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RESEARCH ARTICLE

The use of ethnography and grounded theory in the development of a management information system

Elisa Mattarelli,
Fabiola Bertolotti and
Diego Maria Macrì

Department of Engineering Science and Methods (DISMI), Università di Modena e Reggio Emilia, Reggio Emilia, Italy

Correspondence: Elisa Mattarelli, Department of Engineering Science and Methods (DISMI), Università di Modena e Reggio Emilia, Via Amendola 2, Padiglione Morselli, 42122 Reggio Emilia, Italy.
Tel: +39 0522 522275;
Fax: +39 0522 522609;
E-mail: elisa.mattarelli@unimore.it

Abstract
This work presents new evidence on how ethnography and the grounded theory approach can be integrated within a participatory information system development process. We conducted an ethnography in a hospital unit, collecting data from observations, interviews, and documents. The discussion about emergent themes with the actors in their natural context and the development of a grounded model allowed us to identify widespread discomfort felt by personnel and to code it as process conflict, that is a particular type of conflict caused by inefficiencies in the organization of work activities. The grounded model was the starting point for conducting a series of focus groups during which the organizational actors were allowed to face process conflict while defining the requirements of a new management information system. We conclude with a discussion of the implications of our study for IS researchers and practitioners.
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Introduction

Adequate development of information systems (ISD) is an important element of organizational success (Reddy *et al*, 2003). When developing the characteristics of an information system, traditional approaches adopting a 'universalistic perspective' (Avgerou & Madon, 2004) focus on technical requirements based on best practices (Wagner & Newell, 2004) and tend to underestimate the specific needs of the organization (Jackson, 1999; Lee & Pai, 2003). As a consequence, the misalignments between the structures embedded in the organization and those embedded in the IS are detected too late in the implementation process (Soh & Sia, 2004), causing the failure of organizational change (Doherty & King, 1998; Baskerville & Land, 2004).

Recently, studies on the ISD in organizations have moved away from the 'simplistic notion that IT drives, forces, or merely enables change' (Wagner *et al*, 2004, p. 271) and have underlined the importance of (1) the comprehension of the reciprocal causality between technology and context and (2) the active participation of the users from the early stages of the requirement definition process (Wynekoop & Russo, 1997; Orlikowski, 2000). Ethnographies, that is field studies mainly based on long-term observation of subjects in natural settings (e.g. the workplace) and aimed

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at understanding the culture of a specific group or organization, are particularly suited to achieving the two aforementioned objectives.

The aim of this paper is to show how ethnographic methods and the grounded theory (GT) approach can be integrated within the ISD process. Specifically, we will concentrate on the initial phase of requirements determination, illustrating the ethnography we conducted in RP, the radiotherapy unit of a major hospital in Northern Italy, and the GT approach we adopted to develop a grounded model that explains how conflicts and disapproval emerged during interactions between healthcare professionals. The grounded model eventually became the input for a series of focus groups that allowed RP professionals to address their conflicts and disapproval during the definition of the requirements of a new management information system (MIS).

This paper is organized as follows. First, we discuss the academic debate on the use of participatory approaches in ISD and the role played by rich ethnographic studies. We then describe the context of our exemplar study and the methods we followed to collect and analyze data. We portray the ethnography we conducted in RP, the GT approach we used to generate a grounded model and the subsequent definition of MIS requirements based on the grounded model. Finally, we discuss implications for researchers and practitioners.

Participatory approaches to the ISD

Contextual issues at different levels – individual actors, groups, and organization – influence the development of IS (Avgerou & Madon, 2004; Wagner *et al*, 2004, 2005). At the individual level, Lamb & Kling (2003) dispute the most common conception of the user in IS research, seen as 'an atomic individual with well-articulated preferences and the ability to exercise discretion in ICT choice and use, within certain cognitive limits' (p. 198). The authors develop a new conceptualization of the user as a social actor, whose interactions are influenced by the socio-technical affiliations and environments of the work group, the company, and the industry. The influence of groups – with different interests and professional identities – on decisions about IS and its implementation is becoming a recurrent theme in literature, but there is still little empirical research addressing inter-group behavior (Lee & Pai, 2003). An example is given by Kirsch & Haney's work (2006), showing that global IS requirement determination is an iterative, emergent process of negotiation among users and IS developers. Organizational level issues in IS development, such as organizational alignment and system integration, are largely recognized as relevant by academics and IT professionals, but, in practice, only few technical issues are usually addressed, while social ones are typically overlooked (Doherty & King, 1998).

Many approaches and methodologies exist to effectively develop IS by taking context into account (Iivari & Hirschheim, 1996; Iivari *et al*, 1998; Isomaki & Pekkola, 2005). Among them, participatory development has the peculiarity of directly involving organizational actors in the definition of requirements for new information systems in order to favor technology acceptance (Kozar & Mahlum, 1987; Muller, 2003). Two examples are the socio-technical participatory approach of ETHICS (Effective Technical and Human Implementation of Computer Based Systems, Mumford, 1995), and techniques such as cooperative workshops inspired by the Scandinavian approach of Development Work Research (Karasti, 1997).

The use of ethnography and GT approach in ISD research

IS researchers and practitioners have recently showed an increasing interest in the application of ethnography in the field of design and implementation of information systems. Ethnography enables the rich incorporation of context at different levels of analysis (from individual to organizational) and the involvement of organizational actors in the development process. This form of qualitative research, whose roots can be traced back to social and cultural anthropology, is aimed at developing culturally focused descriptions and understanding of a social setting in order to account for the observed patterns of people's actions and activities (Spradley, 1979; van Maanen, 1979; Locke, 2001; Atkinson & Hammersley, 2007). Because the ethnographic researchers' aim is to become immersed in people's everyday life and actively interact with members of the setting, ethnographers spend a prolonged period of time in the field and collect qualitative data, primarily through observations and unstructured interviews and, secondarily, through documents (Locke, 2001; Atkinson & Hammersley, 2007).

As far as IS development is concerned, ethnographic approaches are acknowledged as useful for enhancing organizational transparency, creating a positive organizational climate, and encouraging the acceptance of technology, especially in early stages of IS development (Kohli & Kettinger, 2004). In fact, research shows that initial decisions regarding IS requirement gathering ('initial configuration') are profoundly influenced by negotiations between stakeholders and initial configuration, in turn, influences the overall outcome of IS design and implementation (Pozzebon & Pinsonneault, 2005). This consideration suggests that higher investments in initial phases may be useful to address the complexity and risks associated with configuration.

A few authors notice that the way ethnography has been conducted and used in ISD studies is quite varied (Hughes *et al*, 1995; Beynon-Davies, 1997; Wasson, 2000; Crabtree *et al*, 2009). Among them, Beynon-Davies (1997) distinguishes between ethnography *of, for,* and *within* IS development. In the first case ethnography is interpreted as a social research methodology, rooted in anthropological traditions, used to study IS developers and the IS development workplace. These studies may also provide 'insights that are most useful in product planning and high-level conceptual design'

(Siegel & Dray, 2005, p. 60). Exemplar ethnographies of ISD are provided by Myers & Young (1997), Orlikowski (1993, 2000), and Vaast & Levina (2006).

When used for IS development, ethnography is regarded as a practical resource for IS developers and is mainly conducted in a 'quick and dirty' fashion before the design development or as a 'sanity check' on an already formulated design proposal (Hughes *et al*, 1994). Here, structured observation protocols, often integrated with *ad hoc* pre-defined coding schemes, are provided for the researchers. Examples of this type of ethnographies are given by studies aimed at understanding the practical work accomplished in offices or command-and-control settings, and by usability studies in the human–computer interaction field (e.g., Hughes *et al*, 1992; Anderson, 1994). For sake of clarity, it has to be noticed that many 'traditional' qualitative researchers would not give the label 'ethnography' to such studies.

