

develop methodologies to cope with integrating environmental concerns into design and management of processes and to deal with the conditions for use and consumption.

The development of greener technologies is not simply a question of improvements and integrations in the technical sciences and in design practices, though we should not underestimate the importance of these areas. A change in the dominant priorities for technological development is dependent on priorities set in the business sector, and changes therefore must address both management practices and societal governance. Likewise, since business is not unresponsive to public pressures and consumer actions these concerns must be addressed as well. In short, the greening of technology is a multi-sectoral and multidisciplinary subject which is likely to increase in importance as future generations cope with increasing demands to meet human needs, needs that are being redefined to include environmental quality (IHDP 2000).

See also: Agricultural Sciences and Technology; Consumption, Environmentally Significant; Ecotourism; Environmental and Resource Management; Green Revolution; History of Technology; Industrial Ecology; Industrial Metabolism; Land Reclamation; Land Use and Cover Change; Precautionary Principle; Sustainable Development

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Grounded Theory: Methodology and Theory Construction

Grounded theory is an inductive methodology that provides systematic guidelines for gathering, synthesizing, analyzing, and conceptualizing qualitative data

for the purpose of theory construction. In addition, one of its creators, Barney G. Glaser (1978, 1992), has long proclaimed that grounded theory methods may be used with quantitative data. The term, 'grounded theory,' derives from its central premise: theory must be developed from systematic analysis of empirical data. This methodology consists of flexible strategies to guide qualitative data collection, and, particularly, data analysis. The strength of the grounded theory method lies in articulating: (a) logical steps for handling data collection and analysis, (b) a means of correcting errors and omissions and of refining analytic ideas, (c) tools for studying basic social and social psychological processes in natural settings, and (d) strategies for creating middle-range theories.

Prior to publication of Barney G. Glaser and Anselm L. Strauss's *The Discovery of Grounded Theory* (1967), training in qualitative research had largely occurred through an oral tradition of mentoring and immersion in a field setting. Thus, the grounded theory method represented a significant advance because it codified steps in analyzing qualitative data. The distinctive features of the grounded theory method include: (a) simultaneous data collection and analysis, (b) reliance on comparative methods, (c) early development of categories, (d) intermediate analytic writing between coding data and writing the first draft, (e) sampling for developing ideas, (f) delay of the literature review, and (g) a thrust toward developing theory.

1. The Intellectual Heritage of Grounded Theory

Grounded theory derives from the intellectual traditions of each of its founders. Strauss brought Chicago School pragmatism, symbolic interactionism, and field research to grounded theory (see also *Symbolic Interaction: Methodology; Field Observational Research in Anthropology and Sociology*). Hence, grounded theorists study processes in natural settings and invoke pragmatic criteria of usefulness to evaluate the completed study. Grounded theory methods themselves echo pragmatist and symbolic interactionist assumptions of social life as emergent and open-ended, and answer Herbert Blumer's (1969) call to study social action in natural settings. Glaser's training in survey research at Columbia University lent grounded theory its systematic approach, positivist proclivities, and procedural language. Glaser codified steps of analysis of qualitative data in an analogous way as quantitative research had been codified. His efforts culminated in an explicit statement of how to handle data analysis (Glaser 1978, Glaser and Strauss 1967). Glaser's approach assumed a knowable world waiting to be discovered, unbiased observers who are uninfluenced by preconceived logico-deductive theories of this world or by prior research about it, and a view of grounded theory

categories as arising from the data. As a result of its divergent origins, grounded theory contains elements of both positivism and constructivism.

Glaser and Strauss developed grounded theory methods at a time when quantification had gained hegemony throughout the social sciences. Theory and research had become separate pursuits. The quest for quantified research findings resulted in the waning of qualitative studies. Except for an occasional classic study, most quantitative methodologists ignored qualitative research and relegated it to disciplinary sidelines, or treated it only as a precursor to rigorous quantitative research. Qualitative research was deemed impressionistic and anecdotal, unfitting the scientific quest for quantified facts. In contrast, Glaser and Strauss (1967) argued that qualitative research could stand as science in its own right, demonstrate rigor, and generate theory.

Glaser and Strauss's arguments found receptive audiences. Their methods appealed to social scientists who wished to conduct qualitative research but lacked tools for doing it. In the late 1960s and throughout the 1970s, grounded theory methodological rationales contributed significantly to re-establishing the legitimacy of qualitative research. This method provided researchers with ready justifications for conducting qualitative studies and strong rationales that their research inquiry was systematic. Not surprisingly, diverse qualitative researchers still claim to use grounded theory to establish their credibility and the legitimacy of their research enterprise. However, their claims of using grounded theory may rest on having conducted some form of qualitative research or on only following the initial steps of the grounded theory method.

