Goal-Driven Business Process Analysis Application in Electricity Deregulation

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Abstract

Current business challenges such as deregulation, mergers, globalisation and increased competition have given rise to a new process-centric philosophy of business management. The key issue in this paradigm is the concept of business process. From a methodological perspective, this movement has resulted in a considerable number of approaches that encourage the modelling of business processes as a key component of any improvement or re-engineering endeavour. However, there is a considerable controversy amongst all these competing approaches about the most appropriate way for identifying the types and number of relevant processes. Existing business process modelling approaches describe an enterprise in terms of activities and tasks without offering sufficient guidance towards a process-centred description of the organisation.

In this paper we advocate the use of a goal-driven approach to business process modelling. A systematic approach to developing and documenting business processes on the basis of the explicit or implicit business objectives is put forward. We argue that such an approach should lead to a closer alignment between the intentional and operational aspects of an organisation. Our approach is exemplified through the use of parts of a large industrial application that is currently making use of a goal-driven business process modelling.

1 Introduction

The traditional practice of managing an enterprise adopts a functional view in which the business is organised along individual types of work performed, resulting in organisational structures which reflect the particular functional view adopted by the business. The main reason for adopting a functional organisation is the achievement of maximum performance of individuals or business functions. Nevertheless, this inward focus on 'internal' performance rather than 'global' efficiency suffers from a number of drawbacks, especially when business improvement is sought. In particular, improvements occur piecemeal and independently of one another, while concentration on the symptoms of one function ignores causes in important cross-functional interdependencies.

Current business challenges such as deregulation, mergers, globalisation and increased competition, have given rise to a new philosophy of business management that organises an enterprise in terms of processes rather than functions and tasks. The basic characteristic of this approach is the re-orientation of business from performing as a cluster of functions or divisions to integrating activities within a limited number of core processes. Each core process captures cross-functional interdependencies and concentrates on few strategic objectives that determine competitive success. Therefore, a process centred approach links improvement efforts in different functions to a shared set of strategic objectives.

Adopting a process view however, requires suitable tools for identifying, modelling and measuring business processes. Existing business modelling approaches describe enterprises in terms of activities and tasks offering little or no guidance towards a process-centred description of the organisation. In this paper we advocate the use of a goal-driven approach whereby a business is seen as a purposeful system aiming to achieve defined objectives which add value to its customers. This approach is part of a larger enterprise knowledge modelling framework, known as the EKD approach [Loucopoulos, Kavakli, et al   1997].

Allied to business process modelling is the larger issue of *business change* itself. Business change is also seen as goal-driven in EKD; the need for business change is externalised in terms of strategic business goals, which in turn shape business processes. Therefore, business change management is the process of identifying the business goals for change and analysing the impact that these goals have to business processes.

The paper is organised as follows. Section 2 introduces the industrial application which is referred to throughout the paper. Section 3 introduces the notion of business process in terms of its defining characteristics and presents a critique of existing process modelling techniques. Section 4 briefly introduces the goal-driven approach to business process modelling. The application of the approach is illustrated in section 5, using examples from the industrial application introduced in section 2. Finally, section 6 concludes with a discussion on the role of goal-driven business process modelling within the broader context of business change management.

2   Background to the Application

The work presented in this paper is part of a big industrial application that concerns de-regulation of a large European electricity company.

The company is divided in three operational areas generation, transmission and distribution. Generation is responsible for the production of electrical power. Transmission is responsible for the high voltage transport of electricity. Finally, 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. These areas operate under the rules and regulations of a governmental regulatory body that controls issues like tariffs, production levels, environmental policies, etc. Currently the company operates in a total monopoly market which means that it is the single operator of all three areas. A high-level view of the main company actors and their roles is illustrated in Fig. 1.
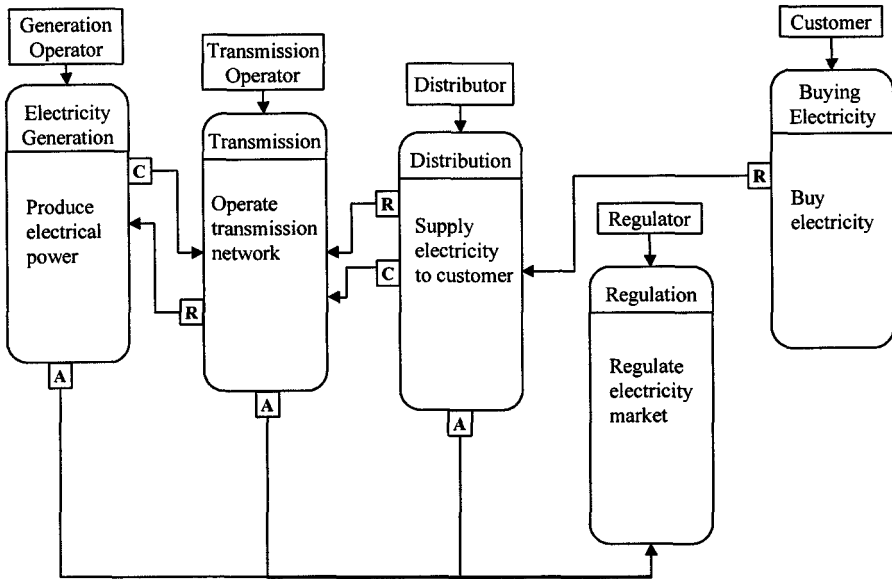

Fig. 1. Main company actors and their roles in the monopoly market

In anticipation of the opening of the European electricity market, the company is in the process of re-designing its business structure and planning reforms for the future, in order to increase its competitiveness and retain its market share. This is especially critical in the distribution area which is the interface of the company with the final customer. Adopting a process view of the business is a key factor in this effort.

Experience from previous projects in the company has shown the need for a structured approach for describing and measuring the business processes. Nevertheless current methods focus on *what* it is done (the tasks and activities performed) rather than *how* work is done in terms of processes, offering little assistance in this direction. This study reports on the application of a goal-driven approach whereby business goals are put forward while identification and analysis of business processes is based on their *intentional affinity*. For the purpose of this paper we focus on one section of the distribution area, namely the Distribution District.

