Experiences With Goal-Oriented Modeling of Organizational Change

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***Abstract*—In today's business environment of relentless change, the topic of how one should proceed with understanding the reasons for change and alternative strategic options, has received much attention by researchers and practitioners alike. This paper considers the relation between goal-oriented business process modeling and organizational change and addresses the question "how can we reason about organizational change using a goal-driven approach?" To this end, it describes a systematic way-of-working for modeling organizational change and presents empirical results and observations from applying this approach in a large industrial application in the domain of utility deregulation. The purpose of this paper is twofold. Firstly, to demonstrate and assess the applicability of the proposed methodology on a nontrivial application and secondly to illustrate a number of challenging issues that need to be addressed by goal-driven methodologies in order to effectively support the process of change.**

***Index Terms*—Change modeling, organizational engineering, requirements engineering.**

I. Introduction

RAPID market changes such as electronic commerce, deregulation, mergers, globalization and increased competition have led to a business environment that is constantly evolving. The effects of integration and evolution of information technology coupled to the increasing education of people provide opportunities for organizing work in ways that have never before been possible [1]. There is a high degree of consensus amongst information systems researchers and practitioners that the development of systems nowadays is not solely a technical activity and that organizational factors very often have a profound effect on both the delivered system and the design process.

A key challenge in designing such systems is the engagement of different stakeholders (domain experts, users, subcontractors, developers) in the articulation of requirements and in reaching agreement about the possible routes to re-engineering the organization and its support systems. Research in the area of organizational change has stressed the importance of achieving a high degree of consensus, learning and shared vision by different groups [2]–[5]. In these situations knowledge that is often fragmented, individualistic, situation dependent and held in the mental models of the participating stakeholders needs to be codified, and to be made explicit in such a manner so that it could be subjected to analysis in a systematic and systemic way [6], [7]. Toward this end, conceptual modeling approaches have proved to hold a great advantage over informal ones since they provide a framework within which decision making is based on a 'language' that provides commonality of view, formality of expression and systematic analysis [8]–[10].

A class of conceptual modeling techniques that pay particular attentions to organizational change as a design activity is that of enterprise knowledge modeling (EKM). EKM refers to a collection of techniques for describing the structure and processes of an enterprise, its missions and objectives together with the way that these objectives may be operationalised onto system components, for the purpose of supporting change [11].

Most EKM approaches generally view change as either a top-down process (e.g., F3 [12], [13], KAOS [14], goal-scenario coupling [15], GBRAM [16]) or they adopt a bottom-up orientation (e.g., i^* [17], the NFR framework [18], TQM [19]). In the top-down approach, goals for change are prescribed in the sense that they do not explicitly link the need for change to the existing organizational context, rather they reflect how change is perceived from the strategic management point of view or is codified in the organization's policies and visions. In the bottom-up approach, goals for change are described i.e., they are discovered from an analysis of actual processes.

Both of these approaches have drawbacks. Prescriptive goals ignore the details of existing business processes and they assume that somehow new or improved business processes and support systems will follow naturally from a decomposition of high-level goals to more operational ones. Empirical evidence shows the misalignment between strategic goals and actual practice when this approach is adopted [20]. Descriptive goals tend to be too constrained by current practice, which can be a serious drawback especially when business innovation is sought [21].

The work presented in this paper is based on the intention based change (IBC) approach that

1) incorporates both perspectives, supporting the systematic discovery of existing business goals and the analysis of the impact that future goals have on existing organizational structures and practices.
2) adopts a unified intention-based modeling paradigm so that the change process is analyzed in a consistent manner linking organizational goals to business processes for both the current and future situations.

Manuscript received April 7, 2003; revised December 8, 2003, March 9m 2004, and April 27, 2004. This work was supported in part by the European Commission under the 4th European Framework Project 22927. This paper was recommended by Associate Editor J. Chen.

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Digital Object Identifier 10.1109/TSMCC.2004.840066

1094-6977/$20.00 © 2006 IEEE

The purpose of the paper is to demonstrate the utility of this approach in the context of a substantial industrial application and through insights gained from this to inform further developments in the area of modeling for change. The change process project involved the modeling for re-engineering of a major electricity company driven by deregulation legislation. The project lasted two years and involved 120 person-months of change process modellers' effort and 70 person-months of domain experts' effort.

The paper is organized as follows. Section II introduces the industrial application and provides an overview of the current company structure and the need for change. Section III briefly introduces the goal-driven approach to modeling organizational change. The application of the approach is illustrated in Section IV. Section V reflects on the process followed in modeling organizational change and discusses a number of challenging issues that need to be addressed by any goal-driven methodology in order to effectively support real, complex goal modeling tasks. Finally, Section VI concludes with a discussion on the implications of these empirical observations in our current and future research efforts.

II. Application Background

The work presented in this paper is part of a big industrial application that concerns the transformation of the Distribution Unit of a large European electricity company referred to as ESIC. Distribution is responsible for the medium voltage (M/V) and low voltage (L/V) transport of electricity, its delivery to consumers and the merchandising of electricity services.

Since its establishment over 50 years ago, Distribution has been the exclusive supplier of electric energy in the local electricity market. However, as a result of the EU directive concerning the abolishing of monopolies and the progressive opening of the internal electricity market, distribution is at a fundamental turning point. The opening of the market will result in the introduction of competition in the electricity distribution market. This means that electricity suppliers other than Distribution will be allowed to provide electricity services to consumers. Nevertheless, not all consumers will have the right to choose their electricity supplier. Consumers with the choice of electricity supplier are termed eligible customers, as opposed to captive consumers (noneligible customers). Even though the EU directive will open the electricity market to limited competition, the rate of opening may accelerate if captive consumers see eligible consumers gaining large benefits from competition.

The long operation of Distribution in a monopoly environment has resulted in a corporate culture that is strongly technically focused with low commercial awareness. Competition will require Distribution to change its culture, operating style and organization in order to adopt a greater commercial focus and retain profitable customers that are at risk from competition.

Recently, Distribution has been involved in a number of attempts to reorganize the company with support of external consultants who were employed to look at specific areas of Distribution operations, (e.g., Customer Service Systems), with the aim of improving them. These attempts have achieved partial success but none has been able to complete a thorough and widely accepted reform fulfilling all the above criteria, and especially the newly introduced concepts of competition. In order to facilitate the process of deciding and adopting the necessary changes, Distribution requires a systematic approach that will enable Distribution strategists to make informed decisions concerning potential re-organization alternatives complying to the long term view of company objectives.

III. IBC Approach to Modeling Organizational Change

A. Rationale

Organizational change concerns the transition from an initial organization situation, which is unsatisfactory in some aspect, to a desired situation where the problem is treated. Both the future state and the possible routes that can be followed to reach this state have to be specified. Organizational change is a typical planning and design problem of a class of problems that has been termed "ill-structured problems" [22]–[24]. The problem state is not *a priori* specified and there is no definitive formulation. Formulating the problem amounts, to a great deal, to solving it. To this end, one needs to develop hypotheses as to the nature of the solution and subject these hypotheses to evaluation in order to gain confidence as to their validity [25], [26].

The IBC approach is based on the premise that the formulation of hypotheses is done in the context of the intentions that stakeholders hold with respect to the intended change and the possible impact of these intentions on current organization structures and practices. The validity of a proposed solution depends on how well it contributes to achieving the stakeholders' intentions for change.

The need for experimenting with alternative solutions has highlighted the importance of using scenarios in this class of problems for as Carroll argues scenarios support the way of working of experts working on ill-structured problem settings such as planning and design [27]. There are many stakeholders that may participate in a change process design activity and this multifarious setting highlights the need for the use of a common, formal and usable representation medium to deal with the often fragmented, and individualistic knowledge held in the mental models of the participating stakeholders. In general, such knowledge is personal, subjective and situation dependent [6], [7], [28] and its codification using textual descriptions presents serious problems with respect to getting a fully understood and agreed set of definitions. By focusing on intention-driven modeling the IBC approach provides a common language for engaging stakeholders to articulate their goals for change to and test potential scenarios that can be derived from the goal models.