Different authors call for a compromise between the two positions, in order for ethnography to be useful to both researchers and practitioners (Beynon-Davies, 1997; Wasson, 2000; Blomberg *et al*, 2003; Siegel & Dray, 2005; Crabtree *et al*, 2009). According to Crabtree *et al* (2009) ethnographic accounts that (however detailed) describe broad social dynamics and cultural practices 'run the risk that attention will be diverted away from what people do and how they organize action and interaction' (p. 2) in the workplace, providing little practical help to designers and users. On the other hand, Wasson (2000) notices that the 'quick and dirty' manner of some ethnographies for ISD provides overly simplified accounts that help neither practitioners nor researchers in refining an understanding of reality.

As a third strategy to link ethnography and ISD, ethnography *within* IS development consists of using ethnography as a research methodology as well as an IS development technique, thus bridging the gap between social researchers, designers, and organizational actors (Beynon-Davies, 1997; Wasson, 2000). Ethnography within IS development represents a prolonged engagement with the organization and its actors and thus favors the framing of important issues, while taking into account the organizational context's characteristics and inter-group and professional relationships (Thomas, 1993; Baskerville & Land, 2004).

Generally, empirical evidence on the application of ethnographic techniques in the IS field is scarce when compared to other research methodologies (Chen & Hirschheim, 2004) and other IS development approaches (Wynekoop & Russo, 1997). Even scarcer is the use of ethnographies within IS development. The main difficulties associated with ethnographies are summarizing lengthy accounts, finding practical and general implications, justifying the time-consuming effort, and conducting organizational scale studies (Beynon-Davies, 1997; Myers, 1999).

Different approaches exist to analyze the large amount of qualitative data (e.g. observations, interviews, videos, and documents) produced by an ethnography (e.g. Miles & Huberman, 1994; Locke, 2001; Krippendorf, 2003). The approach that has been extensively used in anthropological, organizational, and IS studies is that of GT (Strauss & Corbin, 1998; Urquhart *et al*, 2010). In the IS field the GT approach has been used in two distinct ways (Urquhart, 2002; Gasson, 2009; Urquhart *et al*, 2010). On the one hand, it has been used as a strategy to make sense of a large amount of data, that is as a coding method. This use of the GT approach seems consistent with ethnography for IS design, which mainly aims at focusing on helpful concepts for the requirements gathering phase. On the other hand, the GT approach consists of the structured and progressive categorization of data into a theoretical model that emerges from the field. Here 'analytical codes, relationships, and attributes are constantly compared across and between further data samples to understand how the emergent theory is reinforced or altered by new evidence' (Gasson, 2009, p. 36) in a process of constant comparison. While this latter use of the GT approach has so far mainly led to the development or refinement of academic theories (e.g. ethnographies of IS design) we argue that it can also produce practical outcomes and lead to the effective enactment of ethnographies within IS development.

Specifically, the aim of our work is to bring new evidence and insights to how the GT approach can be integrated with the process of ISD. We answer the call of Wasson (2000), Baskerville & Land (2004), and Siegel & Dray (2005) and we use a GT approach to bridge the gap between social researchers and IS practitioners. Specifically, we show how the findings of an ethnography carried out in a hospital unit contributed to requirement gathering for an MIS.

Our work begins as an ethnography that we carried out in a growing radiotherapy unit of a renowned Northern Italian hospital. Our long presence in the field and the collection of qualitative data, coupled with a GT approach to theory development, allowed us to describe the initial organizational discomfort that the actors perceived as frustrating as process conflict (Jehn, 1997) and we explained its antecedents. The development of a grounded model was the starting point for the identification of a new MIS as a viable option to address process conflict. During focus groups with the organizational actors, participants were largely able to define the requirements of the new MIS. According to a socio-technical perspective (Trist, 1981; Pasmore, 1995) we interpreted technology – in this specific case IS technology – as profoundly interwoven with organizational action. In the following paragraphs we present our ethnographic study, the focus groups, and a discussion on implications for IS theory and practice.

Context: RP, the radiotherapy unit of a hospital

The positive effects of ethnography within IS are relevant for professional organizations like hospitals that are characterized by operational complexity and contextual

specificity (Fehse *et al*, 2002). In healthcare settings the workflow is 'an unpredictable combination of routine and exceptions' (Reddy *et al*, 2003, p. 438). An adequate IS is useful to support the re-definition of service processes and the management of clinical information, with the aim of containing costs and improving quality (Moriarty, 1992). Nevertheless, designing and implementing new technologies is complicated by the organizational characteristics and dynamics of healthcare institutions. In particular, the adoption of a new information system in hospitals influences many different stakeholders: managers, ICT technicians, nurses, physicians, medical specialists, and other professionals (e.g. physicists, radiology technicians, and biologists). These different professional groups are highly specialized, characterized by significant autonomy in operational decision-making (Fitzgerald *et al*, 2002) and develop different perceptions of the set of benefits they can derive, in the short term, by adopting new technology (Bender *et al* 2005).

RP is a radiotherapy unit that is internationally renowned for the cutting-edge contents of the services offered, such as new experimental treatments and has often been an early adopter of innovative equipment and software for radiotherapy. However, at the beginning of our study in 2002, RP did not have a centralized MIS; it relied on one system to collect data on patients and on another to collect data on treatments. Paper documents contained in the clinical records still represented the preferred means of communication between doctors and patients and among the different professionals.

Doctors, nurses, physicists, and technicians work permanently at RP and their activities are organized around the treatment process. In spite of the innovative clinical and technological nature of the unit, the treatment process is highly standardized; that is to say it is widely defined by official protocols and recurrent and consolidated solutions.

Radiotherapy treatment consists of high or medium-energy irradiation of tumors through special equipment called accelerators and includes a sequence of phases where daily interactions among members belonging to different professional groups occur.

Doctors first visit patients. In the second encounter a technician, following the directions of a doctor, takes Computerized Axial Tomography (CAT) images of the tumor and builds the immobilization device to be used for positioning the patient on the accelerator. The technician and the doctor jointly test this immobilization device during the first simulation of the actual treatment. The technician then sends the digitalized CAT images to doctors who are in charge of contouring the area of the body affected by the tumor (the target of the irradiation). Doctors send the contouring electronically to the physicists, who create the treatment plan, that is the program of the radiation doses and the setting parameters for the accelerators, which is discussed and jointly approved by physicists and doctors. Patients then undergo a treatment process of five to ten sessions, on accelerators run by technicians, under the supervision of a doctor. Nurses assist doctors during all examinations, are responsible for medication, schedule appointments with technicians, and collect and store clinical documents. Physicists are also in charge of the maintenance of all the unit's machines.

Since its beginnings in 1992, RP grew dramatically in terms of the number of professionals appointed, patients treated, and treatments offered. While in 1992 the unit counted four employees and treated 100 patients a year, in 2002, 27 employees from different professional groups worked permanently at RP (6 doctors, 11 radiotherapy technicians, 4 medical physicists, and 6 nurses) offering services to about 1000 outpatients per year. During our study, a few trainees also worked in the unit.

Research design

We conducted a 2-year field study at RP: our research process unfolded through a number of steps that were closely intertwined and overlapping (see Figure 1). The head of the unit provided entry and widespread access

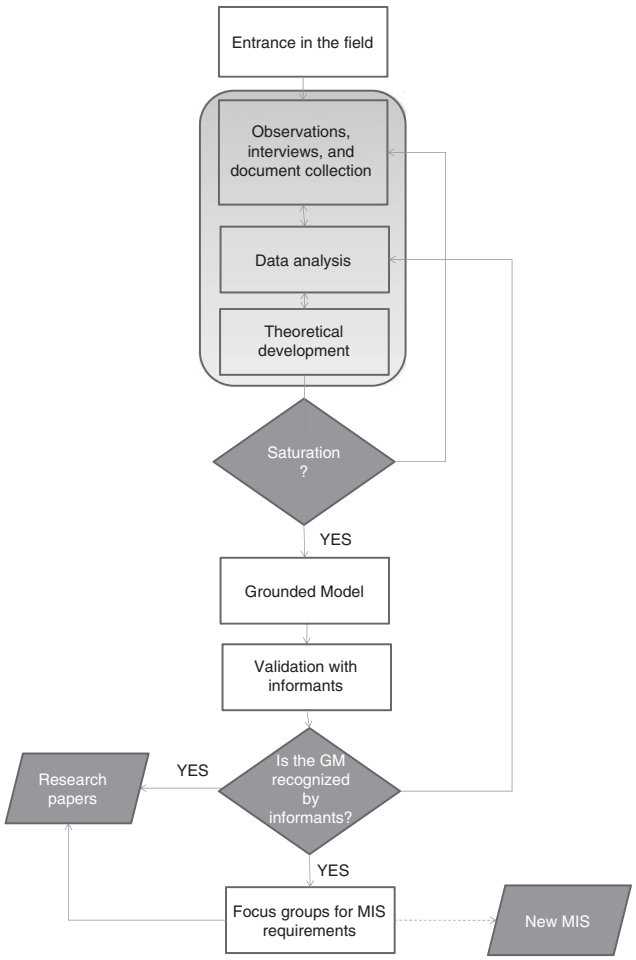

Figure 1 An illustration of the research process.