The current structure of a Distribution District is organised along four distinct functional sections illustrated in Fig. 2: the Technical Section, the Customer

Electrification Section the Personnel Section and the Customer Services Section (or agencies).
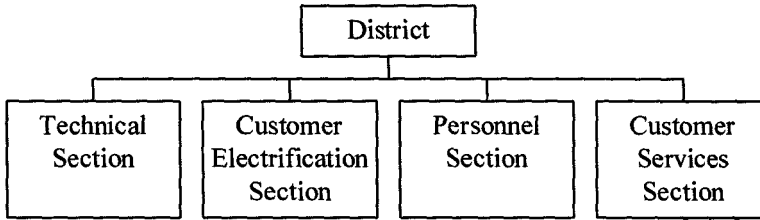

Fig. 2. Functional organisation of a District

The Personnel Section deals with internal matters of District employees, including safety and training issues. The Customer electrification section mainly plays a manager role. It is responsible for checking and checking all expenditures and authorising the construction of works that concern the electrification of customers as well as the managing of customer payments to the company. The executive roles are played by the Technical Section. The Technical Section is responsible for the operation and maintenance of the distribution network, as well as the technical servicing and maintenance of customer installations. Finally the Customer Services Section plays mainly administrative roles being the interface between the electricity consumer and the District. In addition the customer services section performs periodical readings of the electricity metering devices at customer installations in order to calculate electricity consumption and receives customer payments.

3   Business Process Modelling

The concept of business process is a key issue in the process centred paradigm. However, there is a considerable controversy around the number and types of processes appropriate to a given organisation [Davenport   1993]. The difficulty derives from the fact that there exists no explicit way for determining business processes. There is a lack of a coherent and universally accepted definition of what a business process actually is. Nevertheless, there are some common features of business process definition in the literature [Alderman, Maffin, et al   1997; Davenport   1993; Hammer and Champy   1993; Ould   1995] that provide guidance as to how business processes should be defined. In summary a business process in the process-centred organisation demonstrates the following characteristics:

- a business process has well identified *products* and *customers*, such that business objectives are matched through the (product offering) business process and delivered in the form of the product; customers may be external or internal to the organisation; products may include finished goods or services

- a business process has *goals*, i.e., it is intended to achieve defined business objectives aiming to create value to customers
- a business process involves several *activities* which collectively achieve defined business process goals and create value to customers
- a business process crosses functional/organisational boundaries; it concerns the *collaboration between organisational actors* that are contributing to (or constraining) the satisfycing of business objectives

In these terms a business process constitutes the manifestation of what organisational actors do in order to achieve business objectives. Organisational actors include individuals or groups which may be internal or external to the organisation (e.g., company employees, organisational departments, customers, suppliers etc.) and influence the realisation of business objectives. Business objectives aim at creating value to customers in other words they concern customer value goals.

Business process modelling is a generic name that refers to a collection of techniques which are used to model the behaviour of business systems. Existing process modelling approaches mainly originate from the software engineering field and fall in one of three categories:

- *Activity-oriented* approaches describe a process as a set of ordered activities (e.g., SADT [Ross and Schoman 1977], IDEF0 [IDEF0 1993], DFDs [DeMarco 1978], Workflows [Swenson and Irwin 1995], the F3 process model [Bubenko 1994]). The emphasis is on what activities take place. Each of these activities is decomposed in smaller tasks corresponding to smaller steps in the process. In addition to a collection of tasks activity-oriented models define the order of task invocation or condition(s) under which tasks must be invoked, task synchronisation, and information flow.
- *Agent-oriented* (or role-oriented) approaches specify and analyse the role of the agents that participate in the process (e.g., Role Interaction Nets [Singh and Rein 1992], Role Activity Diagrams [Ould 1995], the i* model [Yu 1994], the ORDIT approach [Dobson, Blyth, et al 1994]). The focus is on the entity that performs a process element. Roles represent the sequences of activities carried out by agents engaged in a co-operative behaviour.
- *Product-oriented* approaches represent a process through the evolution of its products (e.g., [Easterbrook and Nuseibeh 1995], [Franckson and Peugeot 1991]). Product oriented models do not put forward the activities involved in a process but rather the result of these activities. The focus is on products and transformations made on them. Each product entity has a defined sequence of states and triggers that cause state transformations.

All the above approaches promote a view of a process that is based on the notion of activity. Activity-oriented approaches focus solely on description of activities. In addition product-oriented approaches couple activities to their output (the product),

while agent-oriented approaches establish an explicit link between the activities and the agent responsible for these activities.

Existing approaches offer little guidance for identifying business processes. In activity-oriented approaches the main mechanism for grouping activities into processes is that of composition/de-composition. This mechanism however, does not offer a unique way to identify a process. The difficulty derives from the fact that processes are almost indefinitely divisible; the activities involved in fulfilling a customer order, for example, can be viewed as one process or hundreds. Agent-oriented approaches on the other hand, group activities into processes according to the organisational agent that performs these activities. Yet, a process may cut across the organisation involving several organisational agents. Finally, product-oriented approaches group activities based on the product that they manipulate and this notion of a process is in accordance with the suggested business process definition as the delivering of products to customers. However this focus on product rather than organisational behaviour fails to describe other important components of a business process such as the business goals that the process intends to achieve and the collaboration of the agents that contribute to the realisation of process goals.

4   The EKD Approach to Business Process Modelling

4.1   Overview

It becomes obvious that taking a single modelling perspective (product, activity or role) is not sufficient for expressing business processes. A different approach towards business process modelling is taken in the EKD approach promoted in [Loucopoulos, Kavakli, et al   1997]. In this view, EKD is a systematic approach to developing and documenting enterprise knowledge, helping enterprises to consciously develop schemes for implementing changes. EKD advocates a goal oriented view to business process modelling. Instead of imposing a single modelling criterion EKD offers a more general modelling framework that allows several modelling views (or rather modelling components), using the notion of business goals to structure business components in coherent business processes. The above are summarised in Fig. 3 which presents an overview of the EKD modelling concepts.

In more detail, a business enterprise in EKD is described as a network of related *business processes* which collaboratively realise *business goals*. Business processes are supported by *business systems*. In the District example the `customer electrification` process, realises the business goal `satisfy customer demand for electricity` and is supported by the `customer information system`.

Business processes are composed of *roles* that *actors* (individuals or groups) play in order to meet their responsibilities. An actor is the physical entity (e.g., the `District technician`, or the `District Technical Section`) that plays one or

more roles. A role expresses a collection of responsibilities (e.g., `service providing`, `service administrative handling`, etc.) and involves a set of *activities*. For example the `service providing` role involves activities such as, `construct customer installation`, `install metering device` and `connect meter to the electricity network`).
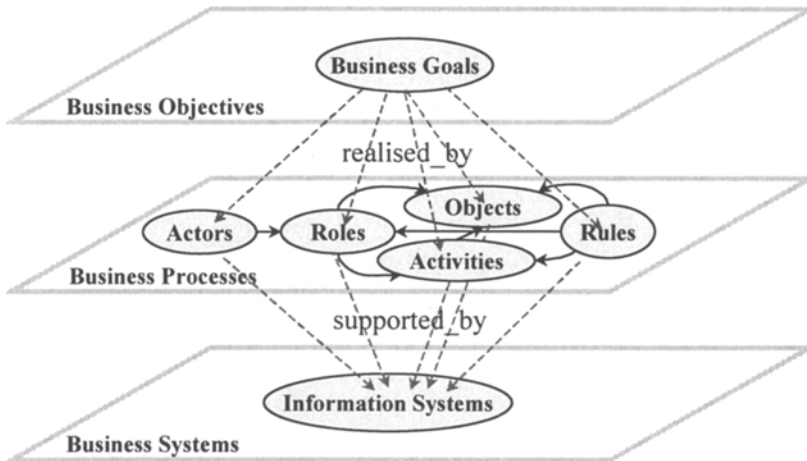

Fig. 3. Overview of EKD modelling components

Activities carried out by different roles deal with business *objects*; business objects are manipulated by business activities and define the resources and information necessary in order to support the way that enterprise actors fulfil their role. For example the `installation` object is the result of the `construct customer installation` activity and is described by the following information in the `customer information system`: installation number, service start date, address of installation, town, town code, owner's name and building location.

