Studying radical organizational innovation through grounded theory[1]

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The main aim of this article is to study the social processes occurring during the implementation of radical organizational innovation. Our aim is to understand the nature of the development of radical innovation by identifying the social processes, that are taking place. The perspective for the analysis stems from "grounded theory" as a generative and inductive analytical strategy (Glaser & Strauss, 1967). An in-depth case study was thoroughly analysed. A total of 14 in-depth interviews were conducted with key informants selected according to "theoretical sampling" criteria. The systematic use of the "constant comparative method" allowed us to differentiate grounded theories leading to a "conceptual saturation" of the categories generated from the empirical data. Results show the emergence of two basic processes, "learning" and "adaptation", during the development of radical innovation. A "grounded" theory concerning the development of radical innovation is proposed, emphasizing the organization's self-regulating capacity for learning and adapting. Our results describe innovation as an adaptable response that causes disorder in terms of "a creative tension in the system". Finally, the methodological implications of grounded theory are discussed with regard to the study of radical innovation. The requisites and limitations observed in using grounded theory are outlined.

THEORETICAL AND METHODOLOGICAL
ASPECTS OF INNOVATION RESEARCH

Organizational innovation, when compared to other fields of study within the general discipline of work and organizational psychology, is a relatively young and growing area. Over the previous decade nevertheless, substantial and diverse publications have tended to reappraise analytical perspectives—to establish classification criteria with regard to concept, content, and method (Anderson & King, 1991, 1993; Bamberger, 1991; Markus & Robbey, 1988; Slappendel, 1996; Van de Ven & Rogers, 1988; Wolfe, 1994). These contributions confirm the existence of a significant body of accumulated knowledge while bearing witness to the complexity of the subject matter, which frequently generates fragmented, inconsistent, and inconclusive results.

With hindsight, it is easy to appreciate the influence that various theoretical perspectives on the organization—and consequently, research strategies—have had on moulding the concept of innovation. The concept of innovation has been linked to varying organizational theoretical approaches; not surprisingly, there are parallels between innovation research reviews (Carrero, 1999; Slappendel, 1996; Wolfe, 1994) and approaches in organizational theory (Becker & Whisler, 1967; Pierce & Delbecq, 1977). This parallelism is reinforced by certain methodological practices, which, by no means exclusive to the various theoretical perspectives examined here, are indeed frequently associated with approaches to the study of organizational innovation.

Thus, the innovation literature has been influenced by certain methodological practices that have been moulding and reconceptualizing the meaning of the innovation process. As Wolfe (1994) expounded, the early stages of innovation research focused on innovation *per se* through its patterns of diffusion. Under this approach, the organization becomes an adopter and is regarded as an individual. The inappropriate and excessive anthropomorphism of the characteristics of the organization (Yin, 1978) contributed to the development of a second stream based on establishing the determinants of the propensity to innovate in organizations.

This second perspective has been referred to in the literature as a "structuralist" (Slappendel, 1996) or "organizational innovativeness" stream (Wolfe, 1994). The general focus was on the organization and its design parameters from a structural approach. Studies of this period sought to establish the covariances within a set of variables while assuming that structural variables are primary determiners of organizational innovation (Damanpour, 1990, 1996; Kimberly & Evanisko, 1981; Slappendel, 1996; Wolfe, 1994). Innovation studies tended to adopt a variance and regression research-type model (Mohr, 1982; Slappendel, 1996; Wolfe, 1994). This approach was not without its stumbling blocks: the representative level of data sources; aggregation bias; problems in the measurement of structural variables; and inconsistencies in the operationali-

zation of key variables. These theoretical and methodological concerns high-lighted the static orientation of the variance model of research and the need to include historical and contextual analysis (Pettigrew, 1985, 1995; Van de Ven & Rogers, 1988).

This has resulted in the emergence of a third perspective on innovation research focused on the *process* of implementation rather than the decision to innovate. Researchers saw that innovation, in contrast to earlier perspectives, is a highly uncertain and complex process that has to be understood from the point of view of the actors involved (Cheng & Van de Ven, 1996; Nicholson, 1990). Innovation research, from this perspective, encouraged works based on longitudinal case studies and focused on the sequence of events in the development and implementation of innovations (Mohr, 1982; Slappendel, 1996; Wolfe, 1994; Van de Ven & Rogers, 1988). This change implied a swing to more interpretative methodologies, which favoured data collection in the *natural* context in which innovation took place, in contrast with other more intrusive methods such as questionnaires or structured interviews. The understanding of innovation as a *process* came about as researchers discovered stages and sequences during the implementation of innovation in organizations.

The present situation is marked by a proliferation of qualitative studies. Even though interpretative approaches focus on the emerging significance of social interaction, not all qualitative research strategies share these criteria. This major issue, highlighted by Van de Ven and Rogers (1988), must continue to be taken into account in order to differentiate between various contributions that, springing from the so-called qualitative investigation strategies, are taking place in innovation research. In this way, research described as qualitative but using confirmable principles can be detected. In these cases, the proposed designs do not differ from positivist models of social research.

In this third perspective, innovation was treated as a process of lineal development, with easily identifiable and predictable sequences. This viewpoint understood innovation to be a process culminating in a visible and tangible result for the organization. The study of innovation is necessarily bound therefore to the follow up of specific results identified as innovation and adjusted, to a greater or lesser extent, to preconceived theoretical models about its development.

In contrast, other authors propose *fluid* models, which are characterized by the diversity of forms that innovation sequences adopt (Schroeder, Van de Ven, Scudder, & Polley, 1989). The indeterminate nature of innovation processes has led some researchers to postulate certain development perspectives whereby innovation is considered as a process of exogenous random events (Hannam & Freeman, 1989; Tushman & Anderson, 1986). This conceptualization, as suggested by Cheng and Van de Ven (1996), assumes that the sources of innovation are exogenous to the system. This implies that, in order to optimize the innovation ability of the organization, an increased exposure to an outside chain of

events and to "blind variations" (Campbell, 1974) is necessary. This view is different to that which affirms the presence of chaotic processes. In fact, the notion of chaotic systems embraces a non-lineal stable system, probably made up of a small number of interacting variables. Such variables produce apparently irregular behaviour to the point that they can suggest random sequences.

Other research suggests that certain types of innovation, characterized by their radicalism (in terms of the level of risk and novelty of the innovation), have less probability of showing stable and sequential linear processes (King, 1992; Pelz, 1983). Tushman and Romanelli (1985) suggest that radical innovations occur during periods of discontinuous change, in contrast to incremental innovations, which occur in adaptable periods. According to the notion of radical innovation described in the literature, characterized by a greater level of uncertainty and complexity during its implementation, the development of radical innovation conveys the idea of non-linearity (Gopala-Krishnan & Damanpour, 1994; Pelz, 1983).

