

Designing for an Ecological Agricultural Association – A PD case study

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ABSTRACT

In this paper, we describe a case study of the participatory design process of an information system for an “ecological” farmers association. It describes how the techniques of PD were applied and adapted to analyze its viability in the design of information and communication systems for complex democratic organizations.

Keywords

action research, participatory design, requirements analysis, democratic organizations.

INTRODUCTION

The principal objective of the experiment upon which this report is based was the design of an information system for an “ecological” farmers association. The methodology used was based on the adaptation and combination of software engineering and ergonomic techniques, and adapted the principal methodologies of action research, participatory design and of the pedagogy of liberation of Paulo Freire. More specifically, it sought to apply and adapt the techniques of participatory design (PD) in order to analyze its viability in the design of information and communication systems for complex democratic organizations.

The importance of this experience arose from the confrontation with difficulties during its implementation due to the complexity and peculiarity of the organizational context. In addition to a large number of members, and a lack of transportation infrastructure, electricity and telephony, the organization had been confronting frequent crises due

to the risks and threats present in its surroundings. Since the members live at the mercy of superstructural factors, under the effects of globalization and barely democratic public policies, there was a need to make them competitive without losing the internal characteristics of solidarity, which is what guarantees the entity’s existence. This demands constant changes in the organization and innovations in its productive and administrative methods, in addition to a constant search for new partnerships.

This article begins with a description of the organization, its context and its internal structure. It then relates the steps of the design process and of the implementation of the system and systematization and reflection about the experience.

THE CONTEXT OF THE DESIGN EXPERIENCE

Santa Catarina is a state in southern Brazil in which for historic and geographic reasons the rural region is dominated by small-scale productive structures such as family farms. This productive segment, despite its economic and social importance, has little political weight. It is dominated by family enterprises that have weak social and political networks and are poorly informed. These family farmers have a dependent position within agribusiness. The globalization process threatens to leave this economic sector unviable and cause the consequent intensification of rural exodus and intensity of poverty in rural and urban areas.

Concerned by these risks, various organizations have been working to guide and assist these families, and to establish a network which develops support programs for the various associative forms and/or collectives established by the agricultural families. The programs in execution are highlighted by those related to small-scale agribusiness; credit cooperatives, rural tourism, local development,

In *PDC 02 Proceedings of the Participatory Design Conference*, T.Binder, J.Gregory, I.Wagner (Eds.) Malmö, Sweden, 23-25 June 2002. CPSR, P.O. Box 717, Palo Alto, CA 94302 cpsr@cpsr.org ISBN 0-9667818-2-1.

agroecology, training and exchange.

These programs have achieved rather steady results and the sector continues to be able to attend the production demand for food and supply the state's agro-industrial complex. Nevertheless, this population is experiencing enormous difficulties and is entering a growing process of economic and social exclusion. On the other hand, to the degree in which these programs become broader, the need for more organization and administrative efficiency has become evident, as well as the need for communication to more effectively articulate the diverse programs.

In this context a group of professionals linked to NGOs and researchers at the Federal University at Santa Catarina created the AgroREDE project to provide structure to and implement a network of communication and information services which articulate the various rural social actors. The project works with a perspective of autonomous development in which "*autonomy is the capacity that the human being has to transform the world or environment in which he or she lives*" ([21], p. 182) and development is the process by which subjects achieve this autonomy.

In other words, the goal is for the actors to become capable of identifying the reasons to use the technologies and the transformation that they conceive as possible based on this use. This participation is promoted based on methodologies presented by Paulo Freire [9] according to which the themes and problems are codified and decodified based on the mediation of the intervenors, who are responsible for creating conditions for problematization and to challenge the community to become engaged in the process.

During this process, communities frequently demand more than information already available over the Internet. This was the case of AGRECO – Associação de Agricultores Ecológicos das Encostas da Serra Geral, [The Ecological Agriculture Association of the Slopes of the Serra Geral mountains]. AGRECO requested the design and development of its own information and communication system that could meet the needs of its structural organization. AGRECO currently establishes an association between family farming and sustainable agriculture – and bases all of its actions on a philosophy of solidarity, in an attempt to overcome the fragmentation and isolation of its members. The actions consist in the establishment of a set of principles and rules for sustainable production, the joint planning of production and in the associated commercialization of the products.

