

# DYNAMIC SUPPLY CHAIN MANAGEMENT: APPLYING THE QUALITATIVE DATA ANALYSIS SOFTWARE

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**Abstract.** Analysis of data has been known as one of the most significant stages in a qualitative research process. The purpose of this article is to share elements for understanding during the process of preparing an analysis using the qualitative data analysis (QDA) software. ATLAS.ti version 7.1.7, the QDA software, provides some very valuable tools in academic research, especially for social science fields. This paper offers a review of dynamic capabilities in dynamic supply chain management by utilizing QDA software package. Moreover, steps how to use ATLAS.ti and figures are provided to describe the research presented with examples. This will serve as a guideline for beginner's researchers in qualitative research who are applying the QDA software, particularly ATLAS.ti. As such, use of the analysis outlined in this article should help to support the rigor in qualitative research.

**Keywords:** dynamic capabilities, supply chain management, qualitative data analysis software, ATLAS.ti, qualitative research.

## Introduction

Effective qualitative data analysis is a crucial task in research across a large range of disciplines. Regardless in behavioral, computational, and social science's researches, text data analysis requires a set of almost related mechanical processes. This paper draw on as guides for qualitative data analysis (QDA) software in academic research, and the choice of QDA software for this article is ATLAS.ti [1]. Like many other software packages, there are a helpful user guide and sample data sets for ATLAS.ti. There is also much research of theoretically based on qualitative analysis guidance. Nonetheless, fewer scholarly works to show how to use the software packages with real research cases. Therefore, the motivation for this article is to discuss a software review but with cases of actual research examples. Examples of research later will be presented in illustrations of how to utilize ATLAS.ti. This paper also serves as a practical guide for qualitative researcher's beginners or software users by showing not only which functions of ATLAS.ti to use but also how the example of research is approached. Furthermore, with any case study, this paper will not include all features of software utilization, which is not the aim of the paper. Next section will discuss the description that allows the researcher to build attentive interpretations through related analysis of qualitative data and the range of tasks need.

## The Study

At the beginning with the research project, throughout data collection, analysis and the writing on the report, software program ATLAS.ti has been used. Based on the initial ideas during the proposal writing stage, the first task is to develop the ATLAS.ti projects known as hermeneutic project. It is a filing and analytic system in the software program within which project documents, and codes will be organised.

The purpose to the study is to explore dynamic supply chain management of Malaysia's oil and gas industry players and their firms in order to understand how dynamic supply chain capability's particular supply chain orientation and learning orientation reflects a process of dynamic supply chain management.

The analysis method proposing looks simple in the beginning. The basic steps can be understood very easily due to its simplicity. It enables novices to work in a systematic manner instead of declaring software to be the method. With more experience, the repeated nature of the basic steps becomes clear, and one learns to apply the method in a more difficult mode. Even though this paper applied the context of ATLAS.ti as the method, but other software packages also can utilize a similar method when analyzing data. Frieze [2] highlighted that QDA analysis can be approached in difference ways. This happened due to several reasons as follows: 1) modifying code names and coded data segment's flexibility; 2) more analysis options offers by the software; 3) combination of qualitative and quantitative methods easier; 4) teams across places can work together; and 5) analysis process is more transparent, hence, adding credibility, confirmability and dependability to the entire research works.

Credibility involves establishing that the results of qualitative research are reliable or believable from the perspective of the subject in the research. Whilst, confirmability refers to the degree to which the results can be confirmed or corroborated by others. This can be achieved by documenting the research process, the decisions made during a project and by the presentation of the end product [1]. Finally, dependability substitute's consistency or reliability, which can be, for example, achieved by a procedure called auditing [3, 4]. This paper has adapted Frieze's three mechanism to the analysis process which is noticing things, collecting things and thinking about things, and hence known as "Computer-assisted NCT" analysis [2].

### **Noticing and collecting things**

The first step is noticing and collecting process, which is different but related. There is no collecting without noticing, but often collecting immediately follows noticing. There might be variations depending to the researchers.