Cheng and Van de Ven (1996) demonstrate how the nature of innovation differs according to the setting. These authors conceptualize innovative actions as a means by which the organization learns to interact with its environment. This conceptualization of innovation has already been suggested in other works (King & Anderson, 1995; Leonard-Barton, 1988; Lewis & Seibold, 1993) and has led to the assertion of innovation as part of the organization's process of adaptation (Van de Ven & Rogers, 1988).

In this sense, Nicholson (1990) conceptualizes innovation as a self-monitoring change, by which the organization knows where it stands and where it aims to stand. If the aims are accomplished, the innovation will be considered as internal transformation and renewal. Nicholson recommends understanding organizational change in dialectical terms, delving into systems by asking people therein about discussions between agents and interest groups. All this points to the need to take into account the specific and idiosyncratic characteristics of the organizational setting in which innovative action takes place (Hannam & Freeman, 1989; Tushman & Anderson, 1986).

The focus from this perspective is on understanding the development of innovation by using flexible and open research designs that allow us to reflect on the frequent changes and inner movements that characterize the organizational context. This emerging paradigm often involves theory-building approaches that lead to the discovery of relevant social processes during the development of innovations. But what is more relevant is that it accounts for the changes and processes in a substantive area, as theoretical mechanisms that explain the movement of the data through time. These theory-building approaches are concerned with the generation and discovery of theory grounded in data in the form of theoretical propositions.

A representative example of this theory-building approach is the grounded theory procedure (Glaser & Strauss, 1967) positioned by different authors in an interpretative framework following a post-positivism orientation (Denzin, 1994; Guba & Lincoln, 1994). The grounded theory procedure entails the systematic and continuous transformation of data in the research planning process (Glaser & Strauss, 1967; Strauss, 1987; Strauss & Corbin, 1990). Hence, the design decisions are not pre-established but are generated as data that get continuously analysed; during this ongoing sampling process researchers simultaneously collect, code, and analyse data. This methodology facilitates the elaboration of a formal theory based on empirical data gathered in the field and differing from other methodological approaches which are more slanted towards the (dis)confirmation of previous theoretical hypotheses. Grounded theory is a qualitative data analysis methodology—independent of the nature of these data—and its theoretical position lies within the theory-building genre (Tesch, 1990). It provides new insights into the understanding of basic social processes emerging from the context where they occur, without forcing and adjusting the data to previous theoretical frameworks (Glaser, 1978, 1992, 1995, 1998).

There is little empirical work following this approach in relation to organizational innovation. Bouwen, de Visch, and Steyaert, (1992) and Steyaert, Bouwen, and Van Looy (1996) used the grounded theory procedure to ensure a qualitative analysis of data gathered from four and two cases studies, respectively. The emphasis in these works was on understanding the dynamic social processes of creating new meaning between the key actors in a continuous stream of innovation events.

In the research reported here, we are concerned with discovering the main characteristics and processes involved when radical innovation occurs. The interpretative perspective adopted reflects our research interest in understanding the phenomenon of innovating within the social context where it occurs.

RESEARCH OBJECTIVES

The main aim of this article is to study the social processes occurring in organizations when they sustain radical innovation. We are interested in ascertaining the sense and nature of organizational innovation in a context of radical and transformational change. First, we want to study the significance of radical innovation. Second, we want to understand the nature of the development of radical innovation by identifying the critical experiences therein. To this end, the "grounded theory" approach has been adopted as a methodology for inductive analysis that allows us to make theoretical propositions in the form of conceptual hypotheses, generating a descriptive theoretical model of radical organizational innovation.

GROUNDED THEORY IN ACTION

Research site

The present study was carried out in four stages over a 3-year period applying the grounded theory procedure. Four firms were selected from a population representing the Spanish ceramic industry. The information used to select cases was obtained using the "focus group" technique made up of key people in the ceramic sector. Following "expert criteria", the companies were classified as technology-generating companies and technology-assimilating ones, depending on the level of introduction of technological innovation in the company. Following this classification, four cases were finally selected: Cases A and B were considered technology-generating companies, whereas cases C and D were considered to be technology-assimilating ones.

One of the firms stood out for its development of radical innovation (case D) and the study focused on this case while the others were used as comparative groups (maximizing the variance of data, as is required by grounded theory procedure). A total of 14 in-depth interviews were conducted with key informants that were selected following theoretical sampling criteria.

A brief description of the four cases is reported in order to place in context the history of innovation and biographical data of the organizations.

Case A.   Company A, established in 1974, is a family-run company that manufactures ceramic paving materials. It has 450 workers, and is classified as a technology-generating company. It is a leading company in the industry. Research and innovation are quite important and they set funds aside for co-operation projects with the "Ceramic Technology Institute" and other public and private organizations.

Innovation has been greatest in the production line. Innovations are currently being centred on production given that large-scale innovations were introduced a long time ago. Innovation control strategies are characterized by a great deal of planning, formalization, and participation.

Case B.   Company B was founded in 1967 and started by manufacturing pressed-clay supports. Currently it has a workforce of 570 people and is classified as a technology-generating company. The innovation culture is characterized by understanding innovation as a necessary requirement for competitiveness. Hence, the company considers it as a routine operation mainly concerned with the production process.

With regard to innovation projects, a trend to formalization was observed; however, some ideas are transformed into totally different projects or even the abandonment of certain work strategies.

The extent and pace of the innovations tends to be slow, and is regulated by yearly planning, depending on the type of project. There is a R&D department

responsible for: innovation management, formal workers' participation channels, working teams and the implementation of the diverse innovation projects.

Results of innovation projects are increasing the specialization and expertise of workers, simplifying work, and reducing overload, because many processes are automated. Finally, when the innovation experiences are accumulated, there is a tendency to initiate more projects and "the feeling is that projects seem to be alive".

Case C. Company C was set up in 1988 to produce and market a new kind of floor tile. It is one of the companies that began to manufacture this product, totally innovative in the tile-producing sector. It has a current workforce of 168 people, and has been continuously updating itself. Its technological dynamism and vision of the future has been a prominent feature since it was founded. It is classified as one of the technology-assimilating type of companies.

The company has a broad concept of innovation, including activities such as investigation, amplification, improvement, and so on. Although the innovation projects have not had continuity but consisted of specific actions, the company intends to formalize and normalize innovations as routine or standard practices in the organization. As the company does not have any innovation department, the putting into practice of innovations is more difficult. Workers participate only in small details concerning their implementation. There is one main person involved in making decisions on innovation management. So far, the implemented innovations do not have any homogeneous planning; it depends on the type of project. Hence, the pace will be fast when the result of the innovation succeeds in solving a specific problem in the production plant; but it will be slow when the project involves the automation processes and high costs.