In the case of the ESIC application the types of stakeholder include the company itself, its customers (the electricity consumers) and the electricity market regulator. Each type of stakeholder has a different perspective of the situation, giving a different dimension to the problem expressed through their different goals. From the ESIC point of view the goal is to "increase its competitiveness and retain its market share," while the goal of the electricity consumer is to "get more efficient electricity services in lower prices." Finally, the goal of the market regulator is to "ensure that competitor companies will be provided

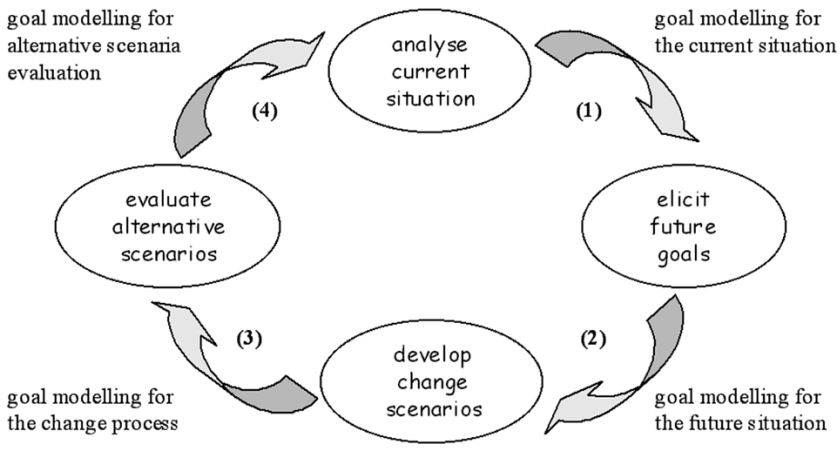

Fig. 1. Goal-oriented modeling of organizational change.

with fair access to the existing network infrastructure owned by ESIC."

These three goals are at least to some extent in conflict. Indeed by allowing access to third parties to its distribution network ESIC risks to lose part of its market share to competitors. Moreover, increasing ESIC competitiveness could mean the discontinuation of electricity distribution in isolated areas where merchandising of electricity is not commercial, which is opposite to the consumers' goal. The exact balance of satisfying these requirements cannot be known in advance of designing a solution. The change process however, is irrevocably constrained by these requirements. Decision makers will need to explore various possibilities for achieving a balance of satisfaction between the interests of the involved parties. Some goals, such as those of the regulator may not be open to discussion and negotiation. Others however, will require value judgement in order to ascertain the degree of satisfiability offered by different solutions.

From a methodological perspective, modeling organizational change in a systematic way requires suitable tools for eliciting and analysing stakeholder goals and describing how these may be satisficed in terms of alternative change scenarios. Analysis of current goal-oriented research [29] shows that existing methodologies focus mainly on representation aspects in terms of (semi-)formal goal specification languages, roughly addressing the way of producing a specification (i.e., the modeling process). Few approaches (namely, i^* [17], [30], [31], ISAC [32], KAOS [14], [33], [34], GBRAM [16], [35], NFR framework [18], [36], and goal-scenario coupling [15], [37]) prescribe a number of steps and associated techniques that can be applied during the modeling process, however the majority of approaches do not describe an explicit way-of-working.

B. IBC Framework

Our approach to modeling organizational change is based on the premise that organizational change (whether it reflects radical business redesign or incremental improvements), can be derived by comparing the 'desired' vision against the 'actual current' reality.

The process adopted by the IBC approach involves four aspects (as shown in Fig. 1):

- analysis of the current enterprise situation (1) provides the background knowledge regarding business structures and processes and provides the context for required change;
- elicitation of stakeholders' goals (2);
- modeling of the impact that stakeholders' goals would have on existing structures (3);
- evaluation of suggested change scenarios against stakeholders' criteria (or evaluation goals) (4) that will lead to choosing preferred options of implementation.

The IBC process yields four types of goals.

1) The analysis of the current situation will attempt to define the current enterprise goals. Unless these goals are clearly specified in existing documentation, they will need to be discovered by analysing existing business processes.
2) The elicitation of future goals will produce a set of integrated goal models that represent a confluence of all stakeholders' intentions.
3) The analysis of future goals on existing goals will yield a set of change goals.
4) Change goals will give rise to different scenarios whose evaluation will be based on a set of stakeholder defined evaluation goals.

Therefore, change analysis in the IBC approach combines top down elicitation of future goals from stakeholders and bottom-up discovery of current goals based on the analysis of actual enterprise functionality.

Current goals are modeled in goal graphs in order to show their causal relationships. These goal hierarchies provide the context for analysing future goals. Each future goal is subjected to impact analysis in order to ascertain the effect that the future goal will have on existing ones. The result of this impact analysis (shown in Fig. 2), is a goal graph containing alternative ways of acting toward realising the desired change; in effect it is a model of the change process. We term this graph the enterprise change process model and the goals forming this graph the change goals.

The IBC framework is illustrated in Section IV, using examples from the ESIC Distribution application.

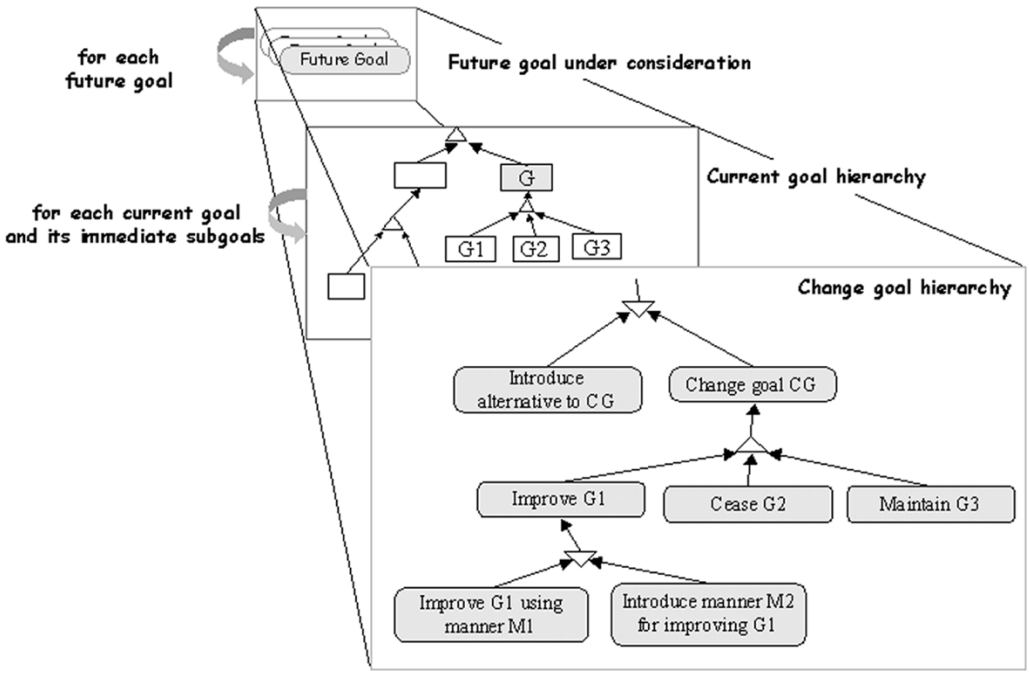

Fig. 2. Generation of alternative change scenarios in the IBC framework.

IV. Applying IBC to ESIC Distribution

The following sections demonstrate the IBC approach in the ESIC Distribution application (i.e., the modeling process); each step in this process results in the construction of goal-oriented models of the organization. Modeling of organizational concepts is based on the EKD ontology. A complete description of the EKD conceptual models is found in [38]–[42].

A. Goal Modeling for the Current Distribution Situation

The most common approach to acquiring knowledge about the current goals is to consult the enterprise actors. The inherent difficulty of this task is that people in the organization, know about their individual obligations however, they are seldom aware of how their role contributes to the realization of enterprise objectives [43]. On the other hand, enterprise descriptions found in existing corporate statements, mission statements, policies, procedures etc. usually prescribe an idealistic view of how things should be done rather than reflecting the actual behavior of organizational actors [16], [17], [44]. To overcome these problems we have used a descriptive approach, where knowledge about the organization goals was abstracted from current practice, thus establishing the connection between the enterprise purpose and behavior.