Created in September 1996 by 12 family farmers and colleagues in the city (professionals from NGOs and universities), it now has 220 associated small family farms. These families had been engaged in supplying the state's agro-industries through a system of mono-cultivation

(production of tobacco or chickens), highly dependent on chemical and toxic inputs. This form of production generated a dependence of the producers on the large processing companies, in addition to degrading the environment and contributing to increased economic and social exclusion.

The growth in the number of members changed the profile of the association. It altered its initial structure in which tacit knowledge and verbal communication were sufficient to administer the generation and dissemination of information, for a more complex organizational structure. It is possible to envision this complexity by recognizing that the productive structure now counts on approximately 1,200 people organized in 54 nuclei (called condominiums) which produce 70 different products, some of which are processed in small agro-industrial companies.

Each condominium has administrative autonomy but produces and commercializes in an articulated manner. Production is organized based on the centralization of commercialization, or that is, the determination of what each condominium will plant and the quantity it will produce is made through an agreement reached in assemblies of the association. The production quotas of each condominium are defined based on sales estimates.

Since AGRECO is a not-for-profit organization, it does not purchase from the farmers at a given price and sell at a higher price to retain profit. It operates as a center that commercializes products in an articulated manner and socializes the losses and profits.

The *central* has an administrative structure equipped with telephone, fax and computers, and a staff responsible for receiving orders, organizing the harvest, delivery and financial management and accounting.

The tasks undertaken by the commercialization team are complex. Three times per week (because many products are perishable) production is collected at each of the 54 condominiums and delivered to more than 50 points of sale. The technical support to undertake these tasks was rudimentary and could not handle the complexity, indicating the need for implementation of a new communication and information system.

DESIGN METHODOLOGY

To implement the new system design methodologies were used that obey the principles of participatory design – PD, according to which users should be capable of making effective decisions about the role of technology in their activity. This requires that the specialists are capable of using, in the analysis and specification phase, representation systems capable of being understood by the community. Moreover, it requires that the communities affected by the use of technological devices have the right

to say if they want their implementation or not [15, 10].

In addition it is understood that the use of this methodology can promote collective processes of technology learning and appropriation, constituting an emancipatory pedagogical intervention [9]. Thus, it was necessary to overcome the perspective that participation of the farmers in the planning would be conducted in a spontaneous form. As mentioned above, it is necessary to provoke and stimulate the explication and expression of the needs, contradictions, knowledge, conflict and more immediate interests of the community served by the conflict, in order to identify the social representation of this group about the possibilities to use technology in their personal, social and professional activities. That is, a research and work methodology is needed that favors and seeks this type of participation.

To do so an action research (AR) methodology was used [2, 24, 26]. The concept of Action Research goes beyond the naive vision that a researcher or extension agent does not have the right to, or should not, influence a reality. To the contrary, in action research, the researcher has the political commitment to act, but should do so in conjunction with the community in a participative and cooperative process. In AR as Thiollent emphasizes, there is a broad and explicit relationship between the researchers and the people involved in the situation being studied. This interpretation results from the order of priorities that are researched and from the solutions to be proposed under the form of concrete action.

During the design process, an attempt was made to establish a relationship between the traditional life cycle of software development and the development steps of the action research.

Pre-diagnostic – Problematization and Institutional Accord

In the first work phase, as emphasized by Thiollent (1996) and by Paulo Freire (1978), an attempt was made to recognize the community and reality, and to evaluate the opportunities for intervention [9, 26]. This evaluation initially consisted in verifying whether the leaders would resist the application of the principles of AR and PD. This resistance normally appears when the research is being conducted in an environment where there are strong hierarchical relationships and or difficult relationships between groups. Thus, an attempt was made to avoid that the results of the research intervention be used to maintain, justify, or incite asymmetrical relationships between the actors in the organization.

For this reason it was necessary to conduct a preliminary diagnostic of the situations and problems to be confronted.

In this phase, an attitude of listening is essential. Participation should be conducted in the community with an attempt to identify and hear all the types of actors involved and the different interests and conflicts that are in play.

In AGRECO, this diagnosis was made through the participation in many forms of group meetings conducted in various decision-making arenas which comprise the association, such as the General Assemblies, meetings of the managers, of the technical team, of the group of assistants, of the commissions for commercialization and of production, of the Board of Directors, etc. In addition, the project participants spent much time with the farmers to accompany the entire production routine from the moment in which seeds were placed in the ground to the arrival of the processed products at market.