2. *Developments and Changes in the Method*

Although *The Discovery of Grounded Theory* called for conducting qualitative research and developing theory, it was less clear on details about using the method. Glaser's *Theoretical Sensitivity* (1978) set forth the most explicit statement of how to conduct grounded theory research, yet its abstract and dense writing made it resonate most with those who have had prior training in grounded theory. Since then, Glaser's position has remained consistent with his early formulations. For Glaser (1992), grounded theory builds on discovered data, avoids preconceiving interpretation of them through extant theories or categories, relies on comparative methods, and aims toward theory development. Thus, the grounded theorist compares data with data, data with concept, concept with concept, and theoretical category with theoretical category. For example, the grounded theorist compares one interview excerpt with another, an interview excerpt with a concept that may explain it, a concept with another concept and so forth.

Strauss with his co-author, Juliet Corbin (1990, 1998), took grounded theory in somewhat different directions than the early formulations. They introduce several new techniques, stress description, and include verification as part of grounded theory. They emphasize adherence to technical procedures which Glaser views as forcing data into preconceived categories rather than letting categories emerge through comparing data with data. Both Strauss and Corbin and Glaser's approaches remain objectivist because they each assume the reality of an external world, discovery of data within that world, a neutral observer of it, conceptual categories as emanating from the data, and representation of data and subjects as nonproblematic.

A constructivist grounded theory (Charmaz 1995, 2000) adopts methods of grounded theory without adhering to earlier objectivist, positivist assumptions (see *Constructivism/Constructionism: Methodology*). It places priority on the studied phenomenon rather than methods of studying it; hence, it adopts grounded theory strategies as useful tools, not as rigid prescriptions. Because these grounded theorists build reflexivity into the research process, they scrutinize their research experience, ways of knowing, and products of knowing (see *Reflexivity: Method and Evidence*). A constructivist grounded theory attends to data collection closely. It does not assume that data simply exist in an external world, awaiting discovery. Nor does it assume that an observer can enter the research scene as a *tabula rasa*. Rather, what observers see and hear depends upon their prior interpretative frames, biographies, and interests as well as the research context, their relationships with research participants, and modes of generating and recording data. The questions that observers ask of the empirical world shape data that they select from it. Similarly, constructivists view their conceptual categories as constructed through their interpretations of the data rather than emanating from them. Thus, they assume that their resulting theoretical analyses provide interpretive renderings of a reality rather than an objective reporting of the reality.

3. *Data in Grounded Theory Research*

Although grounded theorists have given priority to data analysis over data gathering, the quality of their gathered data affects the final analysis. Full, rich data provide a more thorough view of the studied topic. The kind of data obtained for a study should suit the research topic and research participants. Grounded theory methods have become closely associated with interview studies, however, they are suitable to use with varied forms of data such as ethnographic field notes, written personal accounts, and documents (Clarke 1998).

A hallmark of grounded theory studies is that data collection and analysis proceeds simultaneously. Each

provides a check on the other. Grounded theorists code and categorize data during the initial stages of data collection. This strategy helps them to shape further data collection to gather material that fits the topic and field setting. Hence, they are less likely to pursue their preconceptions about their topic and more likely to follow leads obtained through their early analysis to find new data.

Grounded theory methods are emergent; both the type and nature of data and analysis emerges throughout the research process. Before grounded theory methods were developed, researchers separated data analysis and collection phases of research. Often they discovered later that they had gathered extensive, but thin, data that contained gaps. Grounded theory strategies include returning to the field to gather more complete data that fills gaps and answers questions. Because grounded theory methods are aimed to further the theoretical power of the analysis, these methods tailor data gathering to the researcher's emerging analysis. Thus, adopting these methods makes data collection more efficient and, therefore, streamlines the research process.

4. Grounded Theory Strategies for Theory Construction

The purpose of grounded theory strategies is to develop middle-range theories. Each stage of grounded theory analysis moves the work toward theoretical formulations. The techniques involved in three major strategies of the grounded theory method, coding, memo-making, and theoretical sampling, serve to both build theory and to distinguish grounded theory from other kinds of qualitative analysis.

4.1 Coding Qualitative Data

Coding is the first phase of analysis. Rather than apply extant concepts to their data, grounded theorists create codes as they study their data and, in abbreviated terms, define what they see in it. Coding helps the researcher begin to conceptualize what basic processes occur in the research setting or situation. While coding, grounded theorists ask the essential question: 'What is happening here?' Objectivist grounded theorists believe that the most significant processes in the setting will be apparent and that research subjects will inform the researcher of them. Constructivist grounded theorists believe that the most significant processes may be liminal and taken for granted by research subjects.