In particular, modeling of enterprise processes was facilitated by the use of actor-role diagrams [45] which present a high-level view of the association between enterprise actors. Actor-role diagrams describe the behavior of enterprise actors in terms of the roles that actors are playing. This is constrained by a) the actor's goals (presented in the body of the corresponding role) and b) the actor's dependencies on other actors (the dependency object is shown as a label next to the dependency link). This view recognizes the intentional nature of actors that is, actors do not tightly follow steps and procedures rather they purposefully act toward fulfilling their goals. An example of an actor-role diagram describing the actors involved in fulfilling a customer application to get connected to the ESIC Distribution network, is illustrated in Fig. 3.

Using the actor-role diagrams, identification of enterprise goals from individual role goals is based on the notion of goal abstraction through intentional affinities. In more detail, enterprise processes realize enterprise goals and at the same time each process is made up of a number of roles, which are individually responsible for achieving a number of "role goals." The satisfaction of the "private" goals of the roles involved in the process collaboratively supports the achievement of the operational goal that is realized by the enterprise process.

Fig. 4 illustrates the completed goal graph for the "electricity supply application fulfilment" process. The lower-level goals in this diagram are the operational goals presented in the "body" of each role in Fig. 3.

As in the case of role goals that collectively support the realization of process goals, so process goals collaboratively realize higher-level enterprise goals. Hence, by repeating the abstraction process for all enterprise processes a goal hierarchy incorporating all enterprise process goals can be constructed that explains what the enterprise currently aims to achieve. This process of abstracting from operational goals to higher intentions, naturally, involves a number of iterations with different enterprise actors. The resulting alignment between enterprise goals and corresponding processes gives rise to a clear exposition of the current business rationale.

A partial view of the overall ESIC Distribution goal hierarchy is graphically represented in Fig. 5. Each leaf goal in this hierarchy refers to specific enterprise processes studied in the actor-role diagrams. As seen in Fig. 5, the current purpose of Distribution is described by the goal "provide safe and uninterrupted supply of electricity at a reasonable cost." To achieve this Distribution should "minimize operational costs," "ensure

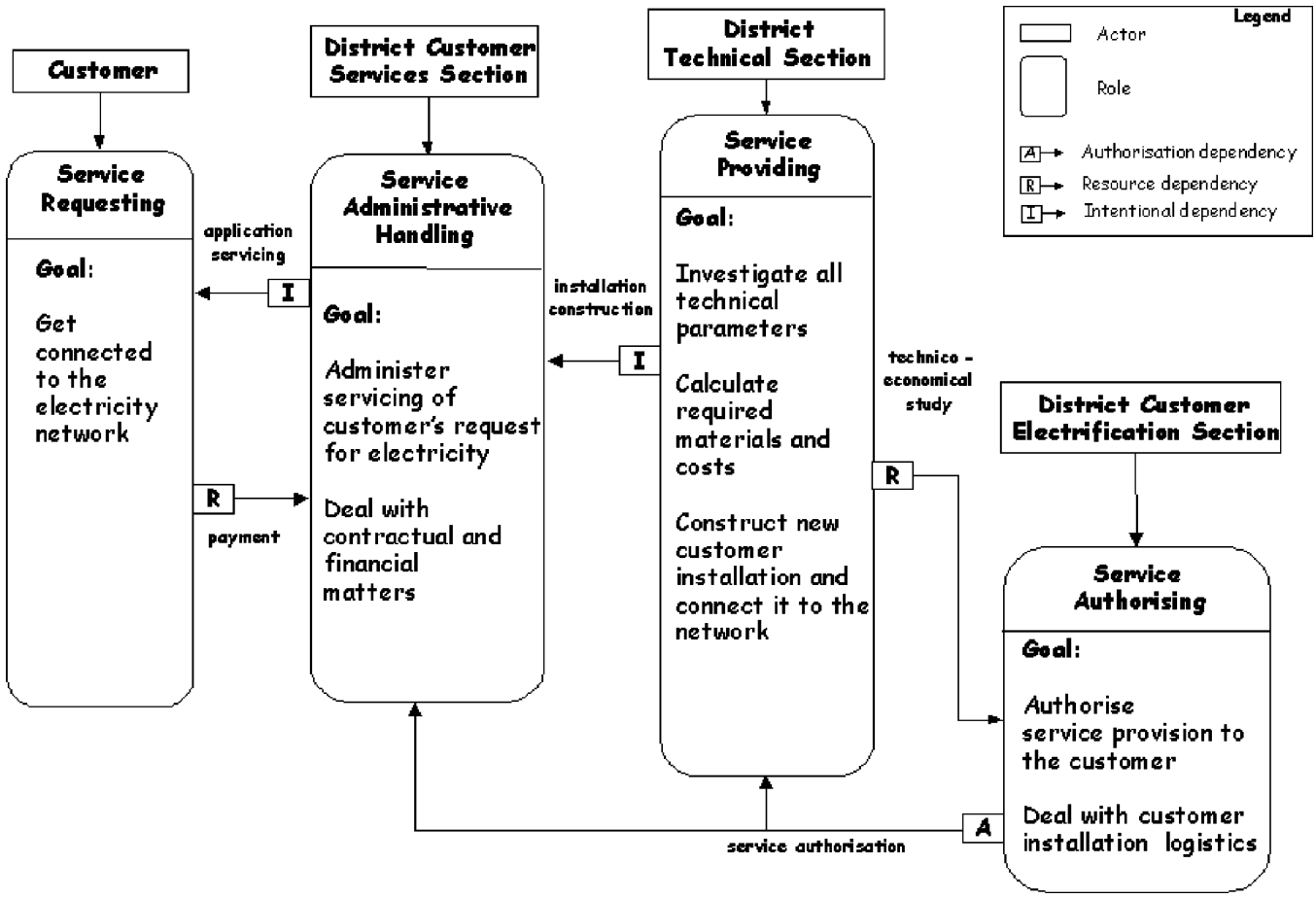

Fig. 3. Actors and roles involved in the "electricity supply application fulfillment" process.

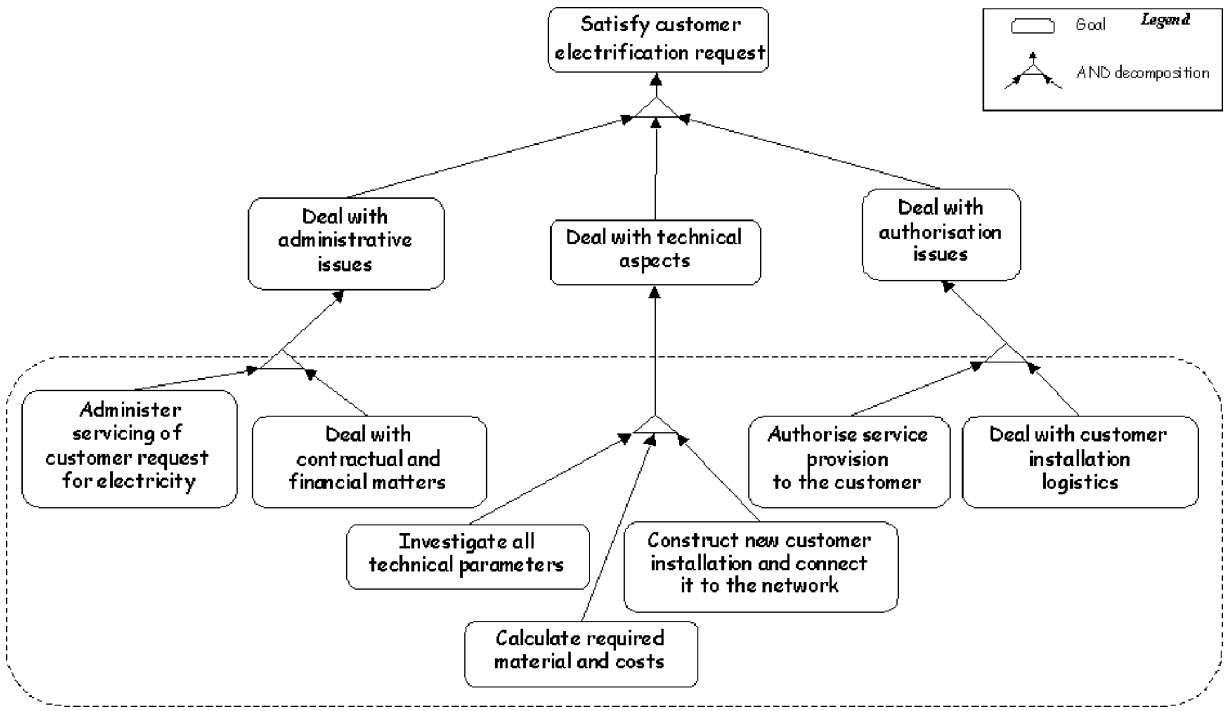

Fig. 4. Goal hierarchy for the "electrification of L/V customers" process.