#### **2.2.1. Noticing things**

Noticing refers to the process of finding appealing things from the data when reading through transcripts, field notes, documents or newspaper articles, viewing video material or images, or when listening to audio files. The researcher may derive codes inductively or deductively, by writing down notes, marking the segments or attach first preliminary codes. Although, the software provided technical code, however, it cannot distinguish between different levels of codes. Thus, the researchers need to transform code into a category or a sub category or a dimension by way of naming it in a specific way and by defining it [2].

#### **2.2.2. Collecting things**

When the researchers do further reading is it likely to come across data segments that are similar, which has been noticed earlier. The segments may even fit under an already existing code label and under a common code name. However, the code can be renamed or consider as different codes if it does not fit under the same heading. The process becomes easier to think of better, more fitting code labels when continuing to collect more similar data segments and reviewing them later. Depending on the research questions and research goals, the focus of the initial process of noticing and collecting can be approached differently.

The NCT analysis method encompasses variety ways of coding and how to deal with them by computer-assisted procedure's suggestion. At the same time, the collected data may be in themes, emotions and values. Researchers may approach the process with a deductive framework in mind as used in provisional coding [5]; instead, it may develop codes inductively as suggested by initial or open coding [6, 7]; otherwise a mix of deductively and inductively also can be used to develop codes. Some researchers develop 40 codes, others a few hundred or even a few thousand codes [2].

According to Friese [2] the NCT method of analysis provides answers for what to do with the codes by offering functions to create new codes, to delete, to rename or to merge them. The collecting process helps new researchers better understanding to develop code is a descriptive label for a data segment and not necessarily to create a new label to all that one notices. Moreover, exceptions in developing a lot of codes may lead to a dead end and in most cases, this may hinder further analysis.

### **Thinking and some more noticing and collecting: Adding structure to the code list**

A first point of saturation thinking happens when the researcher no longer notices new things, no new codes are added, and only apply existing codes. Depending on the length and diversity of the data, the estimated of saturation point is reached after three to five interviews, and approximately 20 to 30 newspaper articles in coding shorter texts. The researcher indicator for the first point of saturation is when all existing codes are applied and as a matter of experience over time [2].

Coding needs to be done in whatever way that relates to the data and the research goal. Thus, researchers need to develop more abstract conceptual level codes, to order and (re)develop codes into categories and sub categories. The more structured of the code list during this stage can be identified by using the data frequency. However, the researcher still needs to make the decision about which code might be developed into a higher or lower order code, and not only by numbers produced by the software [2, 6]. The process of noticing and collecting is repeated by collecting a number of similar items under its heading code labels and later used for developing sub categories. This process stops once all data segments of codes with high frequency counts have been reviewed and anything that cannot be determined at this point remains coded at the main category. Code labels that have only been used a few times also were reviewed. These codes may either be combined with similar codes under a higher order conceptual label, or evaluate as present sub categories. Thus, this process also plays a role when developing codes on an aggregate level.

The aim in the process of developing categories and sub categories is to add structure to the previously loose list of codes, forcing the researcher to rethink the initial codes and further develop them conceptually. Software only facilitates the process of handling the data, creating and applying codes, renaming and modifying them, hence; the researcher needs to come up with the right ideas and labels. Moreover, the software does not teach about which good and bad labels and when or when not to apply a code [8].

This second phase of coding serves as a validated code list. Very few new codes will be emerged if the code list has been developed well. If there is still uncertainty in applying the codes to additional data, then the noticing and collecting process needs to be continued. The idea of the code list for an NCT analysis is to be able to access the data in a systematic manner. A well-developed NCT code list describes what is in the data and not necessarily represent a theoretical framework or the elements into a theory [2].

### **Thinking about things**

The next analysis phase is when the researcher immersed with all the coded data. The aim of this phase is to look for the data again, and specifically from the research question's perspective. This querying process using the various analysis tool software provide is called research question memos. Writing different types of memos is useful and can be attributed to different phases during the analysis process. However, normally the memo function is misrepresented as a comment function and users confounded in a large number of "memos" which are not memos [7, 9]. This does not mean that software users never write memos, but many do so in a word processor and might miss out on the opportunity of linking memos to data [8].