Finally, business processes take place according to a particular logic (or business *rules*); business rules determine the allowable states of business objects and determine the interactions between different roles. An example of a business rule concerning the installation object is `WHEN application form submitted IF contract = signed THEN authorise construction of customer installation`.

4.2   Goal-Driven Business Process Modelling

An important aspect of business process modelling in EKD is the representation of business goals. Indeed business processes constitute the means to fulfil strategic business goals. A business process is also seen as a purposeful system in itself. Each role involved in the process intends to achieve one or more defined goals. This does not necessarily mean that every role in a process aims to achieve the same business

goal rather that satisfaction of the 'private' goals of individual roles supports the achievement of the business goal that is realised by the business process. Therefore, goals related to a business process present a hierarchical structure whereby individual role goals constitute refinements of higher-level goals that ultimately make up the business goal fulfilled by that business process (see Fig. 4). In this sense business goals not only define but also shape business processes.
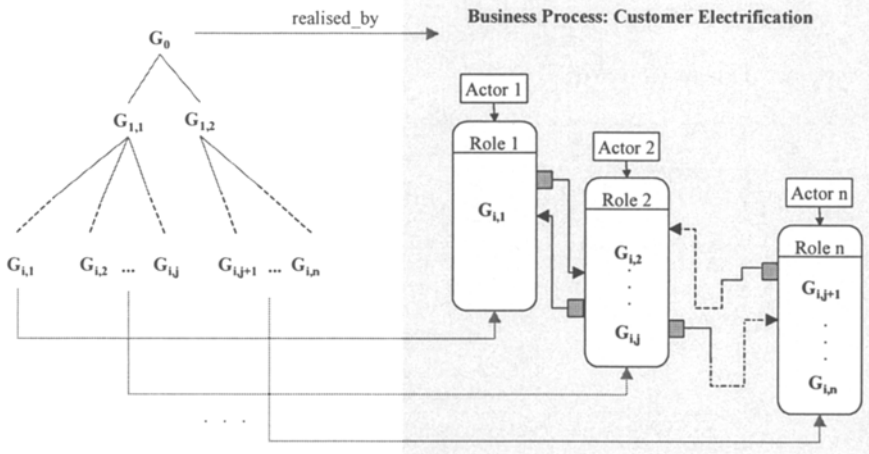
Fig. 4. Relation between business goals and business processes

In the example illustrated in see Fig. 4, `Role1: 'service providing'` role achieves goal $G_{1,1}$: `'construct new customer installation and connect it to the electricity network'`. On the other hand `Role2: 'service administrative handling'` role achieves many goals one of which is the goal $G_{i,2}$: `'administer servicing of customer's request for electricity'`. Achievement of both goals supports achievement of the overall business goal G_0: `'satisfy customer demand for electricity'` which is realised by the `'customer electrification'` process. Thus `'service administrative handling'` and `'service providing'` roles form part of the `'customer electrification'` process.

Business goals do not just shape the current business structure. They also set the vision for business change or business improvement. To this end, business goals establish the context of business change (i.e. the objectives towards which the business change effort is targeted). For example the business goal `'increase District competitiveness'` sets the context of business change for the District case. Achieving this goal can be seen as a gradual process which encompasses the *causal transformation* of the initial goal into one or more subgoals until a plausible business process specification that satisfies the original goal has been defined. In our example the original goal `'increase District competitiveness'` can be refined in the subgoals `'create new markets'`, `'build a commercial profile'` and `'improve current functioning'`. The latter can be consecutively refined into

'improve existing services to current customers' and 'reduce response time of any customer request'. This is graphically represented in Fig. 5. Any goal at each refinement level describes WHAT needs be done. At the same time this goal can also be considered as an end (WHY) for another goal, as well as means (HOW) for still another goal at a higher level.
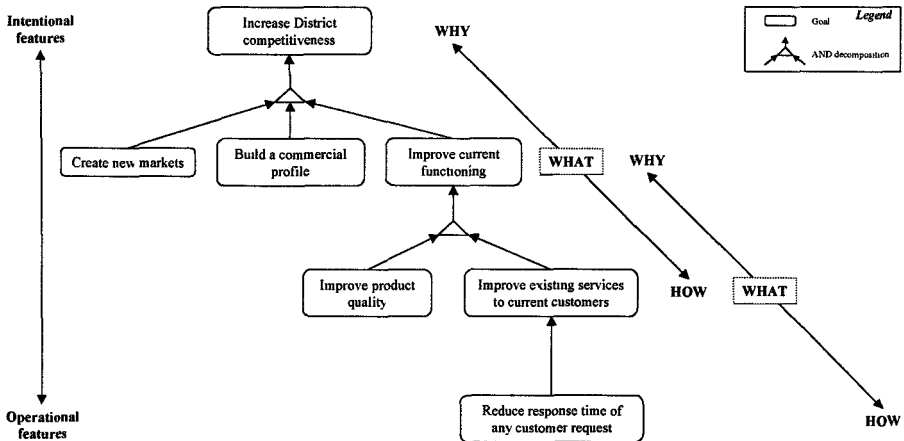
Fig. 5. Business goals define the context of business change

In many cases more than one alternative subgoals can be identified. This will lead to the identification of alternative ways to achieve a business goal and therefore alternative ways of shaping the business. We must note here that goal achievement is not a strict top-down refinement sequence. One could also proceed bottom-up by finding simple goals and then connecting them to higher level ones. Of course, the initial change goals are defined first – otherwise there would be no subject-matter for the whole process.

5   Applying Goal-Driven Business Process Modelling

5.1   Relate Business Goal Satisfycing to Process Modelling Strategy

In this section we discuss the empirical results and observations from applying the approach briefly discussed in section 4, to the industrial application (introduced in section 2).

Any design task for change normally involves multiple stakeholders and decision makers. One of the aspects of the EKD approach is the support of a reasoning cycle that involves *goal setting, deliberation* and *agreement*. Space limitations prevent us from giving a full treatment to this subject but, since it is relevant to the business process modelling activity we briefly describe its use with reference to the industrial application.