to the unit. We entered into the field without a predetermined analytical framework (Urquhart, 2007) and gathered data mainly through observation and semi-structured interviews. We analyzed our data through a GT approach in search for emerging categories and their connections. Thus, during data analysis, we constantly compared emerging categories and relationships with additional pieces of evidence that we were collecting in an iterative fashion to further develop categories in terms of their properties. The emerging framework also guided additional data collection (e.g., new observations, interviews) to support further development or refinement of the framework or to reveal discrepancies that needed clarification. Lastly, the participatory discussion with our informants of the grounded model that we had built on one hand increased its validity and, on the other hand, was the input for conducting a series of focus groups during which unit members were allowed to face their most recurrent issues. During focus groups, a new MIS was identified as a viable solution to address the recurrent issues and MIS requirements were specified. The whole research data and methods will be detailed in the following section.

Ethnographic data collection

We collected the empirical evidence over a period of 2 years and we used three main sources: observations, ethnographic interviews, and documents.

Observations We conducted a total of 364 h of observation in RP rooms (the meeting room, nursing ward, examination room, simulation and CAT scan room, and two accelerator rooms) between July and December 2002. These are the sites where the majority of activities and the intra- and inter-group interactions take place. We spread observations uniformly throughout the working day and on various days of the week.

In performing observations, we followed the guidelines provided by Strauss & Corbin (1998) who invite researchers to be as broad as possible. Therefore we opted not to use an observation protocol but we took notes describing each and every action and interaction that unfolded, while respecting the actors' original language (Glaser, 1978). At the end of each day we transcribed the field notes into files. The coding of field notes (described in detail later) started from the very beginning and guided subsequent observational data collection. For instance, because interactions among actors appeared a dominant phenomenon in RP, at a later point in time we focused on observations in RP rooms when professionals were simultaneously intervening in the treatment process (e.g. a technician and a physicist taking CAT images in the simulation room). For the same reason, later on, we also started to conduct observations of staff meetings. Moreover, we had spontaneous conversations with our informants, for example during coffee breaks.

Interviews At the beginning of the research we carried out 1-h unstructured ethnographic interviews (Spradley, 1979) with 10 staff members to gain an understanding of the radiotherapy process, work practices, and interactions. At the end of the observation period, we conducted semi-structured interviews with all the 27 unit members, that lasted between one and one-and-a-half hours, in order to examine some of the issues that had arisen from the ongoing data analysis more closely. This allowed us to understand if the provisional categories that we were building through the coding process would fit new instances of data or if they would need reconsideration, new elaborations, or clarifications (Orlikowski, 1993; Strauss & Corbin, 1998; Urquhart *et al*, 2010). We continuously adjusted the interview questions throughout the data collection. For example, if we obtained new information in one interview that fitted or contrasted with our framework, we added new questions in the following interviews, to explore the issue further. Our informants were asked to comment on the organization of work, interaction between different professional groups, the distinctive features of their profession, and the recurrent dynamics and problems in the unit, while trying to identify possible causes and solutions. In both rounds, interviews were immediately transcribed into field notes to be analyzed.

Documents To triangulate the evidence collected with the previous sources of data and to enhance our understanding of the treatment process and the task responsibilities of each professional group, we also examined quality manuals, job descriptions, organizational charts, and internal papers throughout the whole study.

Data analysis: GT approach

In analyzing our qualitative data, we used the guidelines provided by Strauss & Corbin (1998), Miles & Huberman (1994), and Locke (2001), to build a grounded model. We adopted an iterative approach of constant comparison, where data collection, coding, and analysis are intertwined. In their seminal work in 1967, Glaser and Strauss illustrated the constant comparison method in terms of four stages that consist of assigning meaning to data by drafting categories and comparing new instances of data related to each category, organizing the emergent categories into a theoretical framework that integrates categories and their properties, progressively delimiting the emerging theory, and writing up the theory. This process, far from following a linear pattern, undergoes continuous improvements and inspires new data collection. Taking these principles into account, we continuously moved back and forth between our field notes, the theoretical model that we were building and new pieces of data, to find support for our theories, and to detect inconsistencies between new ideas and our data. This meant that the theory emerging from the analysis of our

initial field notes from observations and interviews guided further data collection, that is theoretical sampling (Glaser & Strauss, 1967).

More specifically, following Strauss & Corbin (1998), we identified recurrent themes and concepts in our data and grouped them to form categories (open coding). We made connections between the categories, identifying possible relationships to each other (axial coding) and identified a few core categories while relating other categories to them (selective coding). Engaging in constant comparison, we first compared each new data incident to other data incidents, looking for similarities and differences in the data and, once concepts and categories had been developed, we compared each new data incident to the categories. It is worth noting that the long period in the field and the richness of the data collected led to several phenomena emerging as equally important and of interest, that is multiple core categories. Following the suggestion of Strauss & Corbin (1998) we developed each core category and elaborated more than one theory, presented in different outlets (Bertolotti *et al*, 2006; Tagliaventi & Mattarelli, 2006). In the remainder of the manuscript we only refer to those categories pertaining to the GT presented here.

As for the coding paradigm (i.e. conceptual schemes that assist researchers to think about categories and how they can be related to each other, Glaser, 1978), Locke suggests that 'researchers may flexibly draw on the possibilities raised by the various coding paradigms according to the focus of interest in the substantive topic' (2001, p. 78). Therefore, we built a simpler grounded model that includes the causal conditions leading to the core category of interest, but did not include intervening conditions, consequences, and actors' strategies suggested by the paradigmatic model of Strauss & Corbin (1998).

Finally, throughout the whole data analyses process, we used memos, matrices, and tables (Miles & Huberman, 1994) to synthesize and effectively visualize our data as well as to enhance the ability to communicate clearly among researchers and with our informants.

During the coding process we read the field notes collected up to that point several times to get a thorough view of the data. Because since the first observations the amount of interactions among actors emerged as a phenomenon relevant to the definition and organization of the work flow within RP, we decided to perform two codings: one taking the observed interactions among individuals as the level of analysis and one based on observations, documents, and interviews. For the former, the reading of field notes allowed us to progressively develop a coding scheme for interactions. Some of the categories are contained in the interaction process analysis system developed by Bales (1999). We derived the other categories from the continuous interplay of data analysis and data collection that characterizes qualitative studies. Specifically, for each interaction occurring between two or more actors the following features were specified: the active actor (who triggered the interaction), the passive actor, the content, the cause, the presence, and the type of conflict. In relation to the latter, an interaction features a conflict when actors have a strong and verbal disagreement about a certain topic. Following Jehn's (1997) model, we classified three types of conflict: task, process, and relationship.

Overall, we recorded 11,396 interactions. To assess the level of agreement on this coding, two of us, after independently coding our own transcripts, systematically coded a randomly chosen 15% of the transcripts coded by the other researcher and compared coding criteria. We reconciled disagreements through discussion. Overall, interrater reliability, as measured by the correlation coefficient, was approximately 70%.

