INTERACTION BETWEEN INFORMATION SYSTEMS AND ORGANIZATIONAL CHANGE: CASE STUDY OF PETRÓLEOS MEXICANOS

Natalia VOLKOW

London School of Economics and Political Science

2003

Submitted in fulfilment of the requirements for the award of the degree of Doctor of Philosophy by the University of London

UMI Number: U185870

UMI

®

Dissertation Publishing

ProQuest®

THESES

F

8176

To Patricia Kazolides for her friendship and
unwavering support in difficult times and
to my sons, Jeronimo and Santiago, for their
love and companionship.

"If you understand, things are just as they are; if you do not understand, things are just as they are:"

Zen proverb

Abstract

This research investigates the impact of local conditions on the use of information technology in a public organization, and how the use of that technology affects the organization. It focuses on a case study of the state-owned oil corporation of Mexico, Petróleos Mexicanos (Pemex). Since its foundation in 1940 as an integrated national oil company, Pemex has been in a continuing process of modernization. In recent years, this process has involved substantial use of information technology and organizational restructuring, based on models imported from industrialized countries. This has been done without always explicitly considering local conditions, although information systems research has widely emphasized the need to consider the social aspects when implementing information technology. Such research has argued the need to explore how the local conditions shape information systems, as they are constructed and enacted by actors when making sense of their use of systems in their daily work environment. The research uses institutional theory and a contextualist framework to examine both how local social values and historical conditions shape the use of information technology and what impact its use has on the social environment and the organization changes that take place. Although the research highlights the local context, it deals more broadly with processes that are occurring in many organizations in various developing countries because of the global transformations linked to the widely pervasive diffusion of information technology. It therefore also provides an understanding of the generic process of information technology utilization in developing countries, with the aim of guiding practice.

Acknowledgement

I wish to thank all the people who made this research possible by accepting to be interviewed. I avoid personal references in the thesis to prevent misuse of the information. This is a primary ethical concern in social science research and a personal ethical commitment of mine to all those who kindly shared their experiences, provided work documents, offered insights about my work, and generally gave much time to me. The only exceptions to my anonymity rule are the names of the ex-General Directors of Pemex, which are included because their historical identification is public knowledge. I am deeply grateful to all those who gave me their time and enthusiastically shared their experiences in the organization studied. I also greatly appreciate the guidance and insights provided by my supervisor, Dr. Chrisanthi Avgerou, and for her help throughout my work.

Contents

9

1 INTRODUCTION

1.1 BACKGROUND TO THE ISSUE RESEARCHED

The early experiences of the use of computers in organizations were generally understood from an engineering perspective. However, the need soon became evident to address the systems' 'soft' aspects – understood as the social, cultural, and political factors that shape the use of information technology in a social environment. Consequently, 'information systems' has developed as a specialized discipline of study over the last two-three decades. Although research into information systems has recognized the need to address indigenous local conditions in terms of social aspects, generally it is limited in the identification of how the social conditions and cultural aspects actually affect the use of this technology. To do this, the impact of the use of information technology in the environment must be studied in the context where it is implemented. This research aims to guide practice and theory by uncovering, through a qualitative analysis in a specific case, the impact of local conditions on information systems and the impact of the use of information technology in its environment.

A starting point for this work was the *Oxford English Dictionary*'s (Simpson and E. 1989) definition of three concepts that provide the foundation of this dissertation:

> "Rationale - A reasoned exposition of principles; an explanation or statement of reason, the logic of anything.
>
> Rational - Of, pertaining or relating to reason... Descriptive of methods of analysis and planning that make use of calculation to bring about a project result, especially in economics...
>
> Rationalism - The view that reason is the only guide leading to the improvement and progress of human race and that adherence to religious or other 'non-rational' belief is outdated."

1.2 SIGNIFICANCE OF THE RESEARCH

The research presented in this thesis is a case study of Petróleos Mexicanos (Pemex), the stated-owned company that has, since its founding in 1940, monopolized activities in Mexico's oil sector. Although the case study has many unique aspects, the processes undertaken by Pemex might be recognized as familiar by many organizations, in many countries, which find themselves in similar circumstances. In the 1990s, enterprises

throughout the world embarked on such efforts, in order to explore the potential offered by information technology to modernize their structure and operations. They tended to follow an 'ideal' organizational model and tried to take advantage of the enabling power of information technology to drive the processes of change, mirroring the model of organizations in industrialized countries.