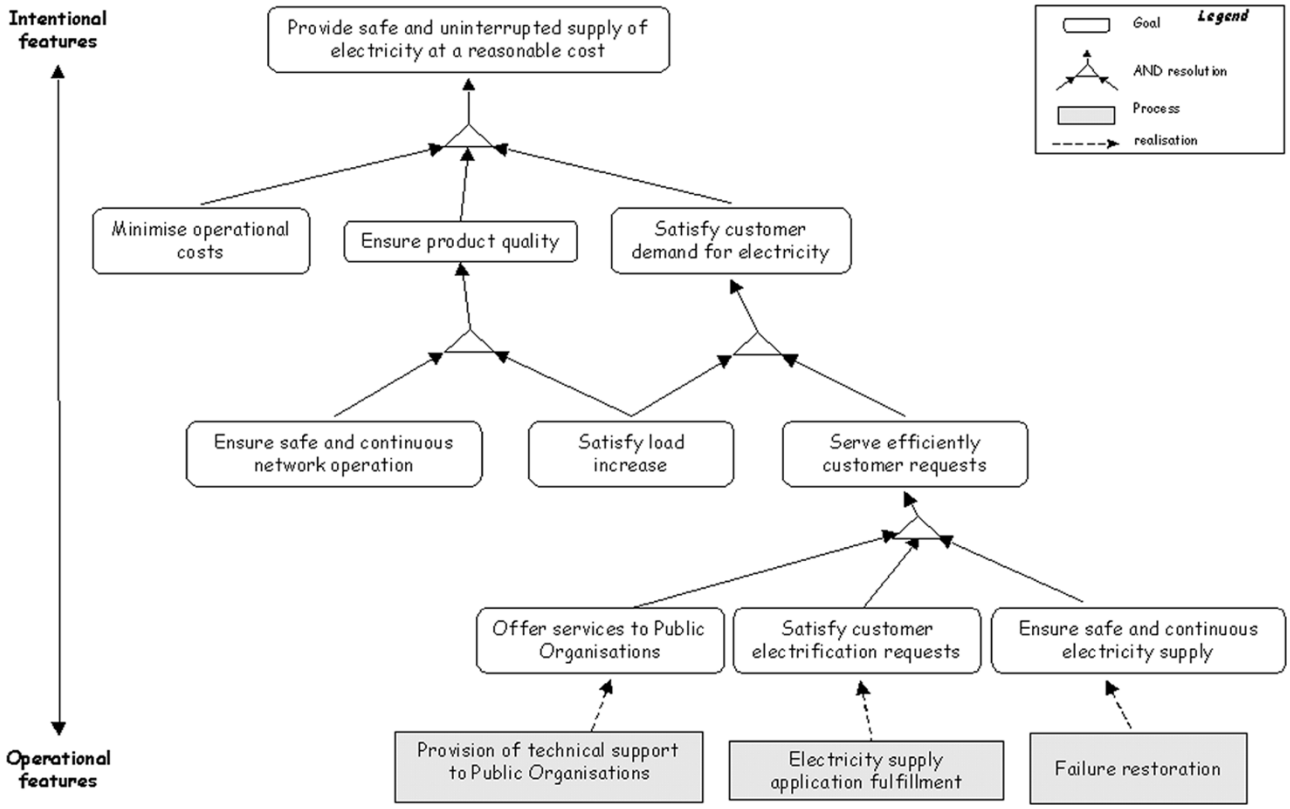

Fig. 5. Partial view of the overall ESIC goal hierarchy.

product quality," and "satisfy customer demand for electricity." In order to "satisfy customer demand for electricity" Distribution needs (among other things) to "serve efficiently customer requests" which in turn is satisfied through a number of enterprise process goals including the goal to "satisfy customer electrification requests" introduced in Fig. 4.

Fig. 5 also demonstrates how different processes support the realization of the same enterprise goal. For example, the "electricity supply application fulfilment" and the "failure restoration" processes both (ultimately) support the enterprise goal to "serve efficiently customer requests." The two processes respond to different types of requests and are serviced by different Distribution departments; as such they have been described as different processes by Distribution personnel. However, modeling of enterprise goals revealed that they both are components of the same macro-process, which deals with customer servicing.

An additional advantage, therefore, of explicitly modeling enterprise goals was that it assisted the logical organization of business processes into a few core processes according to strategic business goals. This contributed to a process-centred orientation of the enterprise, putting emphasis on "global" objectives rather than "internal" goals of individual processes.

B. Goal Modeling for the Future Distribution Situation

Successful identification of future goals is critically dependent on the communication of knowledge among different actors that are affected by or may affect the future enterprise situation. The importance of stakeholder involvement as opposed to passive information provision, is advocated in the systems literature (e.g., [46]–[49]) and is embraced in recent organizational studies [12], [50]–[54]. The benefits of such an approach lie in the face-to-face exploration of current problems and future needs with the aim of developing a shared understanding of the issues involved.

In the Distribution case, initial stakeholders analysis revealed a number of interested groups that affect or can be affected by Distribution re-organization. These naturally included Distribution staff from the different Distribution divisions namely: 1) Distribution strategists who had a long term view of their company's future direction; 2) Distribution operational staff whose work would be affected by the implemented changes; 3) managers of different Distribution divisions who would ultimately be responsible for the introduction of changes; and 4) Distribution IT specialists who would be responsible for any decisions regarding change in the company's support systems. The identification of the above stakeholders was facilitated by studying the Distribution business process models created during the previous step.

Additional stakeholder groups included the external regulators (in this case the EU directive and the ministry of energy), the captive and eligible Distribution customers, the method providers (i.e., requirement engineers familiar with the change analysis route), business consultants specialising in the electricity supply industry, etc.

Stakeholder analysis provided the opportunity for cross checking of assumptions about the stakeholders who might be affected by change process. Subsequently, stakeholders were involved in extensive workshops aiming at developing a shared

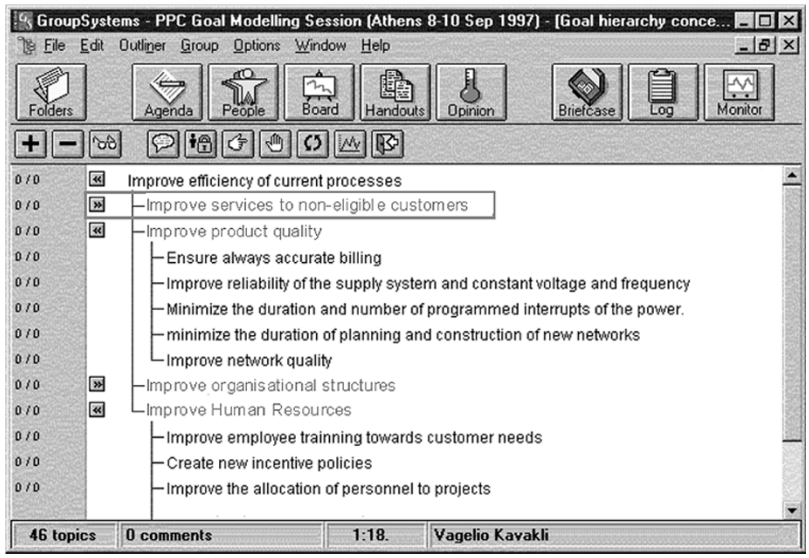

Fig. 6. Refining future Distribution goals.

understanding of the current Distribution problems and weaknesses as well as threats and opportunities facing Distribution due to the introduction of competition in the internal market. Since it was not possible for each and every member of the different stakeholder groups to be involved in the co-operative sessions, it was critical to ensure that all identified stakeholders were adequately represented. This was true both for nonhuman stakeholders (e.g., the EU directive) that could not speak for themselves as well as human stakeholders (e.g., customers, competitor companies, etc.) that even if they played an important role for the company could not be involved in the decision making process concerning the future Distribution strategy.