Case D. Company D belongs to a larger multinational company that resulted from the merging of several tile companies. It was founded in 1994 and innovation and change have been constant ever since. It is now in a stage of total renewal of its production machinery and computer systems, both in production and administration areas. Currently it has a workforce of 159 people absorbed from the different original companies. It was categorized as a technology-assimilating company.

With regard to innovation culture, innovation has two different meanings in the company: (1) Innovation is investment in new machinery or "strong innovation", and (2) innovation involves small investments or "weak innovation". However, in both cases, innovation is often understood as anything that is new.

Managers perceive innovation as a basic vital need and it is therefore imposed on workers. The mission of the organization consists of reaching a level of competitiveness that will ensure its survival. However, the organization begins its innovative actions because of a specific problem ("performance gap"). The old-fashioned systems and outdated production machinery are considered to be

the real problem, and are the instigator of "strong innovation". There is a consensus between the members of the company regarding changes that should take place in machinery and production systems. In "weak innovation", workers, supervisors, or technical personnel detect the problem and the process begins. There are no standard rules for "weak innovation". In certain cases, the level of centralization for making decisions depends on the solution's technical and economic complexity. However, the manager, supervised by the "investments co-ordinator", always offers the last decision.

Changes due to the introduction of new machinery ("strong innovation") are quick. Its intensity is categorized as "brutal". The range of this innovation is wide (e.g., innovation takes place in all areas of the company, though efforts are focused on production). During the implementation of the innovation projects, tasks are redistributed and reassigned depending on individual variables such as resistance to change, basic qualifications, or attitudes to retraining for the new job.

The transition towards the implementation of ideas is based on general performance objectives, on a 3-year plan. However, although the desired result is already known, the procedure to achieve it is not planned. In this transition, new machinery starts being adapted into a system where there are older machines. Coexistence between old and new situations is observed, causing new scope for further innovation.

Gaining access to the field

The study took place over a 3-year period in which there was a combination of data-gathering stages and analytical stages (see Figure 1). The first data-gathering stage consisted of carrying out interviews at firms forming the sample. The first of the series of interviews took place with the general manager of the firm. Contact with the manager provided information about the firm and enabled the key informants to be identified. Officers in charge of technological development and training were initially identified as key informants. Six key informants from the organizations were selected for the initial analysis and a total of six interviews took place. Two of the key informants had their interviews recorded with their prior consent. The recorded interviews were later transcribed for analysis. Analysts present at the interviews carried out the transcriptions.

As the methodology of "grounded theory" suggests, the analysis of this initial information enabled us to define the objective of the study as well as to select the various comparative groups to which the "constant comparative method " was applied. The second stage of data analysis revealed that one of the cases stood out for its development of radical innovation action. It was this case that oriented the research towards the exploration of radical innovation action.
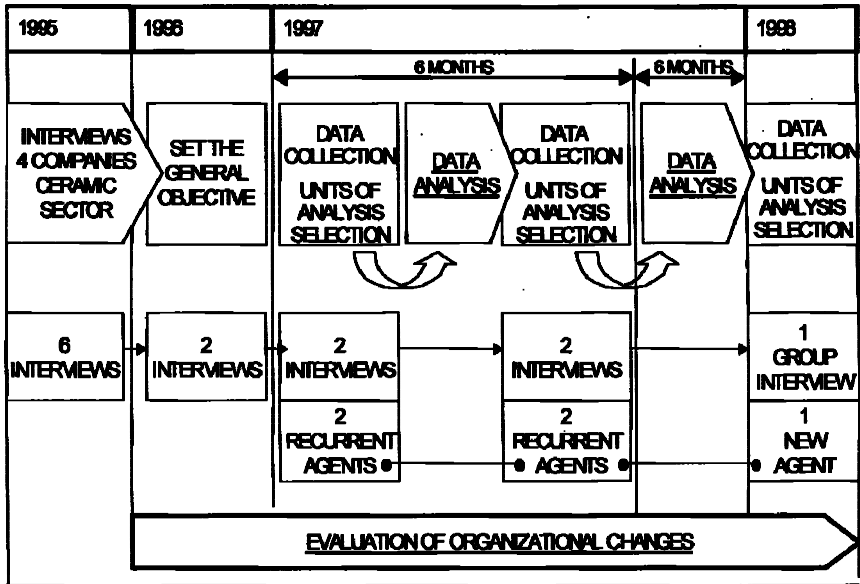
Figure 1.   Procedure: Data collection and data analysis.

The third phase of data-collection consisted of going back to field work and entailed the seeking of permission from the chosen firm to grant a new series of interviews. The selection of the informants was carried out according to the requisites of theoretical sampling. In this manner there were two further interviews of the same agents that had already been interviewed in the initial stage.

After collecting and recording the information, the analytical stage started. The results obtained allowed us to reappraise the initial objective of the study as well as to select both the new units of analysis and the informants required. After 6 months had elapsed the research team decided to go back to the same informants. The gathering and analysis of the information available on the objective of the study was done in such a manner as to saturate the initial categories. At this point the fourth analytical phase took place and this involved the analysis of the last interview transcripts. The requirements imposed by the analysis, following theoretical sampling criteria, led us to choose new informants: the Head of Production, and a group of two production chain workers and a third worker with the rank of chain supervisor. A group interview with these three workers and an interview with the production manager were carried out. By the end of 1998, the analysis of these interviews had concluded and, at

this point, the group of analysts were satisfied with the theoretical saturation of the categories obtained.

Analysis procedure

Both the data-gathering and data-analysis phases in this work have followed the application criteria of grounded theory and thus reflect the "theoretical sampling" process (Glaser & Strauss, 1967). The fundamentals of theoretical sampling allow for the units of analysis to be identified; subsequently the most appropriate kind of informant will be selected.

The analysis procedure was carried out by means of a discussion group consisting of three analysts. The analysts would go along to the organizational meetings while they were updating their field notes, which were added to the transcriptions and documentation gathered at each of the sessions. In the data analysis, the analysts first categorized the gathered information individually. Subsequently there was a "line by line" discussion of the transcriptions and the field notes following the guidelines of Glaser and Strauss (1967). The QSR NUD.IST 3.0 (PC application) program was used in the first stages.

