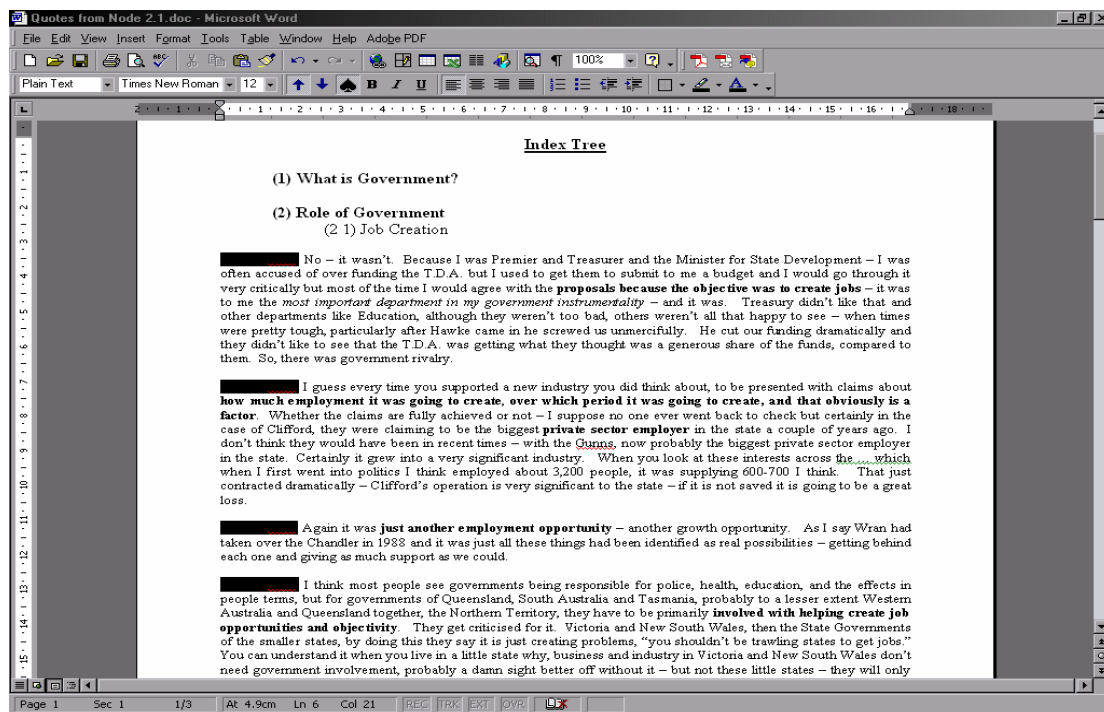


Given the popularity of the MS Word™ in Western educational institutions, the MS Word™ replica can also be readily copied to a number of machines, allowing researchers to store their backup files to as many different computers as deemed necessary. For added security, given the popularity of the MS Word™ suite, we recommend that researchers consider password-protecting the backup files so that only authorised people could access the data – especially where personal or highly confidential research data is concerned. This would allow people such as research supervisors to have guarded access to the research, and be able to view it without needing to purchase an additional copy of the qualitative software package. An additional safety measure may also be the attachment of the entire password-protected MS Word™ backup copy to a

web-based email address. This allows the researcher the opportunity to access their replica data set anywhere in the world, and discounts the possibility of losing hard disk information in the event of a catastrophic event (such as a fire, computer crash, theft, or loss).

Secondly, the use of the MS WordTM program provided a pre-formatted version of the quotable quotes from the literature and qualitative interviews for use in the thesis report. It was when writing up our research findings that this fact impressed itself upon us most strongly. We found that each time we cut and pasted a quote from our CAQDAS database program, the formatting would need to be adjusted to suit the requirements of thesis presentation. The process of constant re-formatting was a severe drain on our time, so a decision was made to use the MS WordTM backup files as the location from which we copied the quotations. In order to uniformly format the qualitative data, we simply opened the MS WordTM files, selected all of the text stored within, and then formatted the text to that prescribed for a thesis. In our case, the quotes were indented left and right, reduced to a 10-point font, and formatted to 1.5 line spacing. Figure 3 illustrates the result of this process. Once this formatting had been applied to each of our MS WordTM backup files, the cutting and pasting of the quotes therein became a much more efficient, and a far less frustrating process.