First, it was identified that the organizational structure of the Association was not stable, due to the rapid increase in the number of associates.

The initial conclusion was that the leaders of the organization tried to work with a democratic system to construct collective agreements. The *articulation work* (Anselm Strauss in [23]) was conducted by the majority of the leaders based on *worked agreements out* which were preferentially based on the strategies that include negotiation, discussion, education and persuasion and not on lobbying, manipulating, threatening, and coercion [1]. The use of non-democratic mechanisms was in general used by some sectors, which although they did not have a visible control (stance) within the rule-making structure (working-out work) [23], exercised a position of great influence and power on the primary work, which was conferred to them by the existence of asymmetries in access to the resources for conducting the work.

These sectors basically correspond to the groups of transporters and technicians. The transporters were the principal transport media of the information between clients and producers. This information was not subject to clear transfer protocol that allowed it to remain classified. They did not obey the rules that had been stipulated for the priorities of attending to the markets, and manipulated the response to client requests in order to obtain advantages that would increase their remuneration. Another sector that had access to privileged information was, because of its function, the group of agricultural technicians and the administrative staff. In both cases the invisibility [11] of the actions led to the impossibility of the application of the normative rules.

In addition, there was also great difficulty in maintaining the process of social interaction which gave support to the Association, because its complexity was making many aspects of the social exchange invisible, and leading to a loss of the common vision [21] which is essential for the maintenance of cooperative processes.

Since nearly all the interactions were based on verbal accords, and there were no clear collective protocol for registering information, nor a division of labor (since the Association was changing considerably and the roles of the actors were still not clear) there was a risk of losing mutual confidence and that the process would become paralyzed.

Another important finding of this pre-diagnostic was the fact that the actors in the organization, especially the farmers, already had identified these problems and demanded the construction of a computational support device to assist the cooperative work. Thus, the need of the farmers was aligned with the intention of the researchers to use technology to break asymmetrical power struggles to assure the principles and democratic ideals of the institution. These principles are those expressed in the design methodology used for *"If we want to change the power structures and flatten organizations then PD is appropriate"* ([14], p. 16).

The pre-diagnostic conducted allowed the construction of the terms of the accord between AGRECO and the AgroREDE project team. In this accord, in addition to the practical objectives, the ethical principles, the compromises and the responsibilities of the partner institutions were also expressed. The accord called for the implementation, based on a participatory process, of an information and communication support system for the organizational activities. These activities were at that time classified in two categories: primary work activities and articulation activities (following Anselm Strauss in [23]). The primary work activities include the **production** process – from planning, to planting, harvest and processing of the products – and **commercialization** - including receiving requests, the organization of collection of products and loads, delivery, billing and payment. In the second category were the **documentation** activities – the registration of the accords made between groups and the information required for the monitoring and support of the primary activities (such as technical visits, solicitations for raw material purchases, book-keeping, etc.).

Expanded diagnostic

After an evaluation of the pre-diagnostic and of the institutional and methodological accord of the action research by the administrators, an Expanded Diagnostic was sought. For this purpose the participation of researchers was intensified in the meetings and activities of the organization – simply as observers. Due to the democratic characteristics of the institution and the fact that the organization was undergoing a moment of historic transition, a number of deliberative meetings were held at the time at which the research began. There was no need to schedule specific meetings to address the issue of design. All of the meetings were recorded on video. In addition to the discussion, all of the members of the technical team,

managers and some assistants were interviewed.

An activity that was especially important for the realization of the expanded diagnostic was the Strategic Participative Planning – PEP [3] which is now conducted regularly at AGRECO. PEP is a planning methodology that has the principal "those who do – plan". It can be said that PEP is a modality of a *future workshop* [18]. Three principal phases constitute PEP: the characterization of the organization, the analysis of the environment and the definition of the strategic questions.

In the first phase the characterization of the institution began at a general assembly where voluntary statements were made about the memories of important facts in the history of the organization. Then, working in a group dynamic and then in general assembly, the group began to define: What characterizes the organization? What makes it different from others? What are its goals? What are the values and principles that guide the organization in search of these objectives? Who are the different interested parties (groups of actors, institutions, individuals, etc.) and what are their interests?

Once the organization was characterized, the next step was analysis of the environment. At this time the risks and opportunities offered by the external environment, as well as the strong and weak points of the organization were analyzed and made explicit.