In the course of the first group session it became obvious that within Distribution there was not yet a common understanding of the future situation in the internal electricity market and the changes that this could bring to Distribution, neither a clear vision shared by everyone in Distribution concerning the strategic goals of the company in order to become more competitive and survive in the new situation. Conflicting views were manifest both between Distribution strategists and operational staff, but also among Distribution strategists, the reason being (a) the uncertainty of the future situation, and (b) the different perceptions that different Distribution personnel had on the issues for change.

In order to facilitate the analysis of change issues and the acquisition of the Distribution future goals, we employed a co-operative, discussant approach, which gave the ability to participants to: 1) loosely define and rationalise issues regarding the future situation; 2) refine and categorise change issues; 3) prioritise issues through a variety of voting procedures; 4) analyze interdependencies between the future goals; and 5) hinder dominant participants so that they did not adversely affect the outcome. The whole process was assisted by the use of Ventana GroupSystems [55]. GroupSystems is a suite of team-based decision software tools (e.g., Issue Categoriser, Electronic Brainstorming, Group Outliner, Topic Commenter and Voting tools) that were used for the elaboration and resolution of change issues and the identification of future goals.

By engaging in these modeling activities the participants managed to agree on a number of critical issues relating to the future of Distribution. These included but were not limited to: 1) regular Distribution "values" (e.g., the safe and uninterrupted provision of electricity); 2) problems (e.g., the introduction of competition); 3) innovations (e.g., new technologies); and 4) development ambitions (e.g., Distribution's plans to become a bigger company by providing additional "home services").

Every topic was discussed and arguments were given concerning the relevance and importance of each topic with respect to the company strategy. Using these topics as a framework for the discussion, the meeting participants identified a number of strategic goals with respect to each topic.

Future Distribution goals were further discussed between the participants leading to a more elaborate list that represented the agreed position of all participants about the necessary changes that formulate the Distribution goals in the new competitive environment. Redundant goals proved useful since they notified strong need in a certain direction and agreement between different stakeholders. An example of this goal refinement activity using the GroupSystems software tool is shown in Fig. 6.

C. Goal Modeling for the Change Process

Future goals express the stakeholders' needs and wishes as well as external constraints with respect to the change into consideration. However, they give very little information about the way these requirements may be operationalised in terms of enterprise processes and actors involved or about how the existing enterprise structures and practices will be affected.

To this end, we used a "goal deployment" strategy which took advantage of the organizational descriptions of the current situation developed in the first stage of the change management process. The main idea of this strategy is to try to re-interpret each future goal in relation to the existing enterprise goals. The process consists of progressively generating the hierarchy of change goals by studying the impact of the future goals onto the current goals in a top down manner, starting with the top level goal and examining its descendants step by step, until the

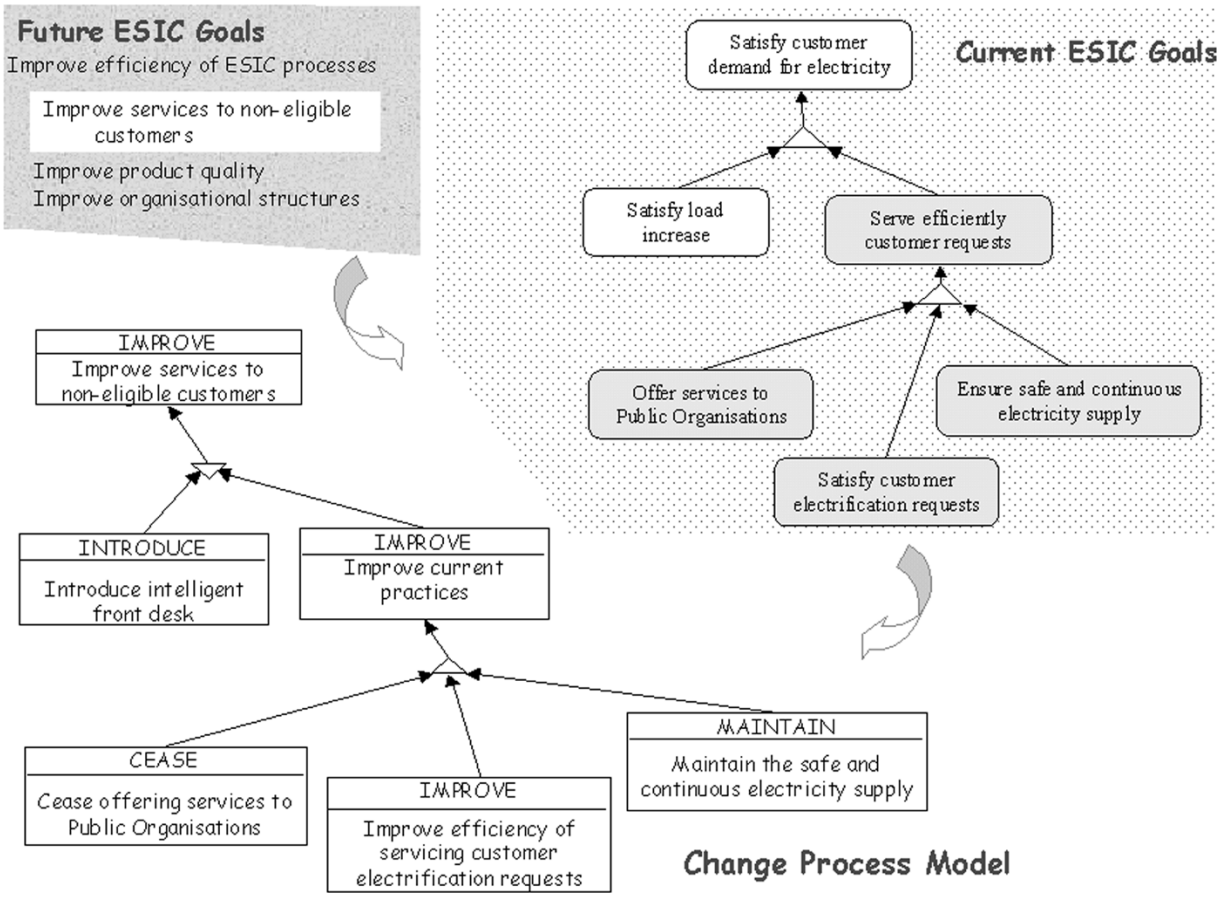

Fig. 7. Reason about future Distribution goals in relation to current goals.

leaves are reached. The hierarchy of change goals is constructed accordingly, in a top down manner, step by step, by generating the change goals either as adaptations of the current goals or by introducing new goals.

Let us consider the future Distribution goal "improve services to noneligible customers" introduced in Fig. 6. Servicing its customers is obviously not a new goal for ESIC. Indeed one of its current high-level goals is to "serve efficiently customer requests" (see Fig. 5). Thus, satisfycing of the future goal "improve services to noneligible customers" will clearly impact the way the current goal 'serve efficiently customer requests' is realized. In particular, ESIC personnel identified two types of impact: to improve/adapt the current way of realization or to introduce a new intelligent front desk. These two alternatives "improve current practices" and "introduce intelligent front desk" are two alternative resolutions of the future goal "improve services to noneligible customers."

The first alternative 'introduce intelligent front desk' is a new goal that will require the introduction of new type of processes that did not previously exist in the company. On the other hand the alternative of "improving current practices" can be realized based on the analysis of the impact on the existing goals referring to customer servicing namely, the current goal "serve efficiently customer requests" and its subgoals highlighted in light grey in Fig. 7.

As shown in Fig. 7, improving current Distribution practices would require to: improve the efficiency of satisfying customer electrification requests, maintain the goal of ensuring safe and continuous electricity supply, but cease offering services to public organizations. These three complementary change goals corresponding to adaptations of the existing goal hierarchy constitute a further resolution of the future Distribution goal to 'improve services to noneligible customers'.

Repeating this process for every future goal and its associated current goals, leads to the identification of alternative ways for resolving the enterprise change requirements. The result of the process is modeled in the spirit of an extended AND/OR goal graph. Change goals in the graph are labeled as introduce, maintain, cease or improve depending on the kind of behavior required by the organization for realising these goals. In particular, introduce goals correspond to the introduction of new processes, while the remaining three types of goal (improve, cease, maintain) correspond to improvement, cessation and maintenance of current processes accordingly.