On the basis of observations, interviews, documents, and the information that we were deriving from the first coding, we singled out the other recurrent themes emerging from the field beyond the interactions among professionals. Each field note transcript was independently coded by two of us. The three of us then met regularly to discuss batches of transcripts; the two coding authors compared their independent coding and the non-coding author acted as a third source of analysis for difficult quotes. Through this first step we identified emerging categories. For instance, the 'autonomy of professional groups' and 'perceptions about other professional groups' work' categories emerged at this stage. As a second step, we separately grouped convergent categories at a higher level of abstraction, that is identified theoretical categories. Once again, we held joint meetings to compare our coding and discuss passages we disagreed about. We traced the two previously reported emergent categories back to 'awareness about activities and contributions of members of other professional groups'. Finally, we looked for links between higher order categories in order to outline a coherent framework. The final outcome of this third step is the development of a grounded model that connects the different theoretical categories (Strauss & Corbin, 1998).

We ended the iteration process between field notes, theoretical development, and collection of additional data when the development of our categories seemed complete and we found that new data incidents resulted in no new category elaboration, that is when we reached theoretical saturation (Glaser & Strauss, 1967). The frequent conversations that we undertook over the 2-year period in RP with our informants offered us several comments about their perceptions of the fit between our findings and theoretical schemes and their own context (Orlikowski, 1993; Corbin & Strauss, 2008).

Focus groups

At the end of the observation period, we conducted eight focus groups (Morgan, 1997; Lee, 1998). Focus groups are 'a research technique that collects data through group interaction on a topic determined by the researcher' (Morgan, 1996, p. 130) and that can be used as a tool for participatory research (Padilla, 1993). Morgan & Krueger

(1993) and Morgan (1997) observe that focus groups are particularly apt in situations with power differentials among participants (e.g. nurses and doctors), when there is a gap between professionals and their target audiences (e.g. academics and hospital practitioners), when investigating complex behaviors (e.g. process conflict), and when individuals may have different opinions on a topic (e.g. due to different roles).

We initially designed two focus groups in order to share with our informants the emerging models that we were formulating and to contextually activate a discussion between RP members on the same topics. Specifically, during the first focus group, we shared all the emerging categories (from the open coding) and relationships between categories (from the axial coding) with the 27 RP members. As previously stated, during the analysis process we found more than one core category and developed multiple theoretical schemes. The first focus group therefore served several purposes. On the one hand it allowed us to grasp the reactions and feedback of all our informants about their perceived fit of our elaborations and their own context (in this sense it served as theory validation) and, on the other, it offered us the insight that the core category of process conflict and the related causal conditions could be the starting point for finding practical implications to help the unit solve its organizational problems and offer inputs to create a more parsimonious model. In a second focus group (where 22 out of 27 RP members participated) the grounded model on disapproval and process conflict was formally presented: participants jointly developed the understanding that a new MIS could be a viable solution to some of the recurrent unit organizational problems related to process conflict that the grounded model portrayed. The first two focus groups overlapped with the analysis described in the previous paragraph.

After the first two focus groups, we set up another six focus groups, targeted at discussing the events and interactions observed through the ethnographic study while our informants dealt with their most frequently recurring issues (Frey & Fontana, 1993) and at developing the requirements of a new MIS. Again, we invited all RP members to participate.

In the eight focus groups one of the authors acted as a moderator and another one as an assistant (i.e. she took field notes that she transcribed into files immediately after the meeting). The focus groups' interview protocol was unstructured: each focus group had an objective and the moderator elicited the discussion among participants. The focus groups always took place in the meeting room of the unit in the early afternoon in order to provide a familiar and convenient environment for all the members of the unit and maximize participation. On average, 15 actors participated in each focus group and all the four professional groups were represented. It was not possible to elicit a higher participation rate (with the exception of the first two focus groups) given the conflicting schedules of the participants, but we invited participants to share the main outcomes of the focus groups with their colleagues. Overall, focus groups lasted approximately 2 h each. Further details about the participants and objectives of the focus groups are reported in Table 1.

Ethnographic evidence

The theoretical categories in the grounded model presented here are disapprovals and conflictual interaction, coordination difficulties, lack of timely information, and limited awareness of the activities performed by members of different professional groups.

Disapproval and conflictual interaction

The organizational discomfort that the unit head declared during an interview at the beginning of our research ('Maybe we grew too much and we want to stop being disorganized, to create a more ordered workflow and, as a result, treat a larger number of patients') was expressed, during our observations, in a conflictual climate that was widespread among organization members. Table 2 shows the causes and the content of the interactions between actors. The expressions of disapproval, disagreement, or dissatisfaction (from now on we refer to them as 'disapproval') represent the fifth cause that triggers interactions (7% of the total number of interactions). The content of disapproval mainly concerns: colleagues within the unit (52% of cases) and management of documents in clinical records (15% of cases).

Disapproval towards colleagues are latent conflictual interactions, in the sense that the comment is directed to individuals or groups not present during the interaction (see Table 3 for examples).

Table 4 considers only disapproval interactions directed towards unit members. The table shows that all professional groups tend to express disapproval towards colleagues.

One per cent of the total number of interactions is characterized by open conflict between actors. In Table 5 conflictual interactions are grouped by professional group. Following Jehn's (1997) taxonomy, 25% of open conflicts are related to operational work practice (task conflict); 18% are related to an animosity regarding interpersonal relationships among co-workers (relationship conflict); and 57% are concerned with the way activities and treatments are planned and managed (process conflict).

Coordination difficulties

Conflicts arise when the fast work pace makes coordination and synchronization between professional groups particularly difficult. This difficulty may be traced back to the following three issues: inadequate management of interdependence between professional groups, scarce resources, and lack of organizational standards.

Unit members work together during the treatment process (for example, the first simulation entails interaction between a doctor and a technician) and coordinate

Table 1 Details on focus groups

Focus group	*Participants*	*Objective*	*Challenges faced during the focus groups*
1	27 (6 doctors, 6 nurses, 11 technicians, 4 physicists)	• Presenting and discussing the categories that emerged from the field and their connections	• To overcome skepticism towards data analysis • To alleviate the initial fear of the outcomes of the analysis • To bridge 'scientific' language and the context language • To involve professionals with different status and tenure in the discussion
2	21 (6 doctors, 4 nurses, 8 technicians, 3 physicists)	• Presenting and discussing a grounded model on process conflict	• Agreeing on the MIS as a viable solution to address process conflicts
3	12 (4 doctors, 2 nurses, 4 technicians, 2 physicists)	• Discussing the coordination difficulties	• To address the perception of over-simplification of the proposed interpretations and solutions • To bridge different perspectives due to different professional identities
4	13 (4 doctors, 5 nurses, 2 technicians, 2 physicists)	See above	See above
5	11 (6 doctors, 1 nurse, 2 technicians, 2 physicists)	See above	See above
6	13 (5 doctors, 1 nurse, 5 technicians, 2 physicists)	• Discussing the difficulties related to the lack of timely operational information	• Emergence of technical issues related to the integration of different databases • Keeping the attention of 'non-technical' members
7	11 (2 doctors, 2 nurses, 4 technicians, 3 physicists)	• Discussing the lack of awareness of the activities and contributions of others	• To address the trade-off between transparency and control
8	11 (5 doctors, 2 nurses, 3 technicians, 1 physicist)	See above	See above

their work sequentially so that the intermediate results are ready at the right time (for example, physicists have to have the treatment plan ready the day before the second simulation). As an example, in the third excerpt reported in Table 3, technician T5 underlines how shift scheduling is not adequate to cover all the unit activities and points out the consequences of this situation.

The scarcity of human and technological resources, compared to the number of patients, also makes coordination difficult. The main bottlenecks are the simulation machine's treatment capacity (number of patients per day) and the physicists' service capacity (number of treatment plans per day).

Moreover, machines are often substituted by new models, but after installation they go through a period of fine-tuning, during which breakdowns are frequent. The breakdown reduces the service and treatment capacity and causes many organizational difficulties. Technicians are the first link of the chain to be affected.

Despite the fact that the scarcity of resources is perceived as a fundamental issue to address, the unit does not objectively quantify resources in terms of treatment capacity. Since no standard times are associated with different pathologies, it is not possible to ascertain how many resources each pathology absorbs in each phase of the definition and execution of the treatment process. International standards for *Diagnostic-related Groups* help classify pathologies according to the resources that are used in the treatment process, but they are not sufficiently detailed to address the unit's specific needs as underlined by Doctor D6 in the excerpt reported in Table 3.