Usually, memos in software do not even have a proper title. Therefore, Frieze [2] suggested memos can be created at the beginning of the analysis about issues the researcher wants to write about. The issues may include the research process, to-do's, ideas for further analysis, issues related to the coding schema or the research question. Furthermore, the researcher also may collect everything that fits under a certain theme within the memo [1, 2].

The researcher may begin the memo by typing the research question to be examined. Research question can be identified earlier or can be developed during the process of analysis. The next step is to think about how to find an answer for this question based on the coded data. In order to make this thinking process transparent, the queries were written down and can be retrieved based on one code, code combinations, cross-tabulation codes, code queries combined with variables and others. The purpose of this is to evaluate the quality to the results and the overall research project. Since qualitative data analysis procedures often remain vague, therefore, writing a short memo about which codes queried add value to the transparency of the research process [2, 10].

Next, the researcher runs the analysis, reads or looks through the data and writes down his or her thoughts and interpretation. The researcher may come across data segments that demonstrate the interpretation written up in the memo. The memo can be linked to these data segments and later retrieved as quotes from the research report. The content of a research question memo may begin at a descriptive level but over time and with further analysis, it is likely to become more conceptual and theoretical.

The aim of writing research question memos is straight forward, such as finding answers to questions. For further elaboration, finding patterns and relations in the data seeking can be used to find out how the various aspects of the findings can be integrated. Visualization tools such as the network view function in ATLAS.ti can be applied to develop a comprehensive picture of the phenomenon studied. The visual depictions assist in further exploration of data in diverse ways. It can also be used as a means of talking with others about a particular finding or about an idea to be developed. Thus, throughout the research process, a number of diagrams like network views may be drawn, redrawn, deleted and newly created [1, 9, 11].

## **Analyzing the Data and Utilizing the Qualitative Data Analysis Software**

### **Approaching analysis**

For this study, the researchers started with the data without prior literature search or knowledge to the area of dynamic supply chain management. Thus, an inductive approach was used. This paper also studies how dynamic supply chain capability's particular supply chain orientation and learning orientation in Malaysia's oil and gas industry.

### **Limitations**

The data set consisted of PDF documents extracted from the Internet. The common theme was "dynamic supply chain management". Due to time constraints and the vast data set, the researcher only used a sub set of the provided codes with limited explanatory power. It is better to provide a smaller data set which will allow fewer choices and analysis.

### **Sampling**

In ATLAS.ti, primary document manager is used to view the documents that have been added to a project. In order to compare in ATLAS.ti, primary document families can be created to various groups of documents such as articles from the different years, subjects and others. The primary document families

function like dichotomous variables. Furthermore, the family's labels are written in a specific syntax and can be exported into Excel table.

### Noticing and collecting

The researchers began the noticing and collecting process after assigning the data to ATLAS.ti and read them. For this particular project, the researchers used descriptive and initial coding [5, 12]. This means codes are developed inductively and very close to the data. The code labels were descriptive and taken directly from the data. When using a code word that matches the text, most software packages provide an option that is called "code in-vivo" and in ATLAS.ti uses the menu label "open coding." The term open coding is generally linked to grounded theory and is defined as: "Breaking data apart and delineating concepts to stand for blocks of raw data. At the same time, one is qualifying those concepts in terms of their properties and dimensions" [7]. The paper discuss step by step to show how to used ATLAS.ti for the research examples, a dynamic supply chain.

Step 1: Use open coding and code in vivo to create many codes. This process of descriptive and initial coding of a dynamic supply chain resulted in 63 codes as in Figure 1.