- Goal setting consists of establishing the stakeholder goals which designate any objectives to be reached, demand to be satisfied, problem to be resolved, issue to be discussed, etc. in general anything that one would like to achieve in using EKD.
- Deliberation includes the expression of hypotheses for achieving stakeholder goals (e.g., expressing alternative problem resolutions, making proposals concerning the satisfaction of some demand, etc.) as well as generating arguments for or against such hypotheses.
- Finally, agreement generates decisions that can alter (produce/modify) the product (the EKD models) while in turn generate new goals to be achieved.

Fig. 6. Reasoning in the District application
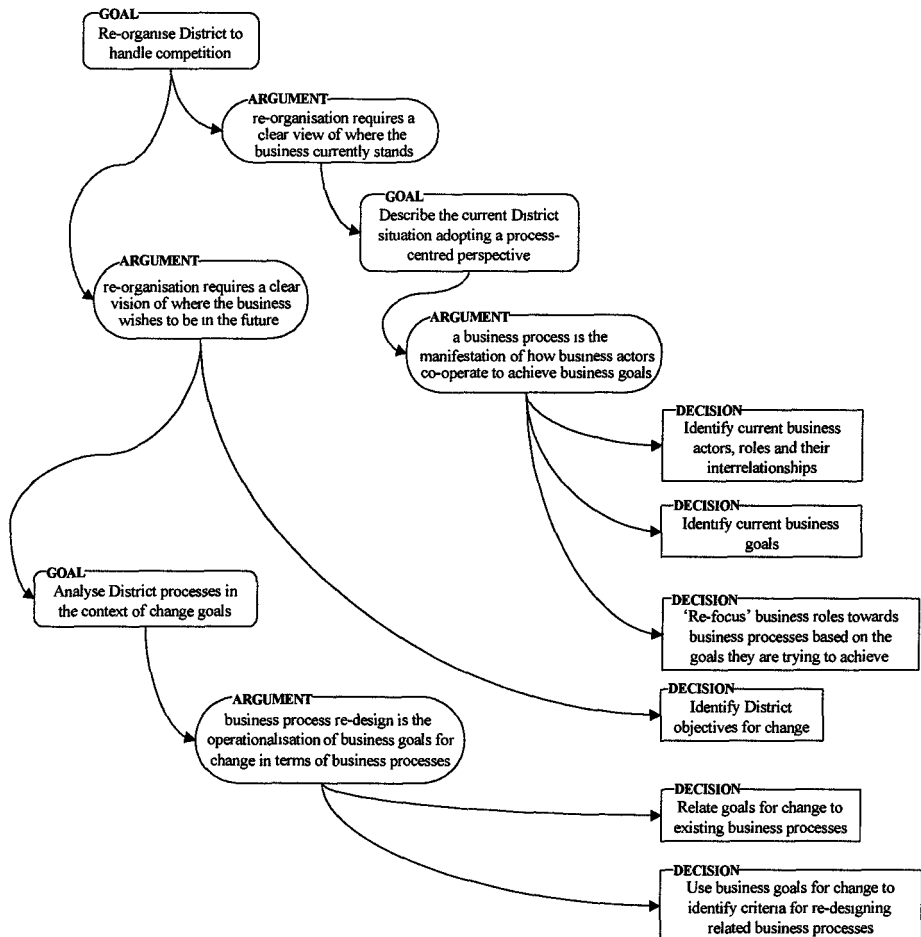
The benefit from using such an approach is twofold. First, the important components of any deliberation are captured and can be used in tracing the history of the rationale

of decisions. Second, it can be used as the baseline for evaluating these decisions, relating these to the business goals, business processes and support systems and acting as a framework for quantifying design options.

Application of EKD in the District case involved several technical and managerial staff together with EKD experts. An example of the reasoning cycle applied to the way that we approached the business process modelling task is shown in Fig. 6.

5.2 Model District Micro-Processes according to Current Functional Organisation

A summary of the business activities performed in each functional section is presented in Fig. 7 which presents a map of District activities as described by the District employees. This map represents a 'vertical' view of the District in which District activities (or rather micro-processes) are organised along the four functional lines introduced in Fig. 2.
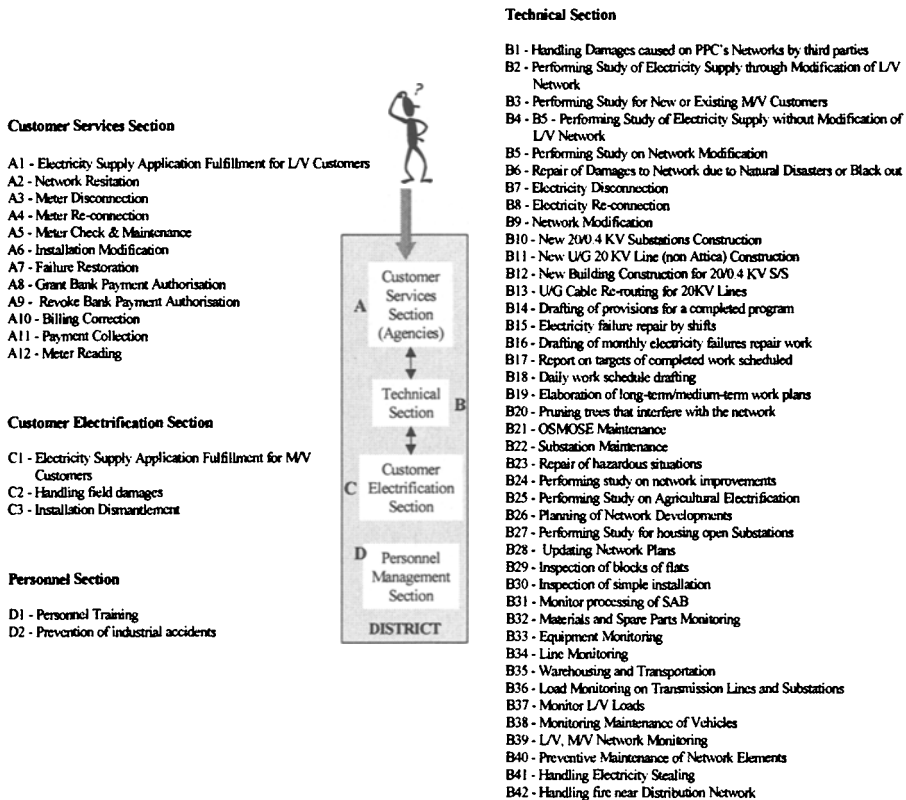
Customer Services Section