Figure 3: The MS WordTM document with applied formatting.



Thirdly, the use of the EndNote program during the literature review process served as a reference-building tool in the thesis write up process. When coding the summaries of the literature, each article was identified by its author(s) and date of publication, such that the source for any coded text unit could be easily acknowledged. Once the node structure was finalised, the contents of the literature nodes were copied

into MS WordTM for the purpose of writing the literature review. This process was expedited by activating the “Cite as You Write Function” of the EndNote bibliographic software program. As each reference was cited in text, the EndNote program automatically formatted the full reference list entry according to the specified style, generating a comprehensive and accurately formatted reference list.

Reflection #3

The thesis write-up

Perhaps the most daunting aspect of the doctoral process is the write up of the thesis findings. This stage of the process requires the researcher to introduce their topic, justify their research questions, their method, and provide critical analysis to their data, such that it qualifies as an original and valuable contribution to knowledge. As with its use in the literature review process, the electronic qualitative analysis software may also be used to aid the structured and logical write up of thesis findings. Similar to the coding of the literature review material, NUD*IST (and similar packages) can be used to create node categories that can be used as discussion points in the discussion and conclusion chapters. If the researcher is careful enough, the order and contents of the “discussion nodes” can directly inform their use of headings and subheadings. In our research, this use can be illustrated by the following example. One author’s research project dealt with *Porter’s industry cluster theory*, a theory that required the categorisation of four factors thought to explain the growth of particular national industries. As such, the coding of the literature reflected these four tenets as separate nodes (see Figure 4). After the analysis of the primary data was completed, the factors found to account for national industry growth in Australia numbered seven (see Figure 5). A quick comparison of these additional categories (or nodes) represented a logical place to begin discussing the contribution of the research to current knowledge. As illustrated earlier with respect to “government social responsibility,” the identification of these “discussion nodes” helped to identify a potential stream of publication themes from within the thesis document. This process of comparing the literature review and primary data node tree diagrams presented no less than nine separate instances of clear divergence, all of which were used to construct the thesis findings chapter as well as separate publication ideas in their own right. As such, the categorisation of the literature review data and the primary interview data provides the researcher with a highly structured and logical process through which they can achieve similarly high level of analysis and reflection.

Figure 4. The NUD*IST node tree diagram after the literature review process.