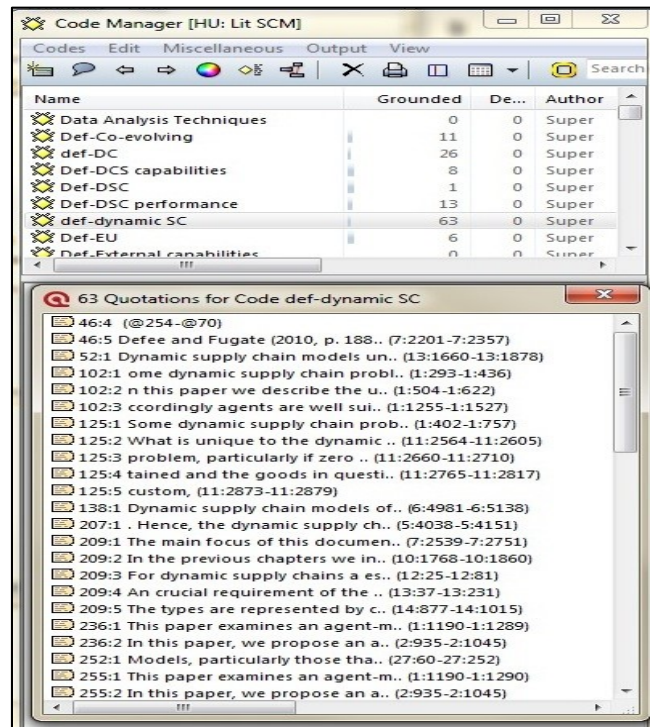


Fig. 1: Code list after the first phase of coding.

### Thinking and some more noticing and collecting: Developing sub categories

The numbers behind the codes in ATLAS.ti indicates the frequency and the linkages to other codes. "Dynamic supply chain (63-0)" means that it used this code 63 times for coding, and it is not yet linked to other codes. A few codes in the list show high frequencies indicating the code labels have collected quite a number of quotations. Therefore, they need to be reviewed for sub categories. To review the coded segments, one need to double click on a code in the code Manager with lists all codes. By going through and reading the coded segments, the researchers realized that the consequences can be divided into various aspects like supply chain orientation and learning orientation for sub codes. The code list in

ATLAS.ti is sorted in alphabetic order; it is best to work with prefixes so that all codes belonging to a category show up as a group. In this study, the initial code "dynamic supply chain" has been renamed to "dynamic supply chain capabilities," as a main category labels on top. Next, is to go through the data and adding content to the sub category codes. If needed, the contents of all sub category codes can be collected later by means of creating a so-called Code Family. This process can be repeated for all initial codes that showed a rather high frequency. It then looked at those codes with a low frequency and paying attention which of these can be summarized.

Step 2: Narrowed down by merging codes ("dynamic supply chain capabilities" merged with "dynamic supply chain," and it is automatically documented in the definition window of the code managers), used comments or memo in addition to codes for future write-ups ("grounded" in the code manager window tells the frequency of code as you code) as in Figure 2.

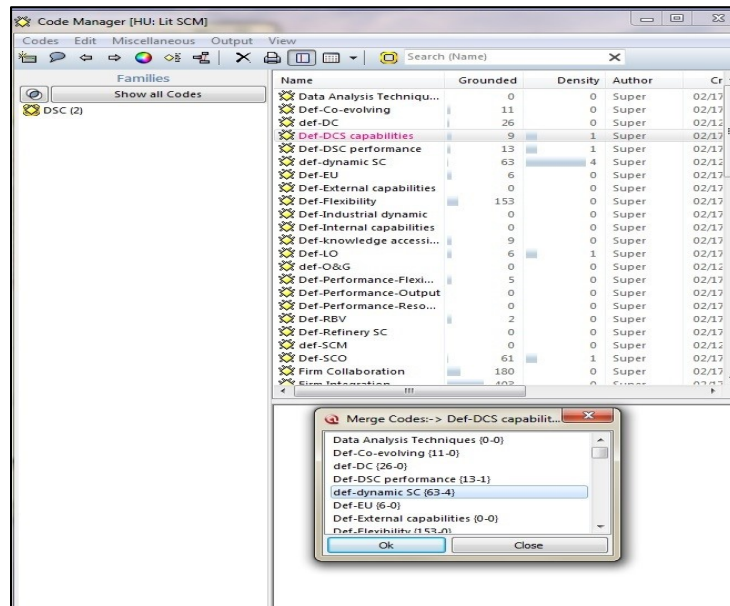


Fig. 2: Merged codes.