Once substantial and theoretical categories began to emerge (substantive codification), and following the guidelines by Glaser (1978), the data became progressively denser (theoretical codification), which allowed for the identification of both the "core categories' and the "basic social processes" generated in the field study (selective codification). Subsequently, the analysts proceeded to theoretically integrate the results by establishing theoretical categories of memos/notes gathered during the discussion sessions and once again revised the initial listing of categories as well as the relationships generated between the distinct theoretical codes (theoretical sorting). It is at this point of the analysis that there is a thorough reappraisal of the existing literature, which is treated as an additional tool for the development and contrast of the categories generated from the study. From this perspective, the literature review does not bring forward any prior interpretative framework but suggests further possible categories.

Finally, a theoretical schema is proposed enabling the final write-up of the report (theoretical writing) and the generation of propositions, which, in the form of theoretical hypotheses, reflect the final conclusions of the study. Analytical resources (i.e., "theoretical classification" and "theoretical writing") guide the analytical process towards the ultimate remodelling of the data. Conceptual maps and models that integrate information generated during the study show these analytical resources.

Results

The results of this work have been derived from descriptive categories (substantive codes) and their properties were related to each other by higher abstract concepts (theoretical codes). The final categories were integrated in

interpretative schemas by way of theoretical charts (theoretical propositions). During the first analytical phase, concepts were drawn from units of transcription-based meaning (substantive codes). A list of the main categories are shown in Table 1, as the second order level index. Examples of these emerging codes from the empirical text are illustrated by vignettes (see Figures 2 and 3). The final list of categories displayed in Table 1 includes the identification of the main theoretical codes, the core categories, and the relevant social processes that were emerging from the field.

The main theoretical codes were established through three different comparisons: (1) between incidents that emerged in the analysis of transcriptions, (2) new incidents compared to the pre-existing concepts, and (3) concepts compared to other concepts. Using the constant comparative method the variance of the data is analysed by detecting both the common and distinctive features of the cases (i.e., comparative groups) in relation to the categories and properties. To reach the appropriate level of saturation, information from different cases was used (cases A, B, C, and D). In this way we were looking for deviant cases where the phenomenon under study does not occur (Bloor, 1978; Johnson, 1998).[2]

The diverse theoretical proposals that establish the relation between theoretical codes, and the conditions in which the main basic social process operates, are explained in the next section. The information is also displayed in the form of graphic charts espoused by grounded theory procedure (see Figures 5 and 6).

The four main theoretical codes are labelled as follows.

The sense of innovating.   From a general perspective, this concept is referred to as the meaning that innovation adopts in the context where it occurs. But this general description, when referred to as "sense", evokes other nuances. The sense of innovating is referred to as a perceived change in the initial meaning given by the actors, and moreover it represents the value attributed to the innovation events. This connotation is reflected in what the informants perceive: "what innovation means for us—is being lost". This viewpoint emphasizes the dynamic and changing meaning of the innovation, and how it is constructed from a social context. Therefore, the innovation takes different meanings depending on the context and the time where it takes place. This *sense* is related to the attitude towards innovation, through the category of "mentalization". It allows the identification of the sense, not just as an adding-on process of all the individual perceptions, but as a collective perception of the way the innovative actions are perceived from the social interaction context.

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[2]Unfortunately, space limitations prevent a fuller description of the substantive and theoretical data to illustrate the different properties and conditions of each category. Instead, the final results are shown by way of a brief description of the main theoretical codes and the core categories. More information can be obtained from the authors.

TABLE 1
Categorization process

Substantive categories	Theoretical categories	Basic social process	Core-categories
1. *Economic resources*			
1.1. Type of investment	Sense of innovation		Adaptation
2. *Innovation concepts*			
2.1. Weak innovation			
2.2. Radical innovation			
2.3. Innovation change concept	Types of innovation		Ecological innovation Vision
3. *Innovation features*			
3.1. Amplitude			
3.2. Pace			
3.3. Magnitude/intensity	Mass effect	Adapting	
4. *Radical innovative indications*			
4.1. Abruptness	Organizational mission		
4.2. Urgency			
4.3. Need			
5. *Organizational goals*			
5.1. Socio-economical conditionings	Profiles		
5.2. Sector	Evolutive cycles		
5.3. Type of organization			
6. *Organizational actions and projects*	Configurating		
6.1. Innovation causes and trigger	Implementation		
6.2. Programation	Climate		
6.3. Planification			
6.3.1. Planification uncertainty			
6.4. Participation	Shared vision		
6.5. Decision adoption			
6.6. Routinization			
6.7. Consequences			
7. *Innovation episodes*	Resistance to change		
7.1. Continuity/discontinuity actions		Learning	
7.2. Mismatches, disparities			
7.3. Innovation sequences			
8. *Attitude and new technologies*	Familiarity effect		
8.1. Positive attitude			
8.2. Negative attitude			
8.3. Mentalization			
8.4. Persuasive elements	Comparison effect		
8.5. New and old things being used at the same time			
9. *Agents of innovation*			
10. *Social and technological change*			

***Paradoxical effect of radical innovation: The great scope
of radical innovation represents a threat and at the same
time it facilitates the acceptance of innovation events when
all members of the organization share the same vision of the situation.
Retrieval for this document: 6 units out of 1171 = 0.51%

++ Text units 356–361:
Interviewer: does it affect
everybody???

Amplitude of innovation
in reference to **the people**

Informant: Then, that makes things easier, although it is like
the mass effect … I mean If I am not alone but it affects
everybody … It is OK but if I am alone in this … then no way!
I am not sure whether it is that way, but at least it is like we
have felt about it. That's it! All the areas in this division—
each one in its own level—have been affected by this
process … but in the end it has been a good thing.
++++++++++++++++++++++++++++++++++++++

The **mass effect**: In relation
to the acceptance of the
innovation action

Amplitude of
innovation: affects to all
the areas

Figure 2. Innovation amplitude/mass effect, case D.

Interviewer: What about the intensity of changes during
the last years?
++ Text units 198–198
Informant: It is abrupt!
Interviewer: Abrupt!!

Radical innovation
characteristics: intensity,
magnitude impact

Informant: The company is constantly remodelling. This
has been the fact since the end of 1994, the whole of 1995,
and until a few months ago.
We have gone through an intense rhythm of changes
concerning equipment replacement, organizational
restructuring … It has been really abrupt!!
++ Text units 225–229:
Interviewer: Well … and has the change been
continuous? … Yes. It has been continuous … it has been really
abrupt because it was necessary … we had to do it! But
during these last two years it has been continuous
++++++++++++++++++++++++++++++++++++

Properties of
innovation: rhythm

Properties of intensity of
innovation
Continuous rhythm

Figure 3. Change intensity, case D.