The last phase sought to define what are the issues considered strategic for planning future actions. A strategic issue is a question about what to do to be able to change a certain aspect of the organization. That is, in the strategic questions, the various actors make explicit their views of the future, in order to reach an accord about the changes that are collectively desired, and to indicate what will be required to undertake them. For each strategic question a short and medium term schedule was defined that included the required actions (already detailed at the level of activities), who those responsible are, and what is the origin of the necessary resources for the desired changes to be undertaken.

This whole process was conducted in four consecutive days of work. More than 100 people participated, representing various types of actors within the Association (founders, new associates, youth, elderly, technicians, etc.) The participation of women was still small. Participation was encouraged through various group dynamics (construction of scenarios, expression via design and diagrams, music, poetry, spontaneous verse, etc.). The entire discussion was registered in various work steps, each group had moderators and someone to write the report and various types of visual resources were employed (post-its, index cards, brown paper).

In the Participative Strategic Planning conducted in January

2001, five strategic issues were defined. Of these five, in four that will be described below, the implementation of the information and communication system was a priority and was defined as an urgent action:

- How to improve the participation of the members in the decision-making process of the Organization?
- What to do to promote the strengthening of the principles of equality of opportunities and distribution of income among the AGRECO associates?
- How to strengthen the behavior guided by principles of sustainable development?
- How to improve the organization and quality of production, processing and commercialization in order to meet growing demand?

Among the various activities indicated as necessary in the improvement of the information and communication system such as improvement of the telephone network, construction of murals, community radio, and monthly bulletins, the design of more than one information and communication system were considered essential.

In addition to the PEP, the researchers participated in various meetings of the production groups in order to design the information needs of the productive units. The strategy was to begin from the production and commercialization charts that had already been issued monthly. The difference between the delivery and the sale price is called the "split". The reason for the "splits" was not being specified on the balance sheets and had an important financial impact. For this reason the groups wanted to know where the "split" "occurred", and maintained that the balance sheet should give the reason for the "splits". In addition, they indicated that it would be more reasonable for the loss or "split" to occur in the field, and not after processing.

For this reason, proposals for new balance sheets that should contain more information were prepared during the meetings, on brown paper with magic markers. That is the farmers designed the spreadsheet that they would like to receive each week.

The researchers also participated in the meetings of the production and commercialization commission which sought to adapt the commercialization strategies to those of production, and reduce the "splits". In these meetings it was determined what the farmers had already indicated in the PEP: sales were planned without information about production and without information about the splits and the reasons for them.

It was also found that the absence of protocols for distributing the information made it possible for the

transporters to control the information which they presented in a non-systematic manner (often verbally) such as information about production, requests and sales.

From the interviews conducted with the administrative technical personal, it was concluded that the most serious problems included the absence of an historic register of production (costs, quantity and quality); the excess administrative work load of the farmers in the condominiums; and the difficulty in communication – that is the lack of an organizational memory. Meanwhile, the assistants and managers had a perspective about the implementation of the system that was more oriented to planning long-term actions, such as offering direct contact between producers and consumers; a better quality democratic process, and a more precise and dynamic process for elaborating and monitoring of the rules.

The results of this expanded diagnostic was communicated to the team of technicians, to the managers and also at the board of directors meetings. The knowledge of these results had an impact in the community, even though the work was just beginning. The themes raised by the diagnostic began to be part of the rounds of conversation and of community discussions. This led to a search for strategies that could offer solutions to the problems. For example, the production and sales sectors began to think about new procedures for receiving requests, about rules for establishing priorities for service and for distributing demand between producers; while the representatives of the condominiums began to consider and suggest possible ways to estimate and communicate to the commercialization *central* the production estimates.

The first description of the System – Analysis of the Requirements

The diagnostic and problematization above gave support to the detailing of the requirements and needs of the system. This detailing was conducted based on the adaptation of methodologies from the field of ergonomics - a Hierarchical Task Analysis – HTA [5, 6, 7] - and software engineering - Use Cases of Object Oriented Analysis [16].