The difficulty in objectively quantifying resources comes mainly from the lack of shared operational guidelines at the unit level. Radiotherapy treatments are guided by standard protocols that are defined by the international scientific community, but doctors still maintain a fair amount of discretion.

The lack of shared clinical standards has negative effects on the organization of work, for example, on deciding the patient's first examination date. At RP, in fact, no one is responsible for deciding which patients should take precedence and for setting the dates for examinations and treatments.

The lack of organizational standards makes performance analysis of the unit complex. It is difficult to understand individual contributions and responsibilities and it is almost impossible to build an operational budget that is coherent with a growth plan for the unit.

Lack of timely operational information

Table 2 shows that 49% of interactions are caused by the request for, or communication of, information. The content of the information that is requested or

Table 2 Cause and content of the interactions between observed actors

Cause of the interaction	*Content of the interaction*									
	Colleagues	*Patient*	*Clinical record*	*Examination and treatment appointments*	*Definition of the position on the machine*	*Examination*	*Technology*	*Others*	*Total*	*Percentage on the total number of interactions*
Request for information	621	467	398	461	81	18	109	657	2812	25
Communication of information	679	504	266	324	74	29	92	751	2719	24
Treatment or examination on patient	0	41	5	6	629	568	1	253	1503	13
Communication of suggestion/advice	167	184	125	82	66	7	68	212	911	8
Expression of disapproval/disagreement/dissatisfaction	425	41	102	29	17	1	41	158	814	7
Communication of orientation/guide	38	169	153	102	136	5	35	68	706	6
Request for orientation/guide	7	158	117	78	106	10	31	50	557	5
Request for suggestion/advice	32	89	75	41	23	1	29	109	399	4
Assigning of task	90	32	57	42	13	3	13	47	297	3
Request of object	6	1	109	6	8	1	7	31	169	1
Delivery of object		2	121	3	4		5	31	166	1
Signaling of a problem	6	9	48	13	9	2	47	12	146	1
Expression of approval/agreement/satisfaction	25	6	23	6	6	1	8	17	92	1
Responsibility taking	7	9	24	9	11	2	8	14	84	1
Communication of problem solution		1	11	1	2		6		21	0
Total	2103	1713	1634	1203	1185	648	500	2410	11396	
Percentage of the total number of interactions	18	15	14	11	10	6	4	21		

communicated relates in 25% of the cases to colleagues (for example: Remember that technician T5 is coming in an hour late today) and in 30% of the cases to data about patients or documents in clinical records.

The request for, or the communication of, operational information is a large part of the interaction between unit members and it is often associated with conflict. Forty-five per cent of the interactions that feature open conflict between individuals are caused by the need for some type of information. Thirty-two per cent of interactions containing open conflict are a discussion about the difficulty of getting operational information, such as examination dates or clinical documents.

Managing clinical records within the unit is critical for two reasons. First, the physical location of a record is not always clear. Different groups use and work on clinical record documents during their tasks. The collective use of a clinical record results in its continuous 'shuttling' around the unit and a consequent lack of awareness of its current location. Delays in the execution of work are the immediate consequence of this lack of awareness.

The second reason it is difficult to manage clinical records is that they are incomplete. Doctors, technicians, and physicists tend not to insert all sorts of data in a timely manner, such as patient demographics, clinical tests, anamnesis, positioning on the machines, treatment plans, or a treatment diary.

Incompleteness is a result of the busy workload of professionals, who tend to postpone completing documents. Moreover, the existence of two separate databases to collect administrative data for cost accounting and technical data on treatments doubles data collection work (for example, the name of the patient is inserted twice) and increases administrative work for professionals.

Limited awareness about activities and contributions of members of other professional groups

Professional groups in hospitals are typically highly specialized and possess very different competencies (Scott Smith *et al*, 2000) and professional identities (Doolin, 2002). Therefore it is not surprising that in RP, although there is a strong task interdependence among all co-workers, the four professional groups organize their work to ensure some individual margins of autonomy (buffers). For example, the physicists group manages its own schedule of activities. The inputs for their activities are the contouring made by doctors, and the time to complete a treatment plan is 3 days. In other words, the definition of priorities, the programming of individual workloads, and the distribution of tasks between physicists is, within the 3 days response time constraint, a choice of the physicists.

On one hand the autonomy of professional groups preserves the uniqueness of their contributions, but on the other hand it accentuates the perception of distance between groups and favors misunderstandings. In particular, in RP members of different professional groups are not always aware of the contribution of members of other

Table 3 Examples of field notes associated to emergent themes and categories (D = Doctor; T = Technician; N = Nurse; Ph = Physicist)

Theoretical categories	*Emerging categories*	*Examples of field notes*
Disapproval and process conflict	*Latent disapprovals*	[A patient asked to talk with N2, but she is not in the unit] N4, murmuring to N7: 'Anyway … . As usual, this morning nobody saw N2!' N7: 'I know! And it is not new … . She's always in a meeting … . Is it really possible? She doesn't give us any help and here we have to do everything by ourselves!'
	Open conflict related to the organization of work activities	D8, raising his voice: 'Hey, T5, listen: you have to stop. We make patient *Z* go out of the simulation room and we start with the next patient. So you can stop being so ratty, ok!' T5: 'No. We are doing this [patient *Z*], so let's finish. Anyway … . We are so late already!' D8 'Let patient *X* in. We'll come back to *Z* later. Send her [*Z*] out and tell her to wait. I am going to see the next patient's CT. Please, position *X* on the simulator and call me when you're ready'.
Coordination difficulties	*Inadequate management of interdependences between professional groups*	T5: 'We need to re-organize patient examinations, competences, treatment scheduling … . Sometimes things overlap! For example, this morning D8 is scheduled to be in the simulation room and in the examination room at the same time. This is counterproductive, creates confusion and forces D8 to run about all over the unit! Also, technicians can't go on with the immobilization system and with the positioning without a doctor'.
	Scarceness of human and technological resources	T9: 'The treatment plans from the medical physics department block the simulation. […]. What actually happens is that the treatment plan of a patient who is scheduled at 1 p.m. for the simulation is often not ready at 8 am, when we [technicians] begin our shift. Treatment plans are done at the last minute for two reasons: first, physicists are not informed on time about the simulation dates and second, because they [physicists] are a very limited number. This means that there is no time to make corrections to the plans if something is wrong. If there is a problem, we start to postpone patients and the delay gets bigger and bigger for everyone. Not to mention that the simulator can do just 10–12 people a day … . This is another huge limitation'. T6: 'When there is a breakdown, it is worse than a collective suicide: we need to call maintenance, to wait for the appointed technician, and to hope that the problem is not really serious. If the problem is a big one, we need to call all the patients, re-do the scheduling, call up physicists and doctors, change our [technicians'] shifts …'.
	Lack of organizational standards	D6: 'an unclear understanding of the instantaneous availability of resources and its relationship to treatment requests is a problem: we are not able to understand what the use of the machines or of our other resources will be in advance …'. D8: 'A pathology can be handled in very different ways, according to who the doctor who examines the patient in the first place is. There are doctors who take the risk of doing a new therapy, but some others don't. For example, we should define, at the unit level, if at RP we want to irradiate Basedow's disease or not; if the neuroblastoma should be treated with the actual resources of RP … . Decisions like those should be made by the unit head or by the medical staff as a whole. Then, they should be written down as protocol'. D2 to D8: 'Here there is only an apparent criterion to define examinations and medical appointments! Scheduling is just a free for all! You put patient *W* in without asking the approval of the doctor who will be in charge of the examination! Are you aware that this problem will snowball to all the people working on the treatment? When there is no time to finish things, we are all forced to work in a rush and imprecisely …'.
	Difficulties in performance analysis	D6: 'Since 1992 the budget was just a historicization of previous years … . We typically look at what we did the previous year and then we decide: this year we'll focus our efforts on this … . There are new projects that determine a cost increase for example. We say: the expenses in 2002 were *X*, we are thinking of increasing *Y*, so that we expect to spend *X* + *Y*. This is a very naïve way of compiling the budget, but we are not able to do it any differently …'.
Lack of timely operational information	*'Shuttling' of the clinical record within the unit*	T3, during the lunch break, tells T4: 'Yesterday, I was in the simulation room and I had a patient scheduled for 7.30. The clinical record was missing and I did not know how to position her on the machine! I had to run all over the unit to look for the clinical record and in the end I found it … in D8's office! At that point I could carry on with my work, but you can tell that the patients were affected …'.
	Incompleteness of the clinical record	T11: 'Our problems with the clinical records come from the fact that when the patient is ready to begin with the treatment on the accelerators, we [technicians] are missing some data or some signatures … . We [technicians] need to stop our work and look for the doctor or the physicists who are responsible for those missing data, otherwise we can't start the therapy! Recently we've been more stressed from running around looking for documents than from our primary task!'