Fig. 8 presents an extract of the Distribution Change model. This model describes a number of possible routes to be followed by Distribution in order to become more efficient and competitive while complying with the constraints imposed by the EU. As can be seen in Fig. 8, the Distribution change model is divided in four major branches each referring to a sub-hierarchy associated to the top level goal "reorganize Distribution to deal with market deregulation."

D. Goal Modeling for Evaluation of Alternative Distribution Scenarios

Evaluation of alternative change scenarios involves both revision of the identified change process model as well as evaluation

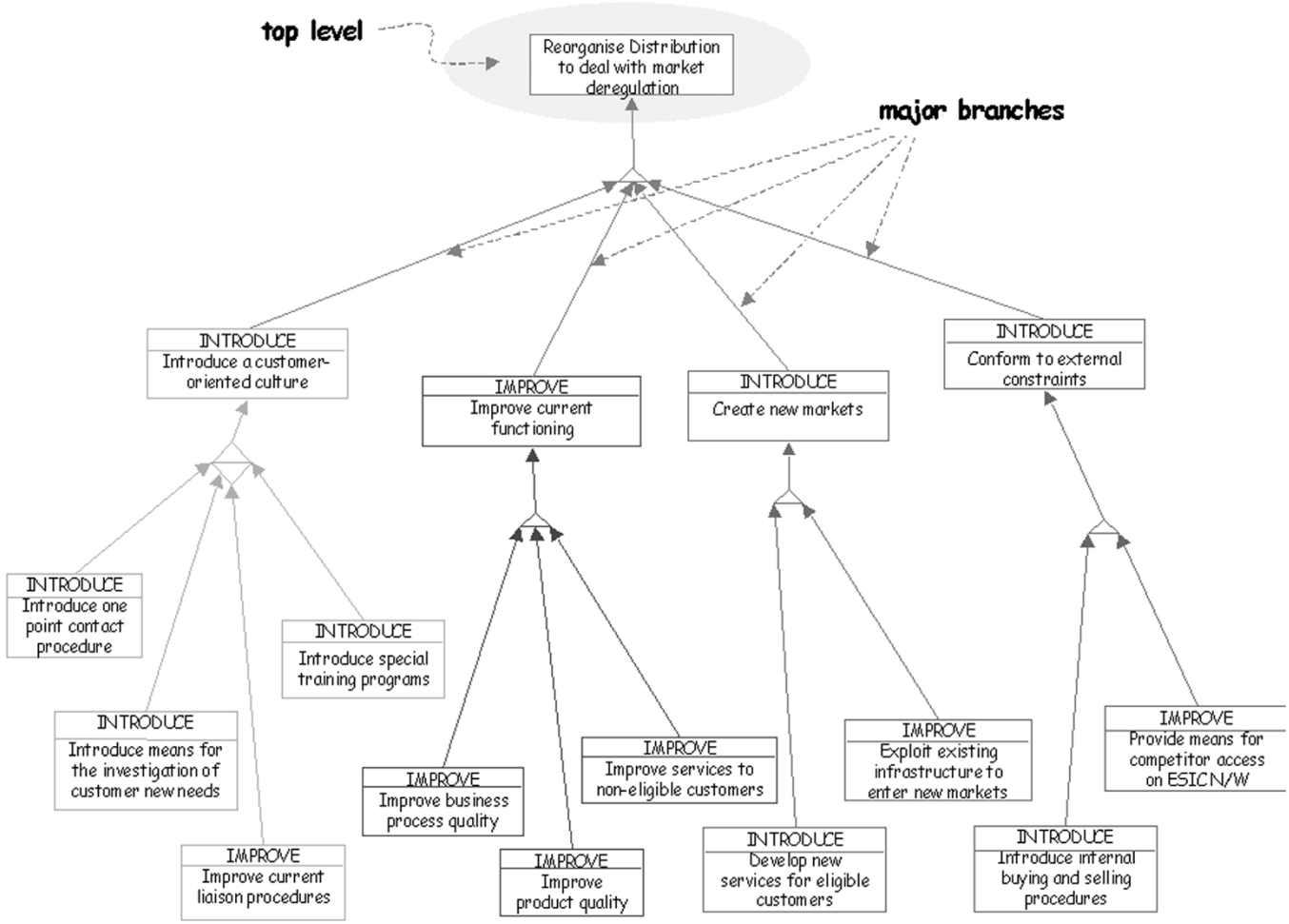

Fig. 8. High-level view of the Distribution change model.

of the revised change scenarios based on stakeholders' criteria (termed evaluation goals).

Revising the original change process model in the Distribution case was necessary due to the extensive number of change scenarios incorporated in each branch. Thus, prior to applying a detailed evaluation technique, it was necessary to further reduce the number of alternatives to a more manageable number. To this end, each branch shown in Fig. 8, was revised by the top managers of the enterprise based on the evaluation goals specified beforehand by Distribution management, namely feasibility to deliver in the given time frame, added value, cost, balance of concerns, product quality, and productivity.

Revision of each branch resulted in a number of alterations including the modification of logical operators in the causal relationships between change goals; the introduction of new change goals; the introduction of new goal resolutions; and most importantly, elimination of change alternatives thus reducing the number of alternative change scenarios. In general, this exercise gave an additional opportunity to validate the goal graphs in the light of gathering new knowledge from top management. The revision of the "branch" corresponding to the change goal "create new markets" is illustrated in Fig. 9.

As can be seen in Fig. 9 the number of alternatives contained in the revised branch was drastically reduced from eighteen to the following two alternatives corresponding to the two alternative change goals: "introduce intelligent front desk as single shot' and 'Introduce intelligent front desk evolutionarily."

Evaluation of the remaining alternative scenarios by major branch was performed first at individual level (using questionnaires) and then, at group level (in co-operative sessions). The former aimed at collecting individual opinions on a particular alternative. Every stakeholder of the enterprise was asked to complete an evaluation questionnaire. Each questionnaire included a natural language description of the change plan into consideration and a marking table. The marking table enabled individual stakeholders to assess each change scenario against the each evaluation goals in a nominal scale from very low to very high. A detailed description of the different evaluation goals was also included.

The main objective of the co-operative evaluation sessions was to assess the level of agreement between different Distribution stakeholders regarding both the evaluation of individual change scenarios and the comparative evaluation of antagonistic scenarios. The Ventana Group Systems toolset was used once again to facilitate sharing of ideas and to poll the evaluation results.

Fig. 10 shows the overall evaluation table concerning the change plan to "introduce intelligent front desk for serving efficiently customers as single shot." This table presents an aggregation of the results of individual questionnaires giving