A1 - Electricity Supply Application Fulfillment for L/V Customers
A2 - Network Resitation
A3 - Meter Disconnection
A4 - Meter Re-connection
A5 - Meter Check & Maintenance
A6 - Installation Modification
A7 - Failure Restoration
A8 - Grant Bank Payment Authorisation
A9 - Revoke Bank Payment Authorisation
A10 - Billing Correction
A11 - Payment Collection
A12 - Meter Reading

Customer Electrification Section

C1 - Electricity Supply Application Fulfillment for M/V Customers
C2 - Handling field damages
C3 - Installation Dismantlement

Personnel Section

D1 - Personnel Training
D2 - Prevention of industrial accidents

Technical Section

B1 - Handling Damages caused on PPC's Networks by third parties
B2 - Performing Study of Electricity Supply through Modification of L/V Network
B3 - Performing Study for New or Existing M/V Customers
B4 - B5 - Performing Study of Electricity Supply without Modification of L/V Network
B5 - Performing Study on Network Modification
B6 - Repair of Damages to Network due to Natural Disasters or Black out
B7 - Electricity Disconnection
B8 - Electricity Re-connection
B9 - Network Modification
B10 - New 20/0 4 KV Substations Construction
B11 - New U/G 20 KV Line (non Attica) Construction
B12 - New Building Construction for 20/0 4 KV S/S
B13 - U/G Cable Re-routing for 20KV Lines
B14 - Drafting of provisions for a completed program
B15 - Electricity failure repair by shifts
B16 - Drafting of monthly electricity failures repair work
B17 - Report on targets of completed work scheduled
B18 - Daily work schedule drafting
B19 - Elaboration of long-term/medium-term work plans
B20 - Pruning trees that interfere with the network
B21 - OSMOSE Maintenance
B22 - Substation Maintenance
B23 - Repair of hazardous situations
B24 - Performing study on network improvements
B25 - Performing Study on Agricultural Electrification
B26 - Planning of Network Developments
B27 - Performing Study for housing open Substations
B28 - Updating Network Plans
B29 - Inspection of blocks of flats
B30 - Inspection of simple installation
B31 - Monitor processing of SAB
B32 - Materials and Spare Parts Monitoring
B33 - Equipment Monitoring
B34 - Line Monitoring
B35 - Warehousing and Transportation
B36 - Load Monitoring on Transmission Lines and Substations
B37 - Monitor L/V Loads
B38 - Monitoring Maintenance of Vehicles
B39 - L/V, M/V Network Monitoring
B40 - Preventive Maintenance of Network Elements
B41 - Handling Electricity Stealing
B42 - Handling fire near Distribution Network

Customer Services Section (Agencies)

Technical Section

Customer Electrification Section

Personnel Management Section

DISTRICT

Fig. 7. Overview of District micro-processes according to the functional organisation

As illustrated in Fig. 7 in the majority of cases District customers contact the company through the Customer Services Section. To fulfil the customer demand there is a need to involve the Technical Section of the District. The service requested by the customer will be delivered by the Technical Section after authorisation by the Customer Electrification Section.

By studying the District micro-processes one can easily conclude that while many activities are performed within different functional divisions they are parts of the same business process. For example micro-process A1:'Electricity Supply Application Fulfilment for the L/V Customers'* and micro-process B3: 'Performing Study of Electricity Supply through modification of the L/V Network' are parts of a bigger process which deals with the supply of electricity to District customers. However, this is not obvious in the functional organisation description since there is no description of the interrelationships between different functions.

In order to understand the interactions between the functional unit described in Fig. 7 we proceeded to modelling the current District behaviour in terms of actor-role diagrams of District activities. An actor-role diagram presents a high-level view of the association between actors and their different roles. An example of an actor-role diagram for the A1:'Electricity Supply Application Fulfilment for the L/V Customers' is illustrated in Fig. 8.

This diagram describes the actors involved in supplying electricity to a L/V customer. This is a core District activity and is realised through the co-operation of several District actors. This co-operation is modelled in terms of dependencies between roles. There are two parties involved in the dependency: the *requester role*, i.e. the one that needs something in order to fulfil its responsibilities, and the *provider role*, i.e. the one that can provide the missing component. This relation can be of various types: (a) a*uthorisation dependency* denotes hierarchical dependencies that can exist between roles; the provider role gives authorisation to the requester role, (b) *goal dependency* reflects the fact that the achievement of a goal that the role brings about is dependent on the achievement of a goal of another role, (c) *co-ordination dependency* expresses the need for one role to wait for completion of another role's responsibilities before it can complete its own, and (d) r*esource dependency* illustrates the need for one role to use a resource that can be provided by another role.

For example in Fig. 8, the 'service requesting' role depends on the 'service administrative handling' role for the achievement of its goal 'to get connected to the electricity network'. On the other hand the 'service administrative handling' role depends on the 'service requesting' role for receiving money (which is a resource). Similarly the 'service providing' role depends on the 'service authorising' role for authorising the construction of customer

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* L/V = Low Voltage

installation. Finally, the `service authorising` role depends on the `service administrative handling` role for completing the contractual and financial tasks before it can give authorisation (co-ordination).
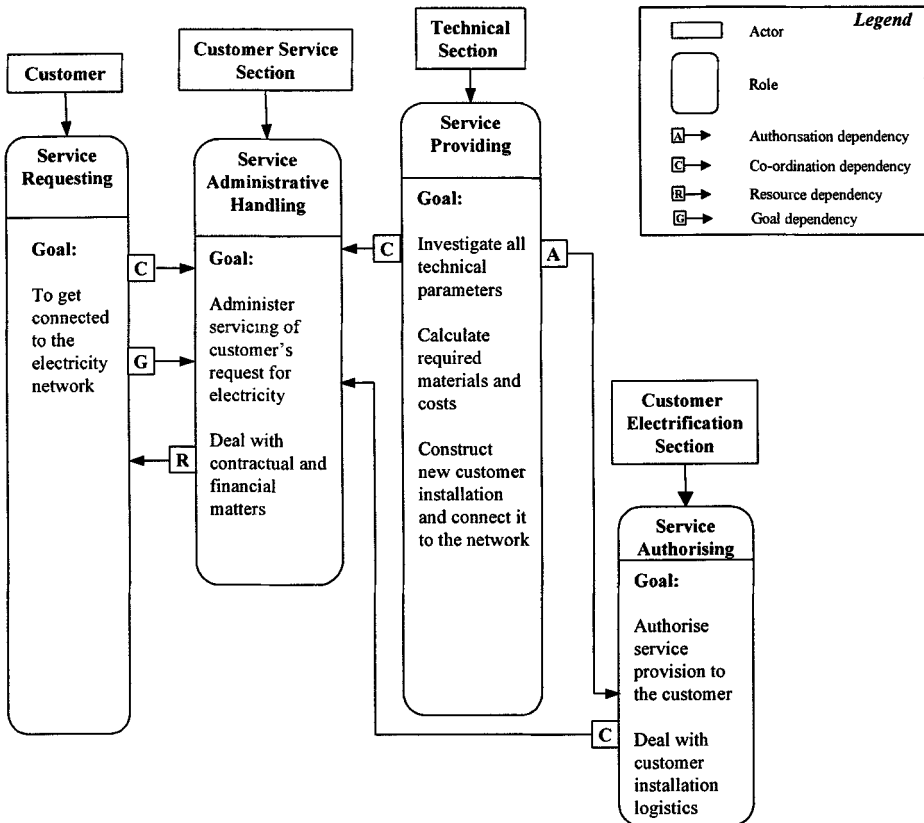