Organizational mission. This concept sets the general goal of the organization but it adds a nuance of purpose in relation to the final existence and survival of the organization. From this point of view, the mission is not just embracing the accomplishment of diverse objectives. The mission implies a personal identity, an imprint, which allows the identification of its members as well as the "leitmotiv" of its activity.

The mass effect. This concept is related to the features that radical innovation sustains. These features are described in this study as abruptness, urgency, and need. These distinctive features, when compared and related to the historical development of the organization, bring about the scope and magnitude that characterizes the nature of radical innovation. As shown in Figures 2 and 3, the amplitude of radical innovation, in terms of the number of persons and areas in the company, is extensive and enormous. It affects almost everybody and everyone in the organization.

Shared vision. This concept is related to the perceived necessity for change that all the organizational members share. This collective perception is a matter of degree and is reported by the informants as "the creation of a curious solidarity" or "the perception of a common agreement on the necessity to change". The diverse connections of this category with others like the mission, the resistance to change, the attitude towards new technologies, etc. suggest that this category explains the level at which innovative actions are accepted. It accounts for the variance offered by the cases under study. It shows how similar strategies for implementing innovative actions can result in distinctive or even opposite results. Hence, the acceptance or rejection of innovative actions is filtered by the negotiation of this "common vision". The conditions for fostering a climate for implementing organizational innovation projects will be established depending on the level of shared vision. Other categories, such as the innovation features and innovation profiles, are facilitators in the creation of greater or lower levels of shared vision and subsequently fostering a strong or weak climate for implementing innovations.

Familiarity and comparison effect. These categories derive from a category labelled "coexistence between the old and the new". One of the common aspects grounded in data is the coexistence between new models, new machinery, new paradigms, and the old ones. This coexistence has diverse effects. One of them deals with the *constant comparison* between the users of the new and the users of the old. The other is related to the *level of familiarity*. The worker perceives the innovative changes as a natural part of her or his job context. If the category of shared-vision is related to those effects, we will be able to propose: When greater levels of shared vision are reached the comparison and familiarity effects have a positive influence on accepting the innovation action. In effect "the jobs of users

of new practices are perceived as better than those who are users of older practices" (constant comparison), or "they perceived the innovation introduced as not foreign and they were adjusting to the new machinery … they believed that it facilitated their work" (the level of familiarity).

THEORIZATION

The analysis of the documentation of the study results in diverse theoretical proposals in the study of the development of radical innovation. These proposals reflect core categories and basic social processes: "adapting" and "learning" processes. These processes emerge from the field of study as (1) the sense of radical innovation, (2) critical experiences in the development of radical innovation actions, and (3) an understanding of the nature of the development of radical innovation. These processes lead to the elaboration of a formal theory of radical innovation in the organization, which emphasizes the adaptive character of innovative actions. In the light of this approach, we propose an ecological approximation emphasizing the survival of the organization based on conserving its ability to adapt to its environment. This perspective has its origin in adaptation models, which permit readjustment starting from situations of continual disorder and change rather than from a position of optimal equilibrium.

This section presents the analysis and description of these proposals. The results obtained, as well as the conceptual maps generated, are set out in Table 1 and in Figures 4, 5, and 6, which aim to clarify the processes of discussion and analysis of the data. The hypotheses generated and their presentation are closely linked to the description and analysis of the basic social processes of learning and organizational adaptation. Hence, the structure, style, and development of the following sub-sections are geared towards the criteria demanded by grounded theory for theorization and reporting (writing-up requirements).

The sense of radical innovation

The term "radical innovation" is derived from Zaltman's typology (Zaltman, Duncan, & Holbek, 1973). In this context, radicalism is conceptualized as a product of new development and highly risky. Likewise, radical innovation is associated with the need for greater economic and human resources (Damanpour, 1996; Ettlie & Rubinstein, 1987). The concept of "radical" so conceived has led to widespread debate (King & Anderson, 1995).

Taking this work as a starting point, "radical innovation" is introduced as a specific type of innovation with regard to the impact that certain episodes of innovation produce in the organization. Radical innovations have an enormous impact on organizations and affect almost every area and job within a relatively short time-span.

Radical innovation is visually apparent due to the advent of new technologies and the content of new jobs, above all in the changeover from manual processes

to automated processes. The change described in this case study began with the fusion of four firms into a multinational and subsequent technological development, all taking place over a period scarcely more than 3 years. Hence, radical innovation coincided with "substantial investments in technology", which requires formidable financing to which the larger firm has greater access (Damanpour, 1996). Hence, it is not mere chance that the beginning of techno-logical innovation materializes upon the absorption of the firm under study by a multinational (see Figure 4).

The concept of radical innovation in our study reflects the simultaneous process in which the technological, structural, and psychosocial changes develop. Yet one characteristic of radical innovation, given the global, deep, and sudden impact of technological innovation, is that it implies a change in the culture of the firm as well as in the social structure of the organization. Radicalism is conceptualized in our study as an array of actions that take place suddenly, rapidly, and universally. It is in this sense a total and inevitable change. Given these conditions, radical innovations appear in contexts where the objective and adaptive strategy of the organization implies the initiation of a new era where change is seen as a necessity and is demanded by the need for the survival of the organization.

Critical experiences in the development of radical innovation actions

Through data analysis, five stages of the history of the organization's development were identified. Innovative actions were present in each and every stage, hence allowing us to identify specific critical experiences in the organization (see Figure 5). Such critical experiences are linked to the stages of historical development, which give rise to periods of innovation development.
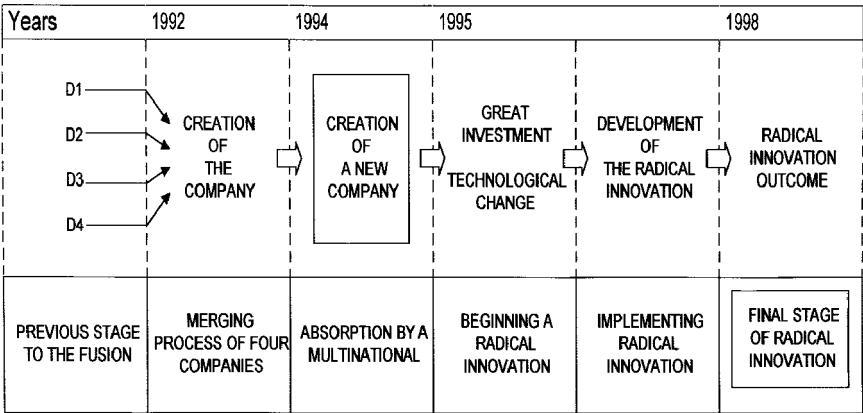

Figure 4.   Historical development of the company.