Grounded theory coding includes the following characteristics: (a) a focus on action and process, (b) a practice of line by line initial coding, (c) a simultaneous involvement in coding and further data collection, (d) an emphasis on analytic development rather than description. In initial or open coding the researcher

proceeds to code line-by-line to begin breaking bits of data into specific types of action. After assessing which initial codes appear most frequently, grounded theorists then apply these codes to large amounts of data during a second stage of focused coding. Strauss and Corbin (1990, 1998) also recommend 'axial coding' which means coding for the dimensions of a category.

4.2 Memo-writing

Memo-writing constitutes the pivotal intermediate stage between coding data and drafting the theoretical analysis. Through memo-writing, grounded theorists fill out their codes and identify gaps in them. They define the code, delineate and analyze its properties, specify conditions under which it exists and changes, demonstrate its relationship to other codes, and weigh its significance for processes discovered in the field. An objectivist grounded theorist proceeds by emphasizing external characteristics of the code and the processes with which it is linked. Constructivist grounded theorists look for their own assumptions and implicit meanings, as well as those of their research subjects. Throughout data collection and analysis, constructivists remain more interpretive and less tied to overt behavior than their objectivist counterparts.

4.3 Theoretical Sampling

Theoretical sampling means sampling to develop or to refine emerging theoretical categories, not to describe populations chosen before the research begins. Thus, theoretical sampling occurs after the grounded theorist has defined and analyzed core theoretical categories through focused coding and memo-writing, but needs more data to develop, refine, and check the properties, boundaries, causes, and consequences of these theoretical categories. Thus, theoretical sampling builds precision, density, and complexity into the emerging theoretical statements and keeps them grounded in data.

When engaging in theoretical sampling, the researcher makes brief inquiries into fruitful areas for core categories of the emerging theory. Techniques of data gathering in theoretical sampling vary and are aimed to answer questions about the emerging theoretical categories. Theoretical sampling raises the conceptual level of the analysis and does so through systematic comparative analysis. The scope of the theory increases as the grounded theorist samples and compares different groups for their relevance to the theoretical category.

Gaps and questions may necessitate either returning to the same field setting or research problem or obtaining data in a different setting that possesses the characteristics the grounded theorist needs to test. Conducting comparative work across groups or field

settings allows the grounded theorist to build variation and complexity into the analysis. The emerging theory determines whether seemingly disparate groups make relevant sources to sample for theoretical comparison. For example, a study of establishing trust may sample such groups as mountaineering partners, con-men and women and their marks, and married couples. Theoretical sampling fosters a developing a full range of the properties of the category. Grounded theorists stop theoretical sampling when they have saturated their core categories and find no new data to shed light on them.

5. Current Emphases and Future Directions

The grounded theory method has significantly influenced the development of qualitative research in the social sciences and professions, particularly nursing and education. Strauss and his colleagues trained several generations of graduate students in sociology and nursing, whose students and colleagues have subsequently adopted the grounded theory method. In sociology, this method has, perhaps, had most influence in medical sociology and social studies of science (see Baszanger 1998, Clarke 1998, Star 1989). However, recent debates between Glaser and Strauss and Corbin, as well as larger epistemological debates about scientific inquiry, have intensified interest in examining and using the method. Although questions have been raised concerning objectivist premises within grounded theory, a constructivist revision of the method provides answers to them and points to new directions. In short, the grounded theory method can be expected to gain renewed support from those social scientists and professionals who value conceptual analysis of rigorous empirical qualitative research.

See also: Content Analysis; External Validity; Qualitative Methods, History of

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Group Decision Making, Cognitive Psychology of

A group is a set of three or more persons who engage in joint activity directed at a common goal. For many groups, the goal is to make a decision. For other groups, the goal is achievement of a political, social, educational, or recreational objective. Regardless of their overall purpose, every group must make decisions so that member's actions are coordinated, and directed toward the common objective. This article presents major developments in the understanding of the cognitive processes involved in group decision making. It begins with a description of the forces leading to the current importance of group decision making, and proceeds to explain how the cognitive processes in decision making groups can be understood with a social information processing model. Next, some of the conceptual and methodological problems surrounding group decision making theory and research are covered. The theme throughout this discussion concerns differences among group members in terms of their information, beliefs, and decision preferences. The significance of two recent advances in addressing differences among group members, the Judge Advisor System and Information Sharing paradigms, is explained.

1. Groups as Information Processors

Group decision making has become increasingly important in the world of work for many reasons. One is that a greater proportion of jobs now involve cognitive work, so just as individual workers shifted from physical to cognitive work, so did groups.

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