Fig. 8. Actor-role diagram concerning the 'Electricity Supply Application Fulfilment for the L/V Customers'

The advantage of the actor-role diagram is that it provides a clear view of the interactions across different functional divisions. In this way it becomes apparent that fulfilling a L/V customer application for electricity supply is not solely the responsibility of the Customer Services Section but also depends on the co-operation of the Technical and Customer Electrification Section. Such interactions would appear as inputs/outputs in an activity-oriented view, thus obscuring the fact that `Electricity Supply Application Fulfilment for the L/V Customers` cannot be performed independently of other activities performed by other sections. In addition the ability to include the customer role in the actor-role diagram, is a step towards a process-centred view of the organisation in which each process has a customer.
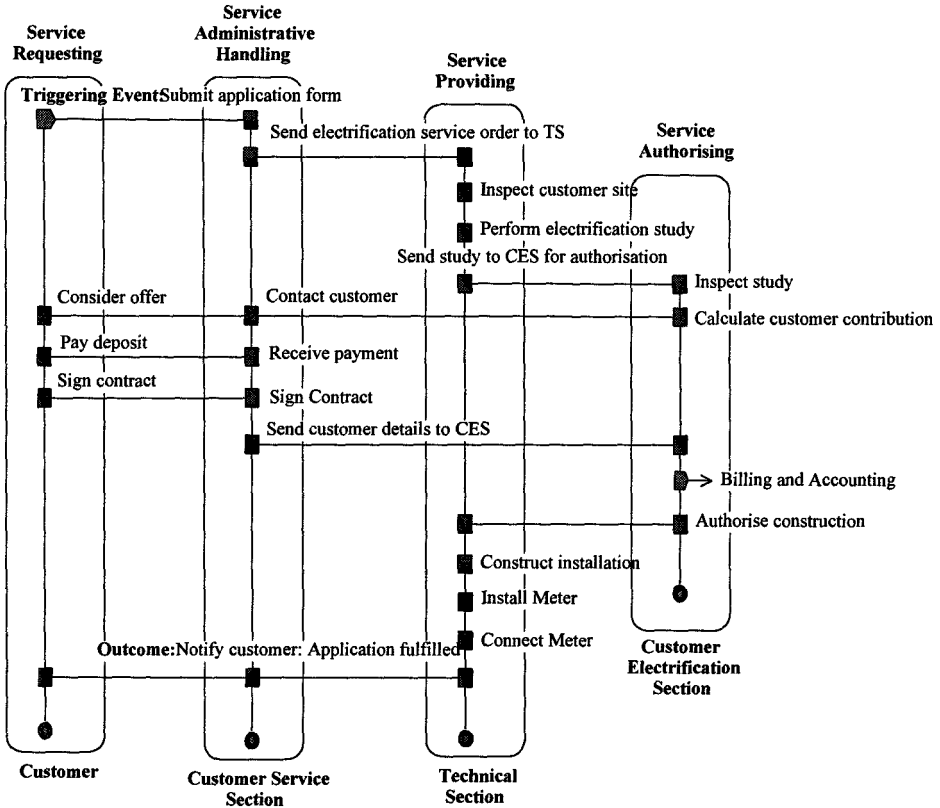
Fig. 9. Role-activity diagram for the 'Electricity Supply Application Fulfilment for the L/V Customers'

The actor-role diagram gives a first-cut view of the organisational aspects regarding the responsibilities of individuals or groups in their involvement in the operation of a business process. A more detailed view of these roles was constructed in terms of role-activity diagrams [Ould 1995]. These diagrams show the set of activities that are generally carried out by an individual or group within the context of their role.

An example of a role-activity diagram for the 'electricity supply application fulfilment for L/V customers' is illustrated in Fig. 9. Role-activity modelling encourages the identification of the key operational components which can be measured (activity duration, actor skills, resource costing etc.). In that sense role-activity models provide the context for performing evaluation of process efficiency.

however of "what are the types of processes and how should be logically organised?" still remains unanswered.
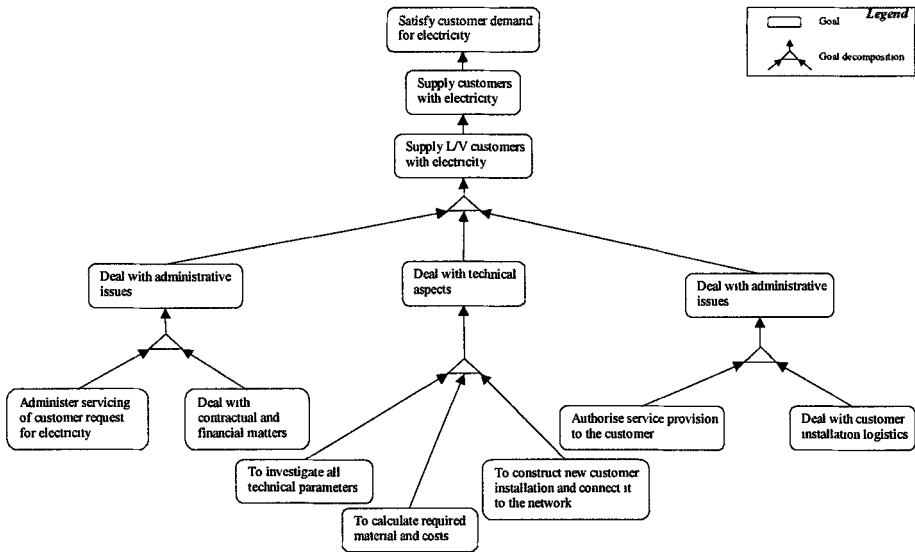

Fig. 10. Partial view of District goals

We address this question by using the business goals that represent the intentions of processes. These goals are presented in the 'body' of each role in the actor role diagram in Fig. 8. Such goals are mainly operational goals, that is they are expressed in terms of business objects and activities that realise them. For example the 'service providing' goal to 'construct customer installation and connect it to the network' refers to the construct installation, install meter and connect meter activities identified in the role-activity diagram in Fig. 9.