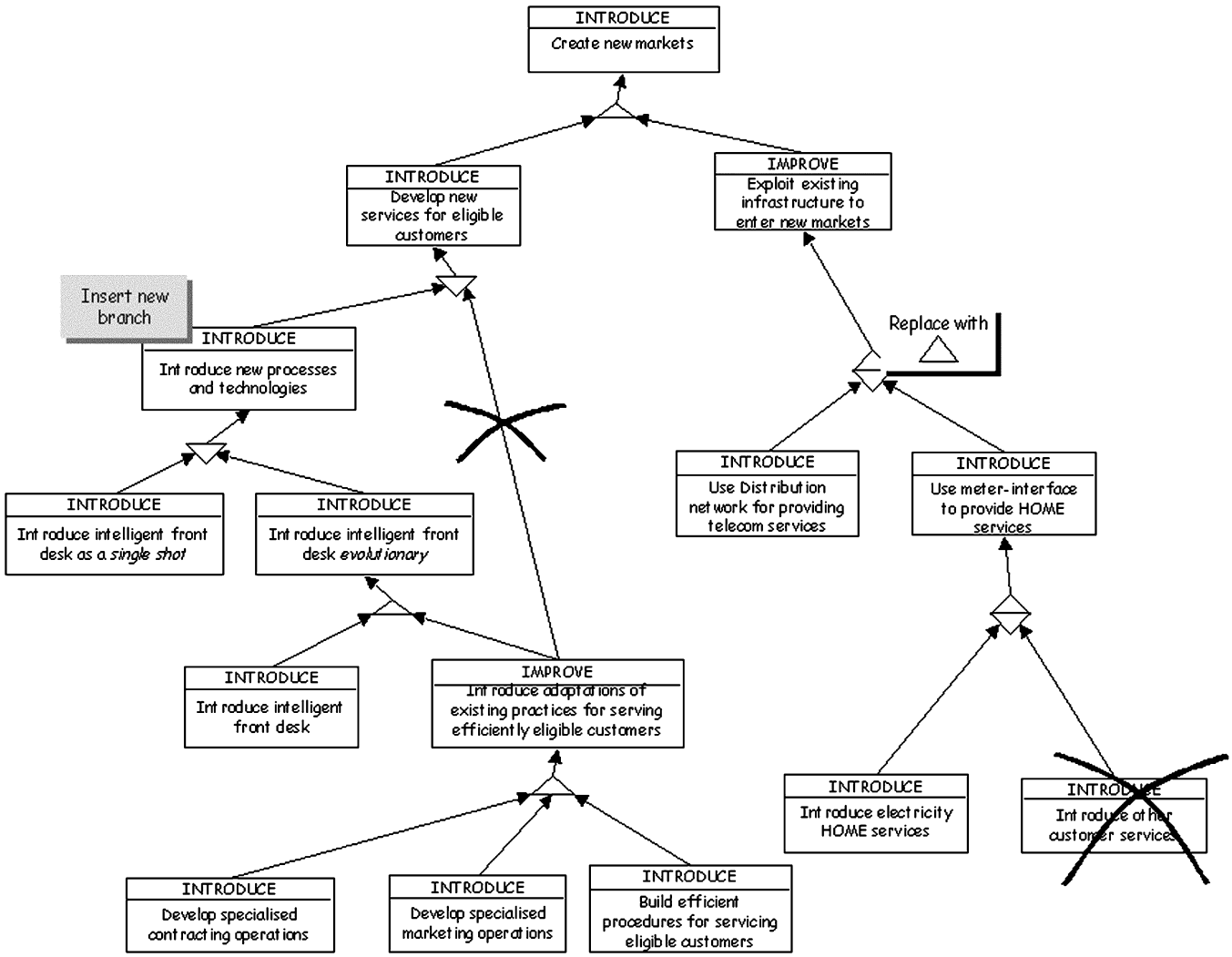

Fig. 9. Partial view of Distribution change model concerning new markets after revision.

Change Scenario	*Introduce intelligent front desk for serving efficiently customers as single shot.*								
Description	*Introduce information front desk as a re-engineering project. The change will involve complete redesign of service processes and supporting IT systems. The implementation horizon is 5 years and focused on eligible customers.*								
Evaluation Goals	**NA**	**Very Low**	**Low**	**Average**	**High**	**Very High**	**Total**	**STD**	**n**
Feasibility to deliver in the given time frame	0	0	1	1	2	0	13	0.96	4
Added value	0	0	0	0	3	1	17	0.50	4
Cost	0	0	0	1	2	1	16	0.82	4
Balance of concerns	0	0	0	2	1	1	15	0.96	4
Product quality	0	0	1	0	0	3	17	1.50	4
Productivity	0	0	0	0	2	2	18	0.58	4
NA = Not Applicable STD = Standard Deviation N = Number of participants									

Fig. 10. Cumulative results of the evaluation of the one shot scenario.

the total score per evaluation goal, the number of opinions considered and the standard deviation.

When the level of agreement between participants was low then the evaluation had to be repeated following a discussion aiming to identify conflicting views and clarify possible misunderstandings of the situation. If again it was not possible to reach a consensus then quantitative evaluation of each alternative was attempted using metrics associated to each evaluation

goal, following the GQM paradigm [19]. For example, the metrics attributed to the evaluation goal feasibility to deliver in the given time frame included the time required to employ new personnel and the man-months needed for training personnel under the new conditions.

The identification of metrics proved to be very useful in making the evaluation goals more tangible to business experts. In addition, metrics provided a quantitative basis for discussing the appropriateness of alternative change scenarios. This quantitative evaluation represented an approximate measure based on the estimations of organizational experts. Nevertheless, such measures provided participants with useful insights concerning the effectiveness of different plans.

Interpretation of evaluation data corresponding to alternative change scenarios, raised a number of issues. First, different evaluation goals were not equally important. For example, there were cases that product quality was considered more important than cost while there were situations that the opposite applied. Moreover, there was no clear relation between different criteria. For example, it was not possible to define that product quality weights twice as much as cost, or that productivity of services is twice as important as the feasibility to deliver services in a given time frame. Thus, a change scenario could get a high average marking but still be unsuitable if it was given a low mark with respect to evaluation goals of strategic importance for the organization. Ranking the evaluation goals with respect to their relative importance to the organization proved to be of assistance.

In conclusion, both change scenario evaluation as well as interpretation of evaluation data was dependent on subjective judgement of involved participants. Disagreement between stakeholder judgements was alleviated by the use of voting procedures.

We should note that since the evaluation was performed by major branch in the change model the evaluation process resulted in a set of preferred scenarios one from each branch. However, due to potential interdependencies between preferred change scenarios in different branches, we also had to consider the global impact that such partial choices could have. This in some cases revealed that the implementation of one change scenario could have a strong impact on a change scenario in a different branch. Therefore, the preferred set of change scenarios had to be re-examined and revised.

V. Insights Into Using IBC to ESIC Distribution

The ESIC case reflects the concerns of a large number of companies world-wide facing the challenges of deregulation, globalization and increased competition. Goal-oriented modeling of ESIC's change process demonstrated a rich combination of challenging features including interfering goals, multi-agent co-operation and communication, uncertainty of the situation and complexity of the problem. The above issues contributed to a considerably large space of alternative decisions and compromises to be made throughout the process.

Even though the work presented in this paper considers one of the possible goal-driven ways-of-working, and thus a subset of the existing goal-driven strategies, the practical implications that we experienced during the ESIC application are not specific to the chosen methodology but highlight significant issues that affect the application of a large number of goal-driven strategies. These are discussed in detail in Sections V-A–V-D.

A. Reflections on Goal Modeling for the Current Situation

Studying and documenting existing business processes is a fairly "expensive" task both in terms of time and human resources. Nevertheless, it dramatically improves the understanding (both among change analysts but as we have seen in Distribution also between enterprise actors) of the work that needs to be redesigned and/or automated through the development of a software system. The process can be substantially facilitated by the use of process modeling tools for authoring, storing and accessing business processes.

A number of goal-driven approaches (e.g., F3, ISAC), suggest a participative rather than an expert-driven modeling approach. Participative modeling should in theory result in better process models, since these are developed by the business experts themselves. However, in practice this is not always possible due to the level of resource and commitment required. This can be further complicated by participants' resistance, particularly if they think that the change into consideration represents some threat to their job and that they may either be replaced as a result of the business re-organization or may be deskilled by the introduction of a new computer system.

In some cases the separation between business experts and change analysts is such that communication is limited to interviews and source document review. The problems that we encountered when using these means in ESIC were: 1) published organizational documents do not always match reality; 2) business actors tend to focus inward toward their individual responsibilities and miss the global organizational picture; and 3) interviews with individual actors do not reflect the political and social structure of the business.

Indeed in all organizations, there are subtle power and influence relationships between the different people in the organization. An actor's view of the organization is influenced by these relationships but this does not become explicit in individual interviews or organizational charts. Rather such political structures become evident in group sessions involving different stakeholders and this gives requirements engineers the ability to better understand the "real" rationale for the existing behavior.

Another area of concern when discovering the existing business state is the level of detail that is necessary in order to describe business processes. Problems likely to be encountered include:

1) simplistic analysis: processes are often complex and sometimes a simplistic analysis of a process suggests invalid description. Checking with business experts before finalising the models is essential.
2) excessive detail: often the objective of business re-organization is radical change. In this context, detailed maps of current processes can be largely irrelevant [43]. In such cases, broad-brush models of the way the business operates and how processes traverse the functional silos are sufficient.

B. Reflection on Goal Modeling for the Future Situation

Analysis of future goals requires the active participation of different enterprise stakeholders, coming together in a meeting situation. As with any group meeting there should be an agenda and someone to act as chairperson or facilitator of the meeting. People must listen effectively, feel free to express ideas, and be empowered to participate in the process and the outcome of the meeting.

Nevertheless, in practice a number of complications may arise (and have indeed arisen in the ESIC case). These include the following.