Table 3 continued

Theoretical categories	*Emerging categories*	*Examples of field notes*
Scarce awareness about activities and contributions of the members of other professional groups	*Autonomy of professional groups*	Ph4: 'We [physicists] have many benefits from this kind of organization. If our group [the physicists] depended directly on the unit head, given the super power of doctors [the head unit is a doctor] we would not have any autonomy in creating treatments plans, doing machine checks, and so on … . The professionalism of physicists is unique and with centralized planning we would probably lose it …'.
	Wrong perceptions about other groups' work	D5 perceives that physicists do not contribute enough to the unit mission, when he states that: 'Physicists are not willing to work during lunch breaks to discuss treatment plans with us [doctors] and they never do overtime …'. Physicists actually perform a large amount of overtime, as Ph3 explains in the following field note: 'We've already done a lot of overtime … . The head of the unit can't ask to work together when it's nearly time to stop! If he says we should discuss the treatment together at 2.30 pm, but the physicist's shift ends at 2 pm … that's a problem, don't you think?'

Table 4 Number of expressions of disapproval/disagreement/dissatisfaction with having colleagues of a different professional group as content, grouped by the professional group of the active actor

	Content of the interaction					
	Doctor	*Technician*	*Physicist*	*Nurse*	*Total*	*% of the total*
Professional group of the active actor						
Doctor	52	25	36	40	153	36
Technician	80	34	18	9	141	33
Physicist	8	0	4	3	15	4
Nurse	54	25	13	20	112	27
Total	194	84	71	72	421	
% of the total	46	20	17	17		

Table 5 Number of interactions characterized by open conflict between actors belonging to different professional groups

	Professional group of the passive actor					
	Doctor	*Technician*	*Physicist*	*Nurse*	*Total*	*% of the total*
Professional group of the active actor						
Doctor	7	14	5	13	39	3%
Technician	14	16	0	8	38	32
Physicist	3	0	0	1	4	3
Nurse	14	10	1	11	36	31
Total	38	40	6	33	117	
% of the total	32	34	5	28		

professional groups (for example, a doctor does not know in detail what a physicist does during a shift). The lack of a system to evaluate individual or group performance favors the development of a judgment of other professional groups based on perceptions rooted in the judge's value set. For example, D5 believes that the unit functions because of 'everybody's willingness and dedication', but perceives that some physicists do not contribute enough to the unit mission. Physicists actually do a large amount of overtime; as Ph3 explains in the field note reported in Table 3.

Negative judgments about colleagues, based on individual perceptions and not supported by objective data, are widespread among all unit members, as Tables 4 and 5 testify. This behavior adds to the conflictual climate of the unit.

The grounded model

Figure 2 shows the grounded model aimed at explaining the widespread conflictual climate in the unit, expressed by process conflict and disapproval among individuals (the core category). We identified three causal categories

that are connected to the main phenomenon: coordination difficulties, lack of timely operational information, and limited awareness of the activities and contributions of unit members belonging to different professional groups.

Our evidence indicates that interactions characterized by disapproval and conflict are mainly associated with the process of organizing activities in the unit (and only partially associated to technical or personal differences of opinion). A limited number of studies analyzed the antecedents and the dynamics of this particular type of conflict, which is called process conflict (Jehn, 1997; Jehn & Mannix, 2000). Process conflict, in fact, is typically difficult to separate from task or relational conflict. The radiotherapy unit, however, represents a privileged context in which to study process conflict. As a matter of fact, if on one hand professionals are very well distinguishable from the point of view of their specialist contributions, on the other hand they are strictly interdependent from the organizational point of view.

Difficulty in managing sequential and reciprocal interdependences (Thompson, 1967), which we have generically termed 'coordination difficulties', complicates the execution of the workflow and makes the context more vulnerable to those situations where the trajectories of patients, resources, and professionals do not meet properly (Strauss *et al*, 1985). Mismatched trajectories occur when information is not available on time (for example, clinical record data) and, as a consequence, the work of people who search for and provide information is fragmented. When the limited awareness of what other people do is added to this situation (Dourish & Bellotti, 1992), then actors are unable to create a shared interpretation of events and behaviors (Weisband, 2002) and conflict is accentuated.

Even though an in-depth analysis of how conflicts unfold in organizational settings is beyond the scope of our paper, it is interesting to comment upon the few studies that focused on process conflict after our own grounded model. Some research has investigated the consequences of process conflict and the relationship between different types of conflicts (e.g., Behfar *et al*, 2008; Greer *et al*, 2008). Research on technology-mediated teams has paid increased attention to process conflict on the premise that the struggles that distant team members often experience when dealing with different perspectives, unshared context, and information, may lead to an increase in disagreements on how teams approach the tasks, methods, and processes necessary to attain team goals (Griffith *et al*, 2003). In their theoretical contribution, Hinds & Bailey (2003) trace the increase of process conflict primarily back to the uneven distribution of information among team members, coordination difficulties in using shared resources that may lead to incompatibilities in work processes, and the difficulty of developing a shared temporal rhythm. The first two categories are consistent with our model.

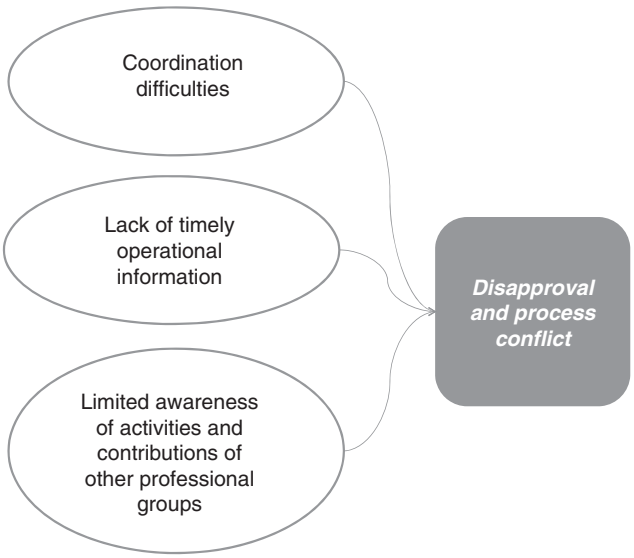

Figure 2 The grounded model.

Requirements definition for a new MIS

The emergence of a new MIS as a solution to handle process conflict

The discussions with our informants, which took place while we were in the field and during the initial two focus groups, helped to refine our grounded model on process conflict and its antecedents. Table 1 reports the main challenges we faced. During the first focus group, some participants expressed skepticism about the data analysis. The moderator overcame this difficulty by describing the coding process in detail and presenting tables and charts summarizing the findings. The interaction was made difficult by the different language used by researchers and informants. Whenever possible, we tried to use the same language adopted by the actors in their work activities and, when not possible, we always defined the terms we were using. Some individuals remained silent or adopted an aggressive attitude due to the fear of the outcomes of the research and the potential effects on their own work. The moderator tried to actively involve these actors in the discussion and often mentioned that the aim of the research was not to judge the contributions of individuals or groups.

During the second focus group the grounded model on process conflict (see Figure 2) was further discussed among the participants. On this occasion our informants converged on the idea that the development of a new MIS could represent a viable action for dealing with process conflict.