As explained in section 4.2 role goals represent low-level goals in a goal hierarchy. Having identified the role goals (i.e. those goals in the goal graph that represent operationalisations of the business objectives) there was a need to establish their causal relationships to higher-level goals. Starting from the goals identified in Fig. 8 we constructed the goal graph presented in Fig. 10.
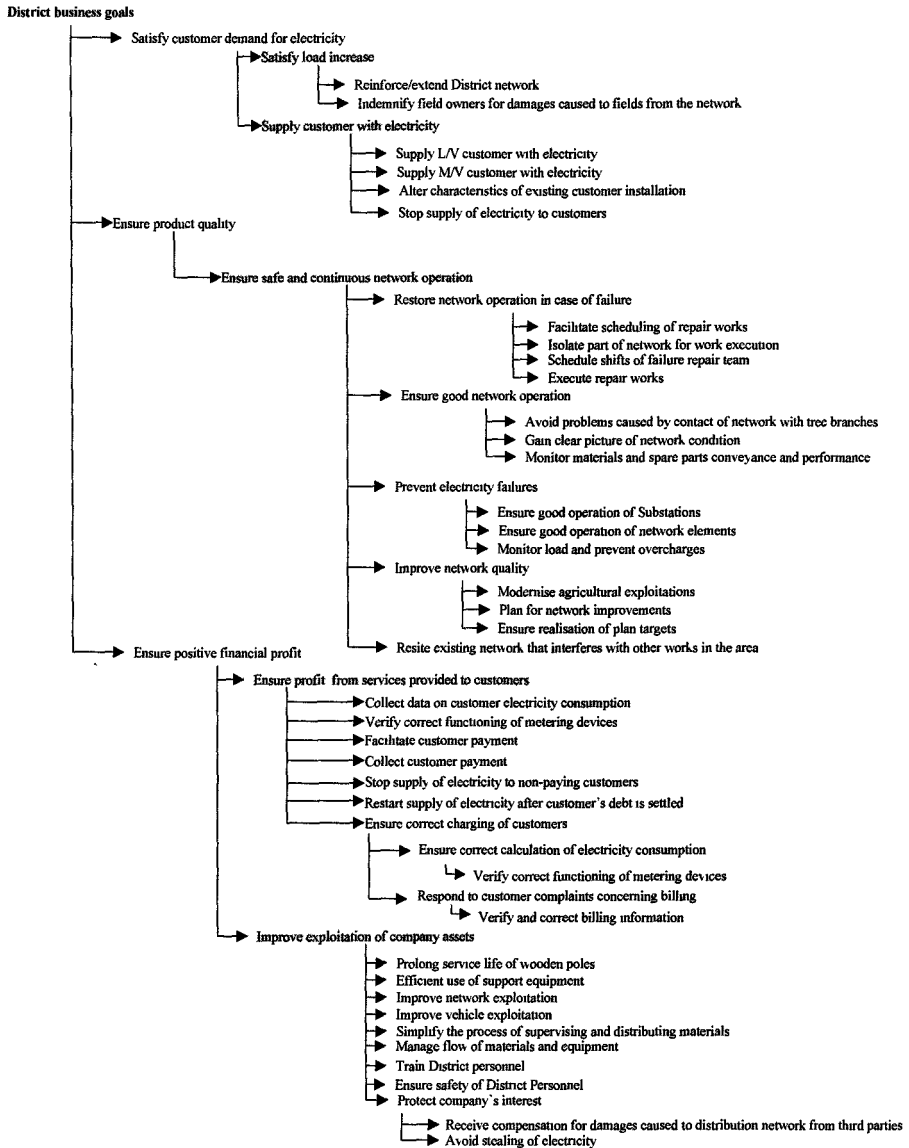
District business goals

- Satisfy customer demand for electricity
  - Satisfy load increase
    - Reinforce/extend District network
    - Indemnify field owners for damages caused to fields from the network
  - Supply customer with electricity
    - Supply L/V customer with electricity
    - Supply M/V customer with electricity
    - Alter characteristics of existing customer installation
    - Stop supply of electricity to customers
- Ensure product quality
  - Ensure safe and continuous network operation
    - Restore network operation in case of failure
      - Facilitate scheduling of repair works
      - Isolate part of network for work execution
      - Schedule shifts of failure repair team
      - Execute repair works
    - Ensure good network operation
      - Avoid problems caused by contact of network with tree branches
      - Gain clear picture of network condition
      - Monitor materials and spare parts conveyance and performance
    - Prevent electricity failures
      - Ensure good operation of Substations
      - Ensure good operation of network elements
      - Monitor load and prevent overcharges
    - Improve network quality
      - Modernise agricultural exploitations
      - Plan for network improvements
      - Ensure realisation of plan targets
    - Resite existing network that interferes with other works in the area
- Ensure positive financial profit
  - Ensure profit from services provided to customers
    - Collect data on customer electricity consumption
    - Verify correct functioning of metering devices
    - Facilitate customer payment
    - Collect customer payment
    - Stop supply of electricity to non-paying customers
    - Restart supply of electricity after customer's debt is settled
    - Ensure correct charging of customers
      - Ensure correct calculation of electricity consumption
        - Verify correct functioning of metering devices
      - Respond to customer complaints concerning billing
        - Verify and correct billing information
  - Improve exploitation of company assets
    - Prolong service life of wooden poles
    - Efficient use of support equipment
    - Improve network exploitation
    - Improve vehicle exploitation
    - Simplify the process of supervising and distributing materials
    - Manage flow of materials and equipment
    - Train District personnel
    - Ensure safety of District Personnel
    - Protect company's interest
      - Receive compensation for damages caused to distribution network from third parties
      - Avoid stealing of electricity

Fig. 11. Overview of District business goals

In Fig. 10 it can be observed that goals related to the roles involved in fulfilling the application of a L/V customer for electricity supply, satisfy the higher goal `supply L/V customers with electricity`. This in turn supports the satisfaction of the goal `supply customers with electricity` which ultimately supports the achievement of the strategic District goal `satisfy customer demand for electricity`.

This process of abstracting from operational goals to higher intentions, naturally involved different stakeholders. The result was a clear, agreed view of the reasons for the business process (the WHY dimension, see also Fig. 5).

By repeating this process for all District roles we delivered the following goal hierarchy that explains what the District is currently trying to achieve. A global view of the District goals and the associated activities is presented in Fig. 11. Each leaf goal in this goal tree refers to specific business micro-processes studied in the actor-role/role-activity modelling step.