The realization of the broadened diagnostic certified for the AgroREDE project team that the decision to implement the system was demanded by the users (*users demanded*). That is, it was not a *technologically pushed* decision. In addition, the fact that this diagnostic had been based on a qualitative methodology aimed at the social processes, allowed the perception of aspects of organizational reality that were not realized in an analysis aimed at the product – as is the case of the majority of methodologies of software engineering. In this way, even knowing the risks of adopting a methodology of analysis of requirements based

on formal methods of software engineering, that are considered product oriented paradigms [8] as is the case of the Use Cases methodology, the project team decided to use it as a tool to mediate the design. It worked with the assumption that the fact that the use cases, in addition to being a high level design technique, can be described in natural language and are, therefore, a bridge between concrete use scenarios and the necessary formalization of the system, and thus allow good user-designer communication

The first step in the application of this methodology consists in having the design team define the set of use cases of the system. The need to communicate a general vision of the system to the users stimulated the organization of the use cases in a hierarchy, as determined by the Hierarchical Task Analysis methodology. The organization of the use cases in a taxonomy was based on their initial grouping and aimed at the processes and sub-processes of the organization (commercialization, planning and monitoring of production, documentation and management).

The use cases are a formal description of the future scenarios of the use of the system. To detail them it was essential to identify and classify the different actors who, because of their responsibilities, would interact with these use cases after the implementation of the system (the clients, the farmers or associates, the administrative staff, the technical coordination and the assistants).

The taxonomy of the use cases was validated at a meeting with representatives of the managers and of the farmers who are members of the Board of Directors. At this first validation meeting, it was not attempted to work with a description of the cases but to analyze the **extent of the taxonomy**, and to establish the **implementation priorities**. The priorities elected were the use cases related to the most direct support for the commercialization process now underway. For example the use case of "register client requests" was a priority over the use case "online monitoring of market stocks". In this way, the taxonomy of the use case constituted an important tool for the design planning.

For each use case, **design** and **validation** groups were defined. **Their** attributions will be described later.

High-Level Design – Critical Analysis

After the definition of the use cases and the design and validation groups, work began for the detailing and specification of each case. This constituted a work of critical analysis of the UC problems. It is important to highlight that a use case, even one that is a priority in terms of implementation, is not always configured as a problem. For example, the registering of a product was considered a

priority because it is a necessary condition in the implementation of the commercialization process, but does not resolve the problematic of commercialization and therefore is not a central design issue. In this sense, the use cases were then classified concerning the criticality of the problem situation in two groups: the strategic and the secondary. The secondary use cases were the object of detailed design in a later step. The step for design and critical analysis of the problem situations described in this section were conducted only for the UCs considered to be strategic. For these UCs the AR methodology was used once again.

1st moment: The expression of the daily representation of the problem:

The design group, which was small, was composed of people who knew the problems well, and who had the ability to construct their initial representation. This initial expression could be made in natural language, or by utilizing pictorial expression, construction of charts, diagrams or even dramatization. The designers could help with questions such as: What is the nature of the problem? What do we know about it? Where does it exist? Who is affected by it?

2nd moment: questioning the representation of the problem.

The representation of the problem made by the actors was then questioned. This was done through, for example, a use case scenario that allowed the identification of the points of view and the still not observed factors, the comparison of the information and the identification of the contradictions between different understandings of the situation, and the relationship of this with other use cases, etc.

This moment, was interlinked with the previous moment, for once the description of the use case was refined, the technical knowledge of the development team was confronted with the tacit knowledge of the actor who was specifying the description. This caused the actors to re-consider their reality and to propose to rebuild it. Then the design team prepared a narrative of the problem in order to explain what they understood of the description made by the users. During this process, other questions frequently arose about the use case. This process was repeated until a stable representation was reached of the UC.

3rd moment: reformulation of the problem.

Once a stable description of the episodes that compose the UC was obtained from the group, the design team prepared a presentation for the group to validate, forming commissions of representatives of users affected by the use case. This could be done through the construction of a prototype or a *low fidelity* "mock-up". The prototypes

allowed people to identify new strategies; to formulate hypothesis for action; to anticipate the evaluation of the implementation of the use case; and to differentiate the solutions of the immediate type and those planned for the long term, as well as those within the reach of participants and that required another type of intervention.

After passing through the validation group, the next step was to develop a high fidelity prototype, according to the reformulations proposed.

Detailed Design – The implementation of the joint action plan

After the high level design was conducted of all the strategic UCs that had been validated, high fidelity prototypes were developed. Once this was done, the implementation of the system (or part of it) could be undertaken. This implementation required an action plan that was coordinated between all of the actors, in the same way as the AR. It was necessary to make clear the new attributions of each party involved, as well as the implications of these attributions in the administrative and productive routines. Various meetings were held to create a task force to make the changes viable.