This consensus, however, was a stormy process due to the attitude of different professional groups towards the technology. For instance, doctors were mainly concerned

with the issue of paper clinical records and the difficulty of tracing their physical location in the unit. They proposed attaching a microchip that emitted a sound to each document whenever it was searched for. On the other hand, the physicists, who were in charge of managing the unit's technological infrastructures, did not want to discuss the issues with other groups, but wanted to be in charge of the new integrated MIS. Nurses and technicians were mostly afraid of the training that a new MIS would require. Through the discussion, however, it became clear that a new MIS, whose characteristics are tailored to each causal condition of the grounded model, would have helped the unit as a whole and each professional group in particular, if properly and collectively designed.

The definition of the requirements of the MIS

Table 6 shows how specific characteristics of the system were associated with each category of the grounded model. These characteristics were developed during another six focus groups. Table 6 also reports meaningful quotations from the negotiation process that occurred among actors during the system requirements definition process. In the following sections we briefly discuss the emergent characteristics of the MIS and its connection with the grounded model.

Definition of standards and priorities at the unit level to favor coordination, while respecting the autonomy of different professional groups The members of the unit agreed that coordination difficulties among different professional groups stemmed from inadequate planning of activities. An emerging solution to favor an efficient use of the limited resources available was to measure, in terms of daily hours, the service capacity (upper limit) of various professionals and pieces of equipment within the different phases of the process. Moreover, defining standard times occupied by different pathologies during the different phases of the process was considered by many unit members a viable possibility for structuring the treatment process better. The discussion about standards was particularly heated, because some professionals felt that the pathologies and the treatment process were too complex to be fully codified within an MIS. A consensus was reached when it was proposed that the system should allow for exceptions, manually imposed by the professionals concerned.

The development of the treatment process entails the progressive occupation of professional and machine service capacity for the different phases. A semi-automatic scheduling system was agreed upon in order to define a complete treatment for each patient that takes into account the available service capacity. RP members agreed that the lack of shared rules about the management of the unit agenda generates a chaotic use of resources, favors misunderstandings between operators and causes delays for patients. Thus, it was decided to introduce organizational rules for the process, such as the definition of admission rules for patients. To ensure flexibility and to preserve the need for autonomy related to strong professional identity, slack resources among the activities of the different professional groups were purposefully designed, whenever the phases of the treatment process did not require the presence of the patient.

Real time availability of operational information RP members shared the idea that the MIS should collect event information about the treatments and information about the state of the actors involved. To avoid duplicating data, the MIS integrates the previously separated administrative and treatment databases. Moreover, the integration enables data to be processed in real time and produces detailed operational information from multiple viewpoints: actors, patients, pathologies, and phase of the treatment process. The discussion of these topics became particularly technical and many participants felt they could not properly contribute or see their concerns addressed. Specifically, five doctors and a nurse often mentioned they felt detached from the discussion. The moderator tried to lead the discussion so that everyone could understand and give his or her perspective.

Transparency of activities and performance The organizational actors agreed that the new MIS should be rooted in the principle of transparency, that is that the activities and the actors involved be totally visible to the unit members. The availability of shared, objective, and easily accessible data would increase the awareness of RP members about what other people do, thus reducing misunderstandings and differences of opinion (Fussell & Krauss, 1992). The issue of transparency was agreed in principle by everyone, but a debate began on its operational practicality in RP. Specifically, the need for transparency and control was perceived as being in contradiction with the flexibility required by some professionals (mainly doctors) who claimed that they were knowledge professionals and not factory workers dealing with repetitive and controllable tasks.

However, RP members recognized the importance of measuring the overall efficiency of the unit in terms of performance (number of patients treated) over consumed resources. They recognized that the MIS should trace the contribution of the various groups to the performance of the unit, simulate the operational budget and collect ex post information to be used to assess the performance of both the phases of the process and the groups of actors.

Discussion

The integration of ethnography within IS development and the GT approach

This work, in line with the considerations of Wagner *et al* (2004), Wynekoop & Russo (1997), and Orlikowski (2000), interprets the development of IS as instrumental

Table 6 The requirements of the management information system and their link with the categories in the grounded model

Grounded model categories	*Field notes from the discussions during focus groups*	*Emerging characteristics of the management information system*
Difficulties in coordination	*On the issue of standards definition* D2: It would definitely help to know the average time for a pelvis or a breast or a roentgen. Moderator (researcher): Then we should try to define some shared standards. D5: What do you mean? We can't say each roentgen is the same! We have different cases. Each patient is a case history *per se* … Moreover, many cases are borderline between cure and palliation. D2: I agree with that, but we need to try to define some broad unit standards. We cannot simply treat a patient as if she were the only one! Every decision we make for one patient may affect the timeframe in which we can start treating another!	*Definition of priorities and standards at the unit level to favor coordination, while respecting the autonomy of professional groups* • Service capacity measurement at every process phase • Use of standard time for the occupation of service capacity in every phase • Definition of organizational rules and constraints • Scheduling system to define the complete treatment of each patient, taking into account the available service capacity
Lack of timely operational information	*On the need for operational information* N1: I simply don't know what patient *X* is doing. I can't find his documents, I was running around for an entire morning. Moderator (researcher): What do you need in order not to run around? T11: We need to have real time information, we can't waste time looking for papers around the unit.	*Real time availability of operational information* • Automatic data gathering about events and actors in the radiotherapy process • Automatic data processing to obtain analytical information from different perspectives: actor, patient, pathology, and treatment process phase
Lack of awareness of the activities and contributions of members of different professional groups	*On the issue of transparency* Ph3: Ok, we are a public service organization and it is important that everything we do is formally documented. Internally, we should find a way to document what each one of us does; our single contributions. I don't have a clue what nurses do, for instance. I always see them chatting. N6: Do you want to have a look at my timesheet for last month? I did so many extra hours that I couldn't even see my son! If you like, you can video-record me while I am working. N2: Stop being confrontational. Let's try to think of a way to make each group's work visible.	*Transparency of activities and performance* • Automatic processing of analytic information and budget documents • Data gathering about group and phase performance, through comparison between standard and ex post values

for and strictly interconnected with organizational action and interactions. We depart from traditional studies on ISD that see technology as prevailing on organizational structure and, instead, focus on the active participation of users in order to identify specific combinations of technological and organizational components that, taken together, are adequate for the context.

Ethnographies in the IS field have traditionally been used to investigate social issues related to design, adoption, use, change of technologies (ethnography of IS development), or to practically help IS practitioners with requirement gathering (ethnography for IS development). The first use of ethnography pertains to the advancement of scientific knowledge. On the other hand, the second use of ethnography supports the identification of solutions to specific problems of design. Beynon-Davies (1997) defines ethnographies within IS development as studies that contribute to creating scientific theories while providing input for developing information systems. Very few studies of this sort have been conducted (e.g., Crabtree *et al*, 2000) and no studies, to our knowledge, have integrated ethnography within IS development with a GT approach.

In our study, we conducted prolonged observations and interviews with organizational actors that enabled us to derive multiple theoretical categories. The grounded model depicted in Figure 2 embodies a theory about process conflict and its antecedents (Bertolotti *et al* 2008).

This theory explains how the development of process conflict within an organizational context where different professional groups co-exist is strengthened by coordination difficulties among professionals, the lack of timely operational information within and between professional groups, and the limited awareness of other professional groups' work and contributions. While an interesting tangent to our study, further discussion of this theory is beyond the scope of the present paper.

The integration between the GT approach and the definition of the requirements of a new MIS took place through focus groups in two steps. One focus group was initially used to discuss our analysis and present all the categories we selected and the relationships among them. In the second focus group we discussed one single core category and its causal conditions. When presenting the ethnographic data, we parted from an overly descriptive account of our findings and we synthesized our qualitative evidence using quantitative tables and schemes. Ethnographic research, as well as an ethnographic approach within IS development, is not a 'work without numbers'. We believe that developing and incorporating such structured communication tools is an important premise for linking the social research community with organizational actors, thus helping the incorporation of ethnographic findings in practical solutions.