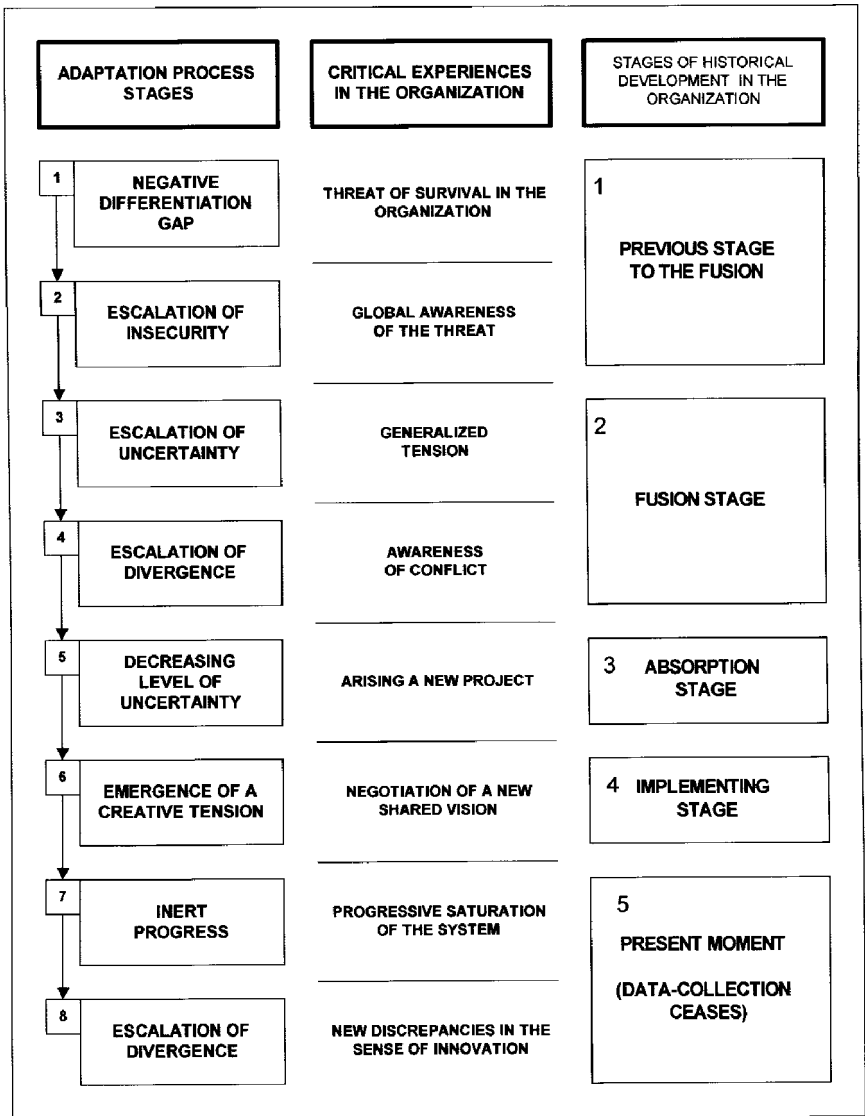| ADAPTATION PROCESS STAGES	CRITICAL EXPERIENCES IN THE ORGANIZATION	STAGES OF HISTORICAL DEVELOPMENT IN THE ORGANIZATION
1 NEGATIVE DIFFERENTIATION GAP	THREAT OF SURVIVAL IN THE ORGANIZATION	1 PREVIOUS STAGE TO THE FUSION
2 ESCALATION OF INSECURITY	GLOBAL AWARENESS OF THE THREAT	
3 ESCALATION OF UNCERTAINTY	GENERALIZED TENSION	2 FUSION STAGE
4 ESCALATION OF DIVERGENCE	AWARENESS OF CONFLICT	
5 DECREASING LEVEL OF UNCERTAINTY	ARISING A NEW PROJECT	3 ABSORPTION STAGE
6 EMERGENCE OF A CREATIVE TENSION	NEGOTIATION OF A NEW SHARED VISION	4 IMPLEMENTING STAGE
7 INERT PROGRESS	PROGRESSIVE SATURATION OF THE SYSTEM	5 PRESENT MOMENT (DATA-COLLECTION CEASES)
8 ESCALATION OF DIVERGENCE	NEW DISCREPANCIES IN THE SENSE OF INNOVATION	

Figure 5. Stages and critical experiences during the development of radical innovation.

The first stage has been identified as "stage prior to the fusion" when the survival of the organization in the immediate context and environment were of utmost importance. The threat of the survival problem, and the general conscience-raising it entailed, amounted to critical experiences for the organization. The organization became aware of the threat to its survival when

negative differentiation and maladjustment with respect to the rest of the sector threatened the identity of the organization. An aura of insecurity beset the organization and the feeling of insecurity was magnified as the awareness of the threat increased.

The next stage of historical development is characterized by the fusion of four firms in the ceramic sector that found themselves in a similar threatening situation and aware of the threat to their survival. The fusion added social tension to the insecurity about the threat and this led to generalized tension and a clear perception of the existence of conflict. In this situation, there was an increase in the feeling of uncertainty (escalation of uncertainty), and divergence in the understanding of the current situation (escalation of divergence). This brought about a predisposition to change and the conditions for the negotiation of a new sense of the situation began to take shape.

The third stage of historical development identified allowed for a change in the perception of uncertainty and divergence. At this stage a multinational absorbed the business and took on the management of the firm. A new and credible plan hence emerged and the level of uncertainty diminished, as a possible solution to the conflict was perceived; thus the conditions that enabled the negotiation of a new vision of the situation were established. These conditions required a change of sense between the dominant logic and the new logic that can be subscribed to by all.

This negotiation took place during the fourth stage of historical development, when there was radical technological development in the organization. The change, which was generated at this stage, was possible due to the emergence, coming from the previous stage, of a relevant creative tension which, in turn, was a result of the previous stages through which the organization had passed. Hence, a favourable climate for innovation is fostered. In order to establish an innovation climate, starting from the emergence of creative tension, a climate of confidence in the future is required, and in our study it took the shape of a survival project, namely the absorption of the firm by a multinational and through the shared negotiation of a new vision of the dominant situation. This change of sense towards a new logic of the situation initiated the transformation of the organization. This transformation in organizations is deep and global and changes the identity of the system. Consequently the organization improves and consolidates its capacity for change and transformation under the most diverse conditions.