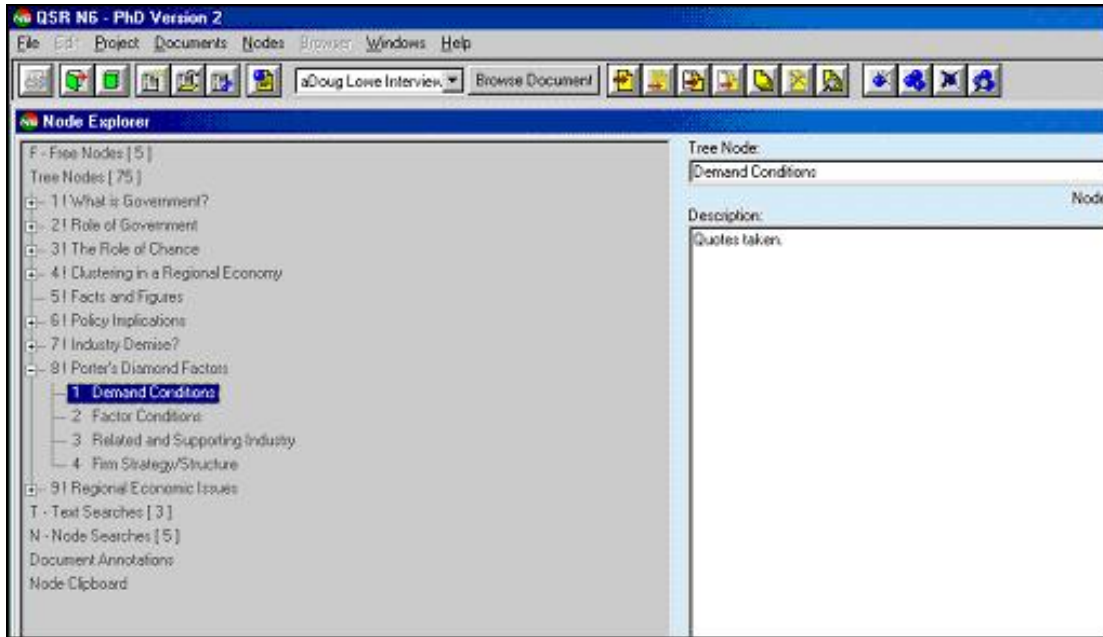
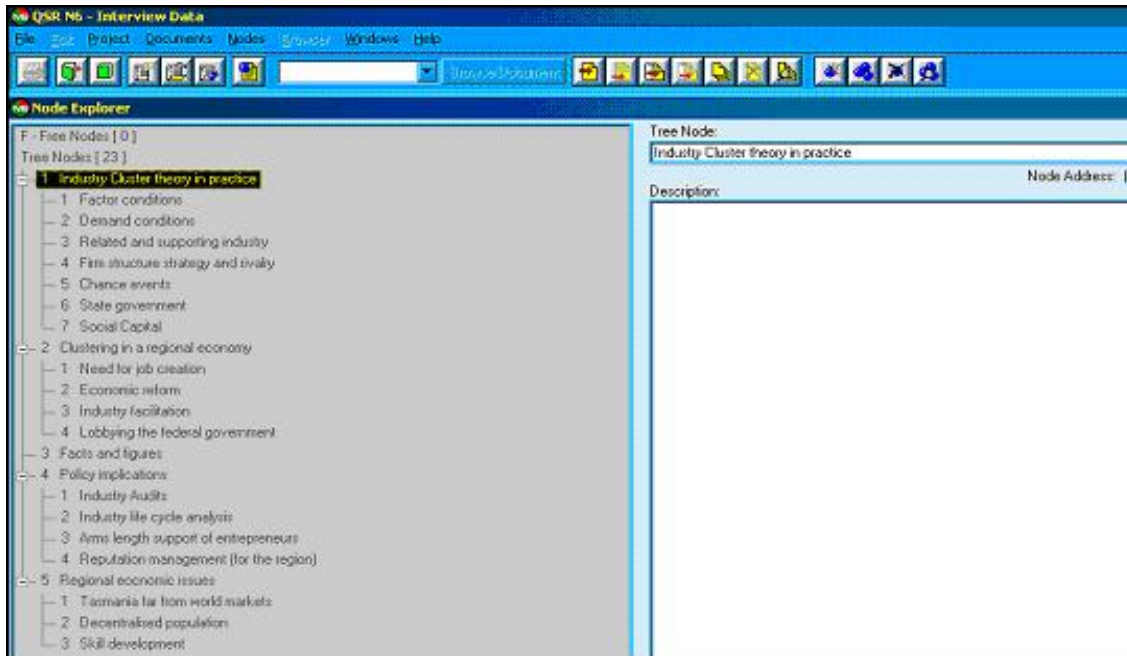


Figure 5. The NUD*IST node tree diagram after the primary interview review process.