This research is a situated study that does not aim to derive generalizations from the specific analysis of Pemex within its Mexican context. Instead, it seeks to build understanding of the dialectical relation between local conditions and the use of information systems, which have implications beyond this specific situation. The local conditions studied refer to both the national context and Pemex's social setting. The case study therefore includes a rich description of the historical development of the country and the vital role of Pemex to the Mexican economy because of its control of a strategic economic sector. The intention of this description is to provide an insight into the characteristics of the social setting in which the process of changing of the organization took place.

Oil is the main source of income for the Mexican government, so the national economy as a whole is highly dependent on Pemex's export revenues. It is the biggest company in Mexico and has had a leading role in the promotion of the use of information technology. It is also one of the biggest companies in the world, exporting oil to the United States, Israel, and some European countries. It is an important participant in the highly competitive international oil market and has become a virtual strategic oil reserve for the United States.

International oil pricing is very complex, but Pemex's productivity level is an important factor in determining its revenues. From the 1970s, Pemex has had the good fortune to possess extraordinarily productive offshore wells. This productivity derives from the geophysical characteristics of the oil deposits, which allowed the company to operate without any pressure to strive for productivity improvements. It is a state-owned company, and its management style has been tightly linked to the public administration's political line and government financial needs.

The company's origins caused it to be structured to enable its operations to be carried out in an *ad hoc* way, without regard to productivity considerations; it did not even have registers of data for costing products. Pemex's *raison d'être* was to produce oil to keep the economy

running, not to generate profits. Nevertheless, during the 1970s general public concern about Pemex's inefficiencies grew to a point where there was a strong public demand for the modernization of its operations – or else its privatization. This pressure derived mainly from external factors. The introduction of information technology was identified as the key strategy the company should undertake in order to modernize its operations and achieve global standards.

Since its creation, Pemex has undergone several major organizational restructuring exercises. In most cases, these can be explained as responses to the growth of the organization and to external environmental influences, among them fads and fashions. During the oil boom of the 1970s, the company made enormous achievements in terms of increasing production capabilities. However, this was accomplished at unacceptable levels of costs, a situation that was publicly known. By the beginning of the 1980s, several factors had come together to trigger a major organizational change. This was initiated to transform Pemex's mission and values with the goal of introducing an economic rationale to its operations. By that time, the company's poor public reputation for efficiency had become incompatible with the Government's policy of striving to modernize the country. There was public demand to stop the excessive abuse of discretionary powers by the company's managers. During the same period, Mexico's trade partners were demanding the liberalization of the oil sector as a part of negotiations to relax trade barriers.

In response to these internal and external pressures, Pemex undertook the process of modernizing its administration with extensive use of information technology and advice from foreign consultants. It had been a major user of information technology since the 1960s, but with systems developed from an engineering perspective to solve specific problems of administration rather than the overall business transformation now being sought. The key element of this transformation was the introduction of evaluation and analysis techniques to adjust the company's operation to market standards. The process of change was undertaken by imitating the latest global models of business administration and best international business practices, but with scant regard to local features.

The case on which this research is based is a longitudinal study. This provides the opportunity to examine over time how local conditions affect processes of using information

technology and organizational change efforts, as well as the impact of information technology on the organizational change process over time.

1.3 PROJECT AND THESIS OUTLINE

The review of the literature on the study of information technology in organizations provided in chapter 2 focuses on how research has tried to disentangle the complex phenomenon of implementing information technology in organizations from the characteristics of the social context in which it is implemented. It examines the different trends developed in the understanding of information technology implementation in organizations, from approaches with an exclusive technical perspective to those that attempt to understand the non-rational behaviour of organizations by addressing the complexity of the human, social, and cultural aspects. Some of the most recent studies, in particular, examine the introduction of information systems into organizations from developing countries with very different cultural conditions to those where information technology was originally developed. This review presents institutional theory as the theoretical base for the analysis of the case study, in particular Peter Berger, Brigitte Berger, and Hansfried Kellner's work (1973) that identifies the predominant institutional orders of modern society.