The fifth and final stage observed in the present work corresponds to the point in time where data collection ceased. This stage was characterized by a progressive saturation of the system leading to sluggish progress in the organization. In this stage there was an emergence of a new escalation of divergence, which caused new discrepancies in the sense of innovation. Thus, one of the previous stages was repeated. However insecurity and uncertainty are not the antecedents on this occasion but a situation termed "inert progress". There was a progressive saturation of the system and an increased psychological fatigue amongst

members of the organization. The repetition of one of the stages as a finale does not allow for the continuation of the cycle. We believe that it is unlikely that similar routes would be produced, even within the same organization. The fact that the antecedent of the repeated phase is different to the antecedent of the last phase suggests, in our opinion, that the cycle is unlikely to be repeated.

The experiences described show a spiral development that is displaced from a "dominant sense" perceived by the members of the organization to a displacement of sense which gives rise to a new logic. During this process the key experiences of divergence and discrepancies take place. These experiences manifest themselves as conflict in some situations, whereas in others they manifest themselves as creative tension. Both situations foster the awareness of discrepancy in the dominant sense. Nevertheless, whereas the manifestation of conflict implies a climate of insecurity due to an escalation of uncertainty and divergence, with the emergence of creative tension, a climate favouring innovation is fostered.

The nature of the development of radical innovation

Radicalism, in our study, is expressed by the deep transformation the organization goes through in order to find survival paths, and hence be competitive within its environment. The nature of the development of these actions underlines four aspects which make up the basic characteristics of organizational innovation: indeterminate; relational; artefactual; and transformational. All these characteristics show up to a greater or lesser degree in different innovative actions, independently of the type, context, and setting where they occur. Nevertheless they can appear in different ways, depending on the mission and historical development of the organization.

The relational nature of innovative actions.   One of the characteristics that defines innovation according to this research, is its clearly relational nature. The sense of innovative actions is linked to the mission and the objective of the organization in its immediate environment (sector and socio-economic market). Innovative actions understood in this manner are significant for the organization in relation to the context in which they arise. In such a context the organization's actions are linked to survival. The organization's need to change takes shape and therefore acquires sense as radical innovation.

The indeterminate nature of innovative actions.   The relational character of innovation suggests that it does not arise of its own accord. The scope of development, formalization, and conceptualization of innovative actions is delimited for the organization and its history. Innovation emerges from the data as a set of actions, linked to other processes, in a non-repetitive way and is

therefore a very difficult model to predict. These characteristics render innovation indeterminate and hence its sequences of action manifest themselves through non-lineal patterns showing self-managed processes. From this perspective radical innovation is self-managing in that it develops action sequences in the form of wave patterns, and represents merely one way among many.

The artefactual nature of innovative actions. Innovation appears as a process linked to other processes grounded in data: adaptation and organizational learning. The nature of innovation as *process* is artefactual; i.e., its basis is theoretical yet its end is to afford a deeper understanding of the adoption and implementation of actions that specific innovations entail. Innovative actions show chaotic patterns, which are non-lineal and non-repetitive and therefore difficult to predict, meaning that they acquire greater significance with regard to conditions of extensive and global human interaction.

The transformational nature of innovative actions. Innovation guides development and changes in the organization towards a better adaptation to the environment. A performance gap is necessary to initiate it, and in that situation innovation takes place as a search for differentiation within the sector. Innovation arises in the sense that it is capable of fostering competitiveness, improving survival prospects and providing continuity. The innovative actions foster a pathway of continuous mismatch linked to the awareness of the need to change. This tendency towards mismatch allows the organization to conserve its adaptation to the environment, thereby creating continual transformations, in contexts where change is permanent. Radical innovation actions permit the adaptation to be conserved by bringing about a "total change" through maladjustment sequences, which make organizations push on in a tiered manner. These entire processes amount to an adaptive change characterized by the transformation of the identity of the organization to conserve a state of dynamic adaptation.

A grounded theory of the development of radical innovation

The integration of theoretical propositions emerging from the analysis of the data enables the elaboration of a grounded theoretical model for radical innovation. This model offers an ecological vision of innovation and it emphasizes the adaptive function of radical innovation in a continuous transformation system (see Figure 6).

The proposed model suggests that the organization learns from different experiences as a result of implementing innovations (innovation historical development) linked to its organizational mission. During this process different members of the system learn to negotiate distinctive visions in the face of conflict, derived from the coexistence between the new and the old situation. This
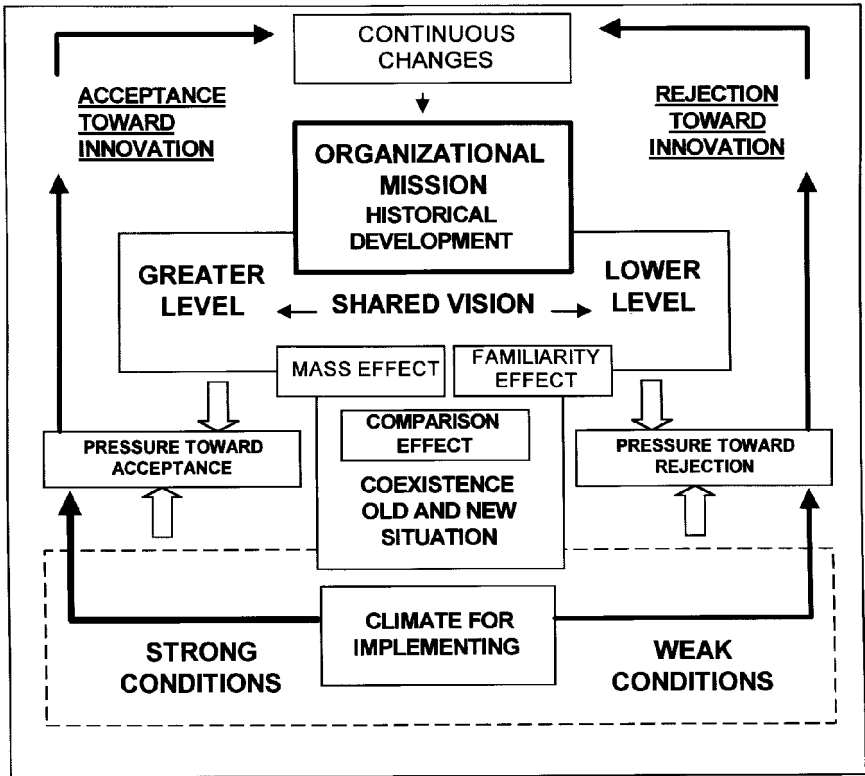
Figure 6.   Radical innovation: An ecological model.

negotiation leads to the emergence of a new comprehension of the situation which can produce insecurity, uncertainty, or confidence depending on the attained level of shared vision. All this brings about the creation of a climate for implementing innovations that puts pressure on the acceptance (strong conditions for implementing) or rejection (weak conditions for implementing) of the innovative events. The manner by which the organization learns and faces moments of uncertainty displaces the dominant sense of innovation towards a new logic of the situation. A new vision of the situation is thereby generated and it is not merely a facilitator but a challenge to which organizations permanently confront each other in a continuously changing and complex way.