Reflection #4

The creation of a CAQDAS protocol document

Our final reflection concerns the issue of ensuring rigour and transparency in the reporting of qualitative data analysis. In order for researchers to pre-empt the questions, issues, and problems raised by readers and reviewers of the research report we suggest the construction of a specialised protocol for the purposes of documenting the qualitative research process. As Yin (1994) and Tellis (1997) indicate, case study research already requires that a “case study protocol” be constructed to document the rationale and proposed case methodology to be implemented by a researcher. A case study protocol documents the procedures to be employed when conducting case research. As well as describing each phase of the inquiry, the case study protocol assists in future considerations of the case by enabling other researchers to fully understand the methodology used. Yin (p. 63) suggests that a case study protocol is an essential element of the case study method because it is “a major tactic in increasing the reliability of case study research, and is intended to guide the investigator in carrying out the case study”. Similarly, we feel that a CAQDAS protocol document would serve as a basis for demonstrating transparency and rigour in the qualitative research process for three main reasons. The first is to ensure that a clear purpose for the qualitative research is communicated to the reader, and therefore enables the researcher to clearly demonstrate the rationale for the research approach. As such, the document would include sub-headings such as “Title of research”, “Research objectives”, “Proposed literature base”, and “Proposed coding”. Variations in the data analysis process can then be more readily identified, detailed, and explained by the researcher, potentially reinforcing validity and reliability of the process. Such a document would also provide a basis for replication should others wish to conduct similar or comparative research efforts in the future. Readers intending to validate, rebuke, or extend the research under review would be able to identify and source the requisite literature base as well as gain a deeper understanding of the coding process undertaken by the original researchers. This in turn would facilitate better appreciation of the constructed “gaps” in the literature, and, potentially, the identification of others not as yet considered.

The second reason is that it would allow the researcher to logically derive the required coding strategy from the literature review process itself. The construction of the CAQDAS protocol, in our case, served to focus our attention on only those issues that were pertinent to the research question. Other codes that were identified during the process were more readily allocated to potential future research efforts. In addition to this, we felt that the readers of the research report would be better able to follow the logic of our analysis, and therefore likely to adopt our perspective more readily. Logically, this document could be used for the construction of research-based texts and/or the framework behind a series of journal article ideas that so often accompany a major research project.

The third reason is to ensure that the research process is transparent to the reviewer(s). Ideally, a well-constructed CAQDAS protocol document would enable a reviewer to gauge the rigour inherent to the study, and be better able to judge the veracity of the study’s conclusions. Necessarily, such a document would need to be constructed so

that it could be read in parallel to the research report itself. For example, as the examiner reads the literature review section, they could check the protocol document for the rationale behind their focus. As such, the protocol could guide evaluations of the quality of the research and research report. This is not to say that the CAQDAS protocol would require thousands of words to justify each data analysis decision, but rather to provide a basis that allows the researcher to inform the reviewer as to why certain codes were chosen over others, and indeed provide greater precision in their use of language throughout the report. For example, both of the authors' doctoral research centred on the subject of "management of business networks," but the literature surrounding "industrial clusters" was significantly different to that associated with "alliance networks". The CAQDAS protocols of both research topics would enable the reader to establish the substantive differences between these research projects, and be better able to examine them in an informed manner.

Conclusion

The increasing interest in CAQDAS is reflective of their increased power, availability, and ability to support the much-maligned qualitative data analysis process. We feel that much of the criticism directed at qualitative research stems from a perception that the process is not always demonstrated to be transparent or rigorous in the same ways that quantitative research can be. It is our contention that in order to overcome this perception, a "transparency" mechanism be attached to all qualitative research processes. In particular, we feel that the use of CAQDAS throughout the entire process allows a reader to examine all of the research method undertaken by the researcher, from the construction of the research's literature review to its conclusions and recommendations. Our experience directs us to recommend the use of such programs in qualitative research projects, and to incorporate the potentially powerful uses discussed here, to simultaneously save valuable time and increase the quality of analytical output. With the addition of a Qualitative Data Analysis Protocol in the write-up stage of the research project, we feel that greater rigor and transparency can also be demonstrated. We further suggest a qualitative data analysis protocol could in time become an accepted element of qualitative research practice, subject to the same processes of critical review and development as any other aspect of research method.

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