Evaluation of the PD as a permanent process

The PD and the AR do not terminate the programming and application of an action plan. The critical analysis of the reality and the realization of the actions called for in the action plan lead to the discovery of other needs and of other dimensions of reality.

In this sense, the action is a source of knowledge and of new hypotheses. The diagnostic, the critical analysis and the action thus constitute three moments of a permanent process of study, reflection and transformation of reality, which are mutually supportive.

These moments wind up unveiling aspects of the dynamic of association that have social and economic implications. The new factors that are perceived lead to a process of reflection that caused the actors to discover a set of new relationships between commercialization and their activity and raised various questions of a political nature.

It was clearly realized that the institution was undergoing a process of reconfiguration, the consequences of which could still not be foreseen. There is currently a demand from the farmers to modify the commercialization process designed by them at a first moment, in order to decentralize the distribution of responses to purchase requests by nuclei of the condominiums. In other words, the farmers want more contact with the clients and greater administrative autonomy, and are demanding that the association make viable the conditions for these requests.

With respect to the AgroREDE project, in order to

understand and qualify the intervention conducted at AGRECO, new studies are being undertaken that should allow an evaluation of the social-cultural and organizational aspects implied in processes of aggregation of technology in rural communities of Santa Catarina state. This evaluation will be oriented by presumptions based on psychological theories that use an historical-critical approach.

CONCLUSIONS

The methodologies used in the design allow the evaluation and critical analysis of attending users' expectations and of the impact perceived in the implementation of the system to occur during the process. These evaluations point to some rather positive results.

The need to explain criteria, principles and organizational rules provoked by the detailing of the use case strategies led the members to change the way that they expressed these criteria, principles and rules, making more clear factors that previously mediated the relations in only a tacit manner and interfered in these relationships. This was the case of the process of clarifying the rules according to which would be socialized the losses from the production surplus. The critical analysis of the previously adopted rules caused the changes to be implemented, allowing a differentiated understanding of these rules and of the modes of construction. The level of understanding was such that it allowed retaking collective control of compliance with these rules – attempts to get around them were quickly perceived and made explicit.

This understanding was also manifest through the rise of autonomous movements calling for changes. For example, the administrative and commercialization modes that were considered centralizing are being changed. These movements indicate changes in the power relations.

Another aspect to be highlighted refers to the need for explication of the roles and functions of each actor at the moment of definition of the design and validation groups of the UC. That is, it was necessary to make visible and formalized the division of labor within the organization. At this time the technical team and the managers were made aware that this division of labor was tacit, and a problem. They then began a collective construction of an organizational chart. The validation of this chart, in addition to the explication of the roles of each actor, was an important factor for the organization and design of the system.

The use cases methodology, organized with a basis in a hierarchy, was the mediating tool that allowed the participative planning of the design. That is, the design and validation groups were defined based on the needs pointed to by the tools and interpreted in conjunction with the actors of the organization. The hierarchical analysis of the

task helped the process of understanding the relations between the cases and facilitated the organization of the interface.

It was perceived that during the work there was an increase of personal confidence of the farmers concerning their ability to confront the challenge of operating a computer. This can be confirmed through the demand to equip the production nuclei with computers to allow on-line access to the commercialization information.

The organization was already experiencing a process of change at the time in which the design team began the work. This established an emergency situation and generated many expectations concerning the implementation of the system. This, in addition to the reduced size of the team and the lack of resources to pay for the design, often led to failures in the documentation process and frustrations – shared with the community – concerning the slowness of the process.

At the end of the process, it was concluded that the experience was a valuable training opportunity for the AgroREDE project team, which acquired experience with some of the basic factors in the application of participative design methodology, and is now prepared to repeat them. That is, the group systematized important elements needed for the construction of a methodology for intervention that considers the peculiarities of complex democratic organizations.

INFORMATION AND QUESTIONS

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ACKNOWLEDGMENTS

We must firstly thank our sponsoring institutions: CNPq (Conselho Nacional de Pesquisa Brasileiro), FUNCITEC (Fundação de Ciência e Tecnologia do Estado de Santa Catarina), UFSC (Universidade Federal de Santa Catarina) and SEBRAE (Serviço Brasileiro de Apoio a Micro e Pequena Empresa).

We want to especially thank AGRECO (Associação dos Agricultores Ecológicos das Encostas da Serra Geral). The courage and the solidarity and environmental ethics of its members allowed the accomplishment of this project.

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