Gradually what was thought of as innovating will become routine behaviour, facilitating stability. This stability, as evidence of saturation of the system, will lead to new discrepancies due to the inner dynamics of the system. These discrepancies in turn create expectations of divergences with a given situation. In this atmosphere organizations create new inner conditions, ensuring the conservation of its adaptation, even though such adaptation may not be optimal.

Therefore, adaptation is not directed towards a stable balance for its survival but rather to continual change and transformation. For Maturana and Varela (1996) the continual change of systems is not contrary to their attainment of balance, but rather it conserves its capacity to adapt. What is more important is dynamic adjustment rather than static balance.

The way in which an organization conserves its adaptation linked to its mission shapes its innovation development. The innovation development shows a chaotic pattern, due to the indeterminate nature of innovation and the complexity of the interactions between diverse conditions and actions. For this reason our point of view is non-determinist: Similar situations or *a priori* antecedents cannot determine innovative actions. This has important implications for our understanding of the way that organizations learn (Cheng & Van de Ven, 1996).

The innovation process is reconstructed by the logic of the social actors but it does not emerge directly as a process grounded in data. Instead, it acquires sense in relation to wider social processes such as adaptation and learning, which lead to the transformation of the system. Innovation, as given by the model presented in this study, became visible as a symptom of the ability to maintain adaptation but the process taking place is the organization's own learning.

IMPLICATIONS OF GROUNDED THEORY FOR INNOVATION RESEARCH

We emphasize, according to the results offered in this study, the necessity to understand the innovation process from pluralist perspectives, both at a theoretical and methodological level. According to Steyaert, Bouwen, and Van Looy (1996) innovation studies require a more interpretative approach that considers the need to deal with the complex, holistic, and dynamic nature of innovation. Hence, the use of in-depth longitudinal design is required while taking into account the social interactions from the actor's point of view (Bamberger, 1991; Bouwen et al., 1992; Frost & Egri, 1991; Slappendel, 1996; Van de Ven, Angle, & Poole, 1989; Van de Ven & Rogers, 1988; Wolfe, 1994). At this point, we believe that it is important to give a new direction to the contribution of this interpretative approach by establishing a difference between qualitative perspectives that underlie "theory building" models and those that demand a logic dynamic of "justification" and "hypothesis rejection". In the first case, the existing theory does not constitute a previous stage to the generation of theoretical proposition; in the second, there is a recognition of a previously espoused theory, which should be confirmed or refuted by collected data, although such data may be of a qualitative nature.

The procedure of grounded theory allows a deeper understanding of organizational innovation from a holistic and global perspective. It also affords researchers the possibility of exploring organizational innovation theory in relation to other wider and complex social processes. The conceptualization of

innovation as a self-monitoring change, in a continuous changing system, brings about a new perspective on organizational innovation theory, referred to as *transformational* . From this perspective, innovation should be analysed within the context and historical background of the organization. Hence innovation becomes more relevant, not because of the way it comes about, nor through its relationship with certain events, but as a result of its link to such wider and complex social processes as adaptation and learning (Carrero, 1999; Cheng & Van de Ven, 1996; Nicholson, 1990; Schroeder et al., 1989).

Methodological implications for studying organizational innovation are concerned with achieving coherence between the focal unit and the analysis unit. Grounded theory overcomes this problem by applying *theoretical sampling* and *theoretical saturation* criteria in category creation. Sampling is not carried out by way of the units of analysis, but rather through emerging processes grounded in data (Glaser, 1978, 1998).

The longitudinal character of the study has highlighted the value of grounded theory in the study of processes and deepens the understanding of how change takes place. It questions the need to measure repeatedly. The sequential nature of events cannot incontrovertibly prove the causal relations between conditions and events that occur. In grounded theory change takes place when a new condition and/or category emerges in the data that offers causal explanations of what has happened. These causal explanations appear as hypotheses concerned more with causal mechanisms than with causal relations. What is of foremost interest to the researcher's understanding of change processes is the search for generative mechanisms or laws that bring about an understanding of events in the specific circumstances in which they occur.

It is worthwhile mentioning the difficulties experienced in the application of grounded theory. First, we have encountered source accessibility problems that are common in field research, but which are aggravated in relation to the theoretical sampling. The specific conditions required in theoretical sampling makes it difficult to forecast the research plan as well as to identify the sample in advance. A second stumbling block is the generation of data derived from conversations. Grounded theory uses the dialogue not only as an instrument of research—it also embraces it as the object of study. This is why quality of discourse is essential, as we cannot accept a mere stimulus–response situation.

A third stumbling block deals with issues concerning the generalizability of grounded theory. In grounded theory an effective extrapolation depends on a rigorous theoretical sampling process that will pin-point the appropriate informant or topic to be investigated. Another important consideration for the sampling process is that the data range must be maximized as much as possible. During theoretical sampling, data are constantly compared to generate meaning in the emerging theory. From this point of view, theoretical sampling results in "ideational sampling" and is not related to the statistical representativeness of the events (Glaser, 1998). Instead it emphasizes the analytical inference (Glaser,

1978, 1998; Kvale, 1996; Maxwell, 1996), inductive generalization (Yin, 1994), logical reference (Mitchell, 1983), or abductive reasoning (Coffey & Atkinson, 1996). In this sense, the proposed theorization is not just limited to a "thick description" but is a shift from a local focus to a global focus, in a continuous movement from *substantive theory* to *formal theory*. Grounded theory generalizes to a conceptual unit, which is the *core category*. It takes sampling outside the boundaries of the unit in which it may have begun. But not going beyond the boundaries of a unit severely constrains the grounded theory and it completeness. If it happens, the theory will be too thin and too specific for reaching the appropriate level of conceptual abstraction (Glaser, 1998, pp. 159–160).

Other limitations have to do with the training needed by analysts on data management and the continuous decision-making dynamic. Furthermore, we must point out that there is a tendency to make excessive use of logical elaboration, thus leaving grounded data behind. In the final instance, grounded theory puts the researcher back in the picture and it is not surprising that Glaser (1978) emphasizes that the researcher's *theoretical sensitivity* is an important ingredient for the successful application of grounded theory. There are no mechanical or magical recipes; the onus is on the mature researcher to attain quality in analytical thought.

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