5.4   Adopt a Process View, Driven by Discovered Goals

Using the goal graph illustrated in Fig. 11 District micro-processes are grouped in five core business processes each aiming to achieve a strategic business goal. These are:

Table 1. List of District business processes

Business Process	*Business Goal*
Customer electrification	Supply customer with electricity
Network reinforcement/extension	Satisfy load increase
Network operation	Ensure safe and continuous network operation
Exploitation and maintenance of company assets	Improve exploitation of company assets
Customer Billing	Ensure positive profit for services provided to customers

The business processes presented in Table 1 process correspond to the goals highlighted in Fig. 11. Each process is composed by the micro-processes that realise the subgoals of the goal that is realised by the entire process. Thus the map of District micro-processes is re-organised in terms of the *goals these activities aim to achieve*. The result is illustrated in Fig. 12.

In contrast to the 'vertical' map illustrated in Fig. 7, Fig. 12 presents a 'horizontal' view of the District whereby each District process crosses functional boundaries and requires the collaboration of more than one District sections. Indeed it can be seen in Fig. 12 that for each business process there is a horizontal referencing, including micro-processes from two or more District sections (shown as A, B and C and D in Fig. 12). For example the `customer electrification` process involves the collaboration of the Customer Services Section, the Technical Section and the Customer Electrification Section.

Customer electrification

A1 - Electricity Supply Application Fulfillment for L/V Customers
B32- Performing Study of Electricity Supply through Modification of L/V Network
B4 - Performing Study of Electricity Supply without Modification of L/V Network
C1 - Electricity Supply Application Fulfillment for M/V Customers
B3 - Performing Study for New or Existing M/V Customers
B30 - Inspection of simple installation
B29 - Inspection of blocks of flats
A4 - Meter Re-connection
A6 - Installation Modification
A7 - Failure Restoration
A3 - Meter Disconnection
C3 - Installation Dismantlement

Network reinforcement/extension

B9 - Network Modification
B5 - Performing Study on Network Modification
B10 - New 20/0.4 KV Substations Construction
B11 - New U/G 20 KV Line (non Attica) Construction
B12 - New Building Construction for 20/0.4 KV S/S
B27 - Performing Study for housing open Substations
B28 - Updating Network Plans
C2 - Handling field damages

Customer billing

A12 - Meter Reading
A5 - Meter Check & Maintenance
A8 - Grant Bank Payment Authorisation
A9 - Revoke Bank Payment Authorisation
A11 - Payment Collection
B7 - Electricity Disconnection
B8 - Electricity Re-connection
A10 - Billing Correction

Network operation

A7 - Failure Restoration
B23 - Repair of hazardous situations
B42 - Handling fire near Distribution Network
B6 - Repair of Damages to Network due to Natural Disasters or Black out
B16 - Drafting of monthly electricity failures repair work
B14 - Drafting of provisions for a completed program
B15 - Electricity failure repair by shifts
B20 - Pruning trees that interfere with the network
B31 - Monitor processing of SAB
B34 - Line Monitoring
B32 - Materials and Spare Parts Monitoring
B13 - U/G Cable Re-routing for 20KV Lines
B22 - Substation Maintenance
B40 - Preventive Maintenance of Network Elements
B36 - Load Monitoring on Transmission Lines and Substations
B19 - Elaboration of long-term/medium-term work plans
B18 - Daily work schedule drafting
B17 - Report on targets of completed work scheduled
B26 - Planning of Network Developments
B24 - Performing study on network improvements
B25 - Performing Study on Agricultural Electrification
A2 - Network Resitation

Exploitation and maintenance of company assets

B21 - OSMOSE Maintenance
B33 - Equipment Monitoring
B35 - Warehousing and Transportation
B37 - Monitor L/V Loads
B38 - Monitoring Maintenance of Vehicles
B39 - L/V, M/V Network Monitoring
D1 - Personnel Training
D2 - Prevention of industrial accidents
B1 - Handling Damages caused on PPC's Networks by third parties
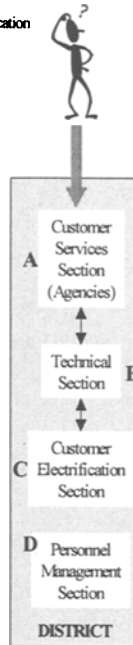B41 - Handling Electricity Stealing

Diagram labels:
A — Customer Services Section (Agencies)
B — Technical Section
C — Customer Electrification Section
D — Personnel Management Section
DISTRICT

Fig. 12. District process map based on District goals

6 Discussion

In this paper we have presented an approach to business process modelling based on the notion of 'process abstraction through intentional affinities'.

The purpose of business process modelling is ultimately the improvement of the enterprise in order to deal with change. In general therefore, we advocate that change management should be seen as the process of identifying business goals and relating business processes to these goals.

Returning to the District application, capturing goals for change presented a number of problems stemming primarily from: (a) the uncertainty of the future situation and (b) the different perceptions that different District personnel had on the issues for change. Relating goals to existing processes proved to be the only reliable way to achieve a clear view of the issues for change.

The result of this exercise was: (1) to increase the awareness of District personnel about the issues for change; (2) to give the opportunity to strategic and operational

District personnel to participate in the creation of the company vision; and (3) to produce a list of strategic goals for change.

Relating change goals to existing change processes helps to further refine goals based on the specific business process characteristics. For example `reduce response time of any customer request` can be refined in terms of measurable goals that refer to specific micro-processes involved in the customer electrification process, e.g., `reduce period from customer application to District offer to 10 days`, `reduce time necessary to construct a new installation to 50 days`, and `reduce period from customer payment to meter connection to 40 days`. In addition, the fact that the customer electrification micro-processes have already been modelled in terms of role-activity diagrams, can further assist in evaluating the reasonableness of these proposals and also to reveal the points where process delay occurs and suggesting improvements.

Of course in some cases it is not possible to identify any existing process that can be related to the goal for change. For example `build a commercial profile` objective refers to processes that are completely new for a company that did not have to deal with competition up to now. In this case the new process should be defined from scratch again as a causal transformation of business goals (see Fig. 5).

The goal of a process organisation is to create a high performance workplace, a high quality work environment noted for excellence in efficiency, effectiveness and customer satisfaction. With a focus on process, it is very common to see process organisations managing interdisciplinary work teams instead of specialised units seen in traditional organisation of enterprises. The approach presented in this paper recognises the need for a co-operative approach to reaching a common view of the products and services delivered by the business processes of an enterprise. In recent years similar approaches have been advocated in the areas of enterprise modelling [Jarke, Bubenko, et al 1993];[Yu 1994];[Kueng and Kawalek 1997] and CSCW [Ellis and Wainer 1994]. The focus of these approaches is on individual agents and the goals that drive and justify their individual activities as well as their co-operation. Whilst our approach shares this direction, we also advocate a more holistic framework whereby, business goals as well as individual actors' goals are considered in terms of systematically analysing current business processes, the goals for change and the impact of these goals on existing or new business processes. Such a goal-driven, deliberative approach presents, in our opinion, a major step towards meeting this emerging challenge of managing business change.

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