Step 3: It Produced a coding scheme graph in a network view as in Figure 3. Network view is a great visual tool, derived from graph theory tradition.

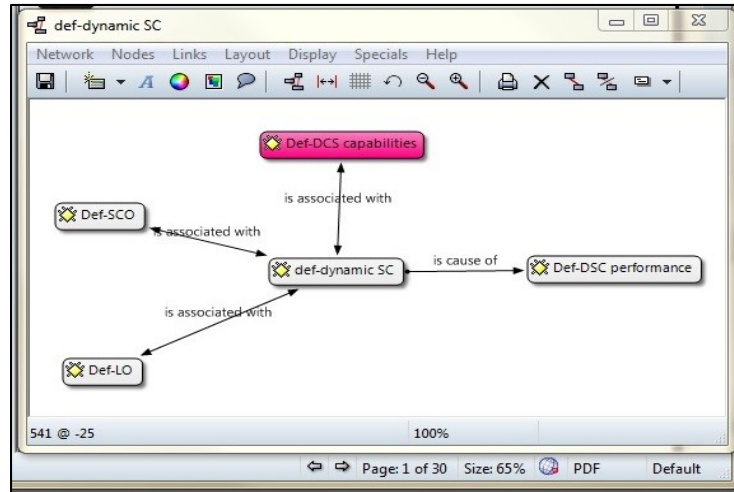


Fig. 3: Atlas.ti network view.

Step 4: Produced a table of code counts (a quick “quotation counts report” from the code manager window can be saved as a document file or Excel file).

Table 1: Code primary document count report.

	2008	2009	2010	2011	2012	Total
Dynamic supply chain capabilities	4	25	11	6	4	50
Dynamic capabilities	0	0	0	26	0	26
Dynamic supply chain performance	0	0	0	0	13	13
Learning orientation	4	0	0	1	0	5
Supply chain orientation	29	0	5	6	1	41
Total	37	25	16	39	18	135

In sum, a table and a coding scheme were provided as feedback for further iteration process.

### Thinking about things: Further data analysis

After coding, the next step was to look at the data with the research questions in mind. The research questions that were provided to for analyzing the study on the dynamic supply chain management were as follows:

1. How do different actors in learning orientation identify the cause of dynamic supply chain?
2. How do different actors in supply chain orientation identify the cause of dynamic supply chain?
3. How does dynamic supply chain identify the causes of dynamic supply chain performance?

Based on what emerged from the data, some of the research questions were added. Later, the data was queried to find answers to each research question. The analysis tools used for this were the query tool, the concurrence explorer and cross tabulations of codes by documents.

### Conclusion

Qualitative data analysis software is fighting for the winning dominance in the world of qualitative researchers when more and more researchers are adopting electronic tools. Eventhough there is an argument against their use, but there are tangible benefits for those who make the investment on it.



Qualitative data analysis software makes many of the more repetitive and mechanical aspects of qualitative research easier and more efficient. Furthermore, the software offers researchers an abundance of tools and accessories which, will enhance the research project and remove much of the stress and boredom.

ATLAS.ti is one such analysis product that is quite widely used in the qualitative research community. It allows researchers to retrieve and code data, and develop theory building and modelling. The future for qualitative researchers is set to improve with even more powerful and flexible data analysis tools which offers features that will make analysis faster and collaborate easier. As with any software, ATLAS.ti software does not do the work automatically. Researchers still need to do the work, because it is an intellectual task. But researcher can get the computer to work as research assistant, which can save time and make work better, especially for large data sets. It can also be used at any point along the qualitative research spectrum, whether it is close to the theory-building or grounded-theory end or close to the theory testing or hypothesis-testing end. For practical benefit, using ATLAS.ti software will save time and make work easier to manage, especially for large sets of data and teamwork settings. For empirical benefit, it will enhance credibility building by making the research processes more transparent and replicable. ATLAS.ti also can handle not only text data but also video and other digital media formats.

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