1) Problems in committing stakeholders. Participation in time consuming workshops (especially in small companies, or ones experiencing rapid growth) entails an increase in the user's workload and responsibility; if they are not appropriately compensated then this may lead to resentment and eventually lack of co-operation.
2) Problems in committing the "right" stakeholders. It is desirable that participating stakeholders have influence by authority within the organization. For example, if the change into consideration encompasses a restructuring of the business, low level managers usually do not have the knowledge or capacity to decide at that level.
3) Problems in stakeholder co-operation. Such problems arise due to the diversity of expertise and motivations of meeting participants. [53] lists a number of complications that may arise during group sessions including: "multiheaded beast syndrome," which is manifested by symptoms such as digressions, interruptions and not listening; the "feuding functions" syndrome where subgroups form within the meeting and there are hidden agendas being pursued; "dominant species" syndrome, typified by unequal air-time and passive/aggressive body language; and "sleeping meeting" syndrome, with symptoms including long silences, absence of ideas, and withdrawal.

Toward the first two problems, it is necessary to ensure the commitment and participation of stakeholders high enough in the organizational hierarchy so that if it is necessary to pull staff resources then they will have the authority to do so.

Regarding stakeholder co-operation, it became apparent during sessions in the ESIC case that for stakeholder workshops to be effective an expertise in facilitation is needed. The role of the facilitator is to assist group members in performing their collective task as a group. This role is often played by requirement engineers. To this end, training in facilitation skills is necessary. To rely entirely on "learning on the job" is time-consuming and potentially damaging to the credibility of the person playing the facilitator role.

In addition to facilitating meetings, the stakeholders need techniques which will encourage multiparty interaction and support negotiations between participants. Our experience in the ESIC case, points toward the advantages of using a software groupware tool to support group meetings. In particular, such tools can assist the organization of more "democratic" group meetings since by allowing each participant to synchronously add (type) their views to the common discussion board, they prevent strong personalities from dominating discussion time and imposing their views on other participants while at the same time anonymity helps shy participants to express their ideas more freely. Another important advantage of using software tools is that all electronic discussions and reported, arguments are stored in the tool repository and can be used to trace the rationale of decisions taken.

However, it takes at least one session for the participants to overcome their scepticism concerning the use of software tools during face-to-face meetings. Indeed, in order to use groupware tools effectively: (a) participants should not be intimidated by the use of technology and (b) it should be made clear that the aim of using such tools is to complement rather than replace verbal face-to-face communication, by providing an additional means of communication that of electronic discussion.

C. Reflections on the Goal Modeling for the Change Process

Generation of alternative change scenarios is one of the most distinctive functional demands posed during change analysis. Generation methods vary in the extent to which they employ reasoned analysis, creative imagination and / or experiential knowledge.

In the ESIC case, emphasis was also put in acquiring and using pre-existing domain knowledge (sometimes called best business practice knowledge). More specifically, an attempt was made to identify generic deregulation models in the electricity supply sector. To this end, we studied several reports concerning electricity deregulation published by international organizations such as OECD [56] and World Bank [57], case studies concerning the reorganization of electricity supply companies in different countries [58], consultants' reports, etc. This enabled us 1) to understand the available alternative strategies for transforming ESIC Distribution and 2) to define the possible ways of pursuing such alternatives in the particular organizational context of Distribution.

In general, the formulation of change scenarios raises the following issues.

1) In several cases initial scenario formulation can be too ideal in the sense that the suggested plan cannot be satisfied due to overoptimistic assumptions about the future situation, or because they were too costly to pursue, etc. Hence, the initial suggestions have to be revised in order to deidealise change plans.
2) The space of alternative ways of satisficing a given change requirement can be very large. Often alternative positions are not exclusive. In the ESIC case, this lead to the introduction of a new goal satisficing relationship termed AND/OR (depicted as a diamond shape in Fig. 8) in order to make possible the expression of a multiple choice between several options.
3) In many cases expressed change goals can be interpreted in many different ways. Relating to current organizational models proved to be very useful in clarifying and resolving change goals (especially the ones dealing with improvements of the existing situation). Moreover, the use of a standard template for defining organizational goals and the provision of keywords for expressing change goals

(e.g., improve, cease, etc), can assist the presentation of change goals in a consistent way so they become more understandable, easier to read, write and collect.

3) Consideration of existing solutions in the form of best business practices or patterns, is an effective way to save time and effort, however such patterns have to be customised in the specific organizational context.

Once again the overall process is very much dependent on involvement of domain experts. Due to the strategic nature of the discussed changes, the profile of participants during this task have to be such that it can provide substantial input to questions of strategic and visionary nature.

D. Reflection on Goal Modeling for Alternative Scenario Evaluation

One of the main objectives of the evaluation process is to improve (rather than prove) the proposed scenarios so that they are consistent with stakeholders' expectations. The problem with evaluating abstract models is that people cannot choose between abstract hypothetical alternatives but only tangible alternatives that are in fact available [59]. Evaluation is more effective in fields like industrial design, where well-understood physical entities and processes are involved, than in a field like organizational design or strategic planning, where little causal knowledge is available [60]. Tracing the rationale of proposed alternatives proved to be of assistance.

More reliable results can be obtained by using test cases to test alternative scenarios. In practice though, it becomes an issue of availability of resources. On the other hand, when using questionnaires the process greatly depends on the ability to define the right evaluation criteria, to ensure that these criteria are understood by all participants and to involve the right people in the process.

Typically, one cannot approach all stakeholders but rely on a sample of individuals. Thus, some degree of bias is almost inevitable. For example, the sample used in evaluation studies may consist of managers and not of front line workers—a very specific group of actors and roles. This phenomenon will tend to bias the results away from an overall unbiased organizational evaluation. Another issue that affects the validity of evaluation results using questionnaires is that the answers given by a respondent are typically influenced, to some extent, by the phrasing of the questions and even by the tone or attitude of the interviewer or session facilitator. Additional bias can be due to fear or hidden agendas such as potential loss of a job or personal aspirations. To overcome such bias more sophisticated statistical methods can be used to select the stakeholder sample and interpret acquired data (see [61]).

Finally, it should be noted that scenario evaluation provides organizational stakeholders with a rationale means of making an informed choice. This choice is ultimately that of the key personnel concerned with change and although this is outside the scope of evaluation per se, nevertheless, one should be aware of the political, social, and organizational factors that affect the final choice.

VI. Conclusion

This paper focuses on the practical aspects of applying goal-oriented modeling of organizational change in an industrial re-organization project. It illustrates the application of a systematic way-of-working focusing on the change modeling process giving an account of the obtained results. The industrial application exposed a number of issues which have been used to revise and enhance the proposed goal modeling strategies.

Furthermore, the experience gained during this study has substantiated the view that the goal-driven way-of-working to be followed as well as its application in a particular change project is very much dependent on the enactment context of the project. Indeed, application of the specific strategies was greatly affected by a number of situational factors including:

- organizational culture;
- ability to commit resources;
- social skills and consensus attitudes of participating actors;
- use of software tools to facilitate the process execution;
- familiarity with applied strategies and supporting technologies.

The implication of these empirical observations is that the goal-oriented modeling of organizational change cannot be fully prescribed. Even when one follows a certain strategy the situational factors dominating the project may cause a number the adaptations to this strategy. This fact strengthens the position that in order to support the modeling of organizational change flexible guidelines are more relevant than rigid rules.

The ESIC application experience has been instrumental in defining the requirements for providing methodological support toward the execution of the goal-driven processes. To this end, our current research efforts focus on the creation of a methodological roadmap for guiding the application of different goal-oriented strategies. A roadmap provides the infrastructure for modularising and consequently integrating parts of alternative goal-oriented methods, called method fragments. This allows the adaptation and extension of existing methods so that they can fit to the characteristics of real projects and their contexts [62]–[64]. Navigation of a roadmap needs to be facilitated by associated guidelines. These guidelines describe knowledge regarding the situations under which a method fragment is applicable as well as the particular process that should be followed in order to apply a particular method fragment. Progress of our work in this area has been reported in [65], [66].

Acknowledgment

The authors would like to thank the contribution of the industrial project partners for their assistance and cooperation in the application described in this paper and the contribution of Prof. C. Rolland and Prof. J. Bubenko and their respective research teams in the overall project. Also, the authors wish to express their gratitude to the anonymous reviewers for their useful comments on an earlier version of this paper.

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