Second, we organized another six focus groups where participants discussed the emerging grounded model and jointly defined a new MIS, whose requirements were related to recurrent problems within the unit (i.e., the antecedents of process conflict). Unit members actively participated in the definition of MIS requirements and, during discussions, they faced many of the problems related to process conflict experienced in their everyday work. The grounded model helped them to focus attention on 'system' problems rather than attempting to apportion blame on others based on subjective perceptions. However, a number of challenges emerged during the focus groups, such as the perception of oversimplified interpretations and solutions proposed and the emergence of different perspectives due to different professional identities (see Table 1 for a complete summary). In the following paragraph we summarize the overall challenges of this research design.

Challenges in the use of ethnography within IS design and integration with the GT approach

Table 7 summarizes the main difficulties associated with the use of ethnography within IS development and the strategies we followed to overcome them in the RP study.

We can think of ethnography within IS development as having five partially overlapping phases: context selection, data collection, data analysis, the definition of IS requirements, and IS design and implementation. Selecting a context for an ethnographic study is traditionally deemed difficult, due to the need to find a context of general interest for IS research (Beynon-Davies, 1997) and, at the same time, obtaining full access to actors (Lofland & Lofland, 1995). In our research, we overcame the two difficulties by selecting a hospital setting, where IS problems are relevant to scientific, managerial, and social communities, and by gaining full access through the support of the head of the unit.

The data collection phase (i.e. carrying out observations and interviews) is often made difficult by the initial uneasiness of those being studied (Lofland & Lofland, 1995). In order to reduce the feeling of 'being observed like guinea-pigs', we organized an initial meeting with all the unit members to present the research project and explain our role as researchers. At the beginning, however, we had a very limited comprehension of the context (e.g. what radiotherapy was) that was improved by conducting 10 preliminary ethnographic interviews, by collecting and analyzing documents (e.g. role descriptions) and by using key informants. Given the nature of the context (a hospital), ethical issues were of primary importance. As researchers, we decided not to be involved in any way with the activities of the unit and to become 'transparent' to the eyes of our informants in order not to disrupt their everyday work. It should also be noted that we did not impose any IS solution on our informants: the MIS requirements emerged as a solution after observations were concluded (during focus groups). Overall, the data collection process was extremely time consuming. Accordingly, many researchers and practitioners may deem ethnography impractical. In order to better manage the large data collection process, we involved multiple researchers.

Moreover, it should be noted here that the analysis we carried out was then used for the development of multiple grounded models (see for instance Bertolotti *et al*, 2006; Tagliaventi & Mattarelli, 2006). In other words, the GT approach allowed us to analyze a large amount of data and use data to develop various core categories for multiple research purposes. In doing so, we developed multiple coding schemes and used techniques to validate our analysis (e.g. the computation of interrater reliability).

When it came to moving from the GT into IS requirements definition, we made use of focus groups, as described in the previous paragraph. One of the typical risks related to moving from a large amount of contextual data to the definition of MIS requirements is that of excessive conservatism. In other words, the ethnographic account 'is situated in current user behavior in work settings. Problems may hence occur in envisioning new uses for technology' (Beynon-Davies, 1997, p. 536). However, in our setting the MIS did not exist before the ethnographic study, so all the requirements had to be thought of anew.

A limitation of the study lies in the fact that we did not show how ethnography within IS, integrated with a GT approach, applies to the next phases of the design and implementation of IS. Future empirical studies should expand our work in that direction. Also, future works should consider the application of this methodology to other organizational settings.

Table 7 Recurrent difficulties associated with ethnography within IS design and how the current study dealt with them

Phase	*General difficulties*	*How the current study dealt with difficulties*
Choice of the context	• Finding an organization willing to be studied extensively	• The head of the unit provided full access
	• Finding a context of general interest for IS research	• IS problems are particularly relevant in healthcare settings
Data collection	• Initial uneasiness of those being studied	• Initial meeting with all unit members to present the research project and describe the role of researchers
	• The researcher's lack of knowledge of the context	• Preliminary in-depth interviews, documental analysis, and use of key informants
	• Ethical position of the researcher	• The researchers were not involved in the unit's activities; the design of the MIS emerged after the ethnography
	• Time consuming process	• Use of multiple researchers; data collection used for multiple outcomes
Data analysis	• Large amount of data to code and synthesize	• Use of grounded theory approach; multiple coding schemes; use of inter-rater reliability coefficients
ISD	• Translate ethnographic material into IS design	• Use of focus groups with organizational actors to move from grounded theory to ISD
	• Moving away from the current characteristics of the context (excessive conservatism)	• The new MIS was not in the mind of the organizational actors before the study and emerged as a completely new solution

Concluding remarks

Our work shows how the theoretical implications of ethnographic research and the GT approach may be integrated in practical solutions for organizations (Wasson, 2000; Baskerville & Land, 2004; Siegel & Dray, 2005). Our ethnographic data collection enabled us to highlight social and cultural processes within the organization (such as conflict between professional groups and limited information flow between actors) through the development of a grounded model and to address the development of a solution – namely an MIS – whose characteristics are compatible with different stakeholders' needs.

Our work has practical implications for IT managers who struggle with decisions about information systems. Initial involvement of multiple stakeholders and an in-depth understanding of their (sometimes conflictual) interactions in their everyday work practice is costly, but may significantly contribute to the evolution of both organization and technology towards a more balanced and democratic socio-technical system. Some works have in fact suggested that involving organizational actors in a process of change from the very beginning favors the creation of a common ground of discussion and makes the effects of change more understandable and less disruptive (e.g. Kohli & Kettinger, 2004). We argue that by using our recommendations and building on the difficulties we faced, researchers could fruitfully collaborate with practitioners to apply ethnography within IS to various organizational contexts. The advantage for practitioners of using ethnography within IS development combined with a GT approach would be to develop an in-depth understanding of organizational phenomena, while directly involving the organizational actors in solving problems. The advantage for social and IS researchers would be to have access to a context that may provide the opportunity to develop multiple grounded models. Finally, an advantage to both practitioners and academics would be to help bridging the taunting divide of IS practice and research (Mooney *et al*, 2009).

To conclude – consistent with an interpretivist approach (Orlikowski, 2000) – we do not want to overestimate the efficacy of IS requirement elicitation. Once a new MIS is implemented, the different perceptions and expectations of the organizational actors could still lead to using systems in a way that is different from what was expected. The users could adopt the system, ignore part of its features or invent new ones, go the extra mile or contradict the requirements originally designed. Organizational problems, in fact, do not exist in abstract, but manifest themselves only when one tries to solve them from within the social network (Crozier & Friedberg, 1994), where they are necessarily subject to re-definition and re-structuring.

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About the authors

Elisa Mattarelli is Assistant Professor at the Department of Engineering Science and Methods of the University of Modena and Reggio Emilia in Italy. She holds a Ph.D. in Management Engineering from the University of Padua, she did a post doc fellowship at the MIS Department of the Eller Business School at the University of Arizona, and she has been collaborating with the Department of Management of the University of Bologna. Her research interests include knowledge transfer in communities of practice, the use of collaborative technologies, collaboration between professional groups, and virtual teams. Among her recent publications are a book on virtual teams and articles on *Journal of Strategic Information Systems*, *Journal of Information Technology & People*, and *Industry & Innovation*.

Fabiola Bertolotti is Associate Professor of Organization Theory and Organizational Behavior at the School of Engineering, University of Modena and Reggio Emilia. In 2000 she was a visiting scholar at the Management Department of the University of Texas at Austin. Her research interests focus on work teams, how people make meaning of their work, the sharing of knowledge among professional workers and the processes of identity creation and organizational identification. She has published on these subjects in journals such as *Qualitative Research in Organizations and Management*, *Journal of Organizational Change Management*, *Journal of Management Inquiry*, and *European Management Journal*.

Diego Maria Macrì is Full Professor of Management at the School of Engineering of the University of Modena and Reggio Emilia. His current major research interests focus on the interplay between technology and organizational choices, the effect of inter-organizational relationships on a firm's performance, and the design of performance management systems. He has published on these subjects in such journals as *Journal of Cost Management*, *Technovation*, *Journal of Organizational Change Management*, *New Technology, Work and Employment*. He is the founder of an academic spin-off devoted to the development of information management systems for Public Administrations.

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