Chapter 3 discusses the main methodological options for investigating and understanding information systems in organizations. It argues that the selection of a qualitative theoretical perspective for the analysis of this case study is justified because it provides an effective means of describing and structuring the understanding of how local conditions affect the use of information technology, and with it the environment in which it is used.

Modernization has been the rhetoric used by authorities to support information technology use in organizations, and all Mexican governments since the beginning of the twentieth century have had the modernization of the country as a key objective. As understanding the social framework in which the historical transformation of Pemex took place is essential for the research, the description of the case study's context starts in chapter 4 by analysing the ideological framework of modernization to give a general background to the historical development of Mexico as a nation that is part of Western society. The concepts of modernity, modernization, and globalization need clarification because they are part of the central political scenario of Mexico and of the political discourse of the party that remained

in power for a very long period; it was also the ideological foundation of all Pemex's organizational restructuring efforts during the period studied. There is also a need to disentangle the role of information technology in the process of social change. After explaining the ideological framework, chapter 4 describes the national and organizational contexts of the case study.

Chapters 5 and 6 examine the process of change undergone by Pemex and its information systems developments. These two chapters refer to two historical periods, the first from the beginning of the twentieth century to the early 1980s and the second moving on to the middle of the 1990s. The research points out that the process of changing an organization is not suspended somewhere outside a specific time and place, but is influenced by the social and political conditions in which it has occurred. It also recognizes that the description of what took place is the researcher's social reconstruction of those events. The longitudinal nature of the case study reflects the importance of long-term processes of continuity and change of the organization. Chapter 7 describes the company's development of information systems other than the mainstream ones discussed in chapters 5 and which are relevant to the analysis of the case study. Chapter 8 addresses the content of the processes described in Chapters 5, 6 and 7 in relation to the impact information systems had on the organizational outcome; these are categorized into three types of change concerned with the way the organization harnessed potential offered by information technology in transforming how its operations are carried out.

Chapter 9 is an analysis of these processes. It aims to show the interaction between social context, organizational change, and the use of information technology, as well as how the use of information technology has affected the process of organizational change. Institutionalism forms the theoretical basis of this analysis (Pettigrew 1983), (Westney 1987) (Zucker 1983) (Zucker 1987). This theory provides the means to structure the complexity of social reality in a way that allows the interaction between the social context and the process of changing the organization and its information systems to be analysed effectively. The analysis also uses Berger's specific framework of the prevailing institutional orders of modernity to identify the features of local conditions that have affected the use of information technology and the process of change of the organization within the ideological perspective of modernization. Overall conclusions of the research and proposals for further research are given in Chapter 10.

The presentation of the case follows Pettigrew's (1983) framework by providing rich descriptions of the context, process, and content of change. The context refers to the general process of modernization, in particular to the national economic, political, and social environment of Mexico; the process involves both the organizational change and the introduction and use of information technology; and the content of change refers to the type of change introduced by the use of information technology in relation to the impact of the information systems in the organization. The rich description of the case is a hermeneutic exercise to help interpret the complexity of the conditions of the organization studied, by immersing the reader in the specific social setting in order to help understand how local conditions influenced the organizational change process. This rich description is needed to identify the prevailing institutions in the organization during the different historical periods that comprise the longitudinal research, as well as the institutional values that determine how people act in their specific time and place. In this sense, information technology is seen not as a neutral tool, but as one that carries specific values.

1.4 AIM OF THE THESIS

The aim of the research reported on in this dissertation is to:

1. Uncover the ideological forces that affect the processes of changing an organization and its adoption and use of information systems within its context; and
2. Determine what influence the technology has on the environment where it is used.

The interpretivist method employed allows the analysis of the complexity and specific features of the social conditions in which the organization has developed; the process by which the use of information technology was influenced by its context; and the outcomes of changes of the organization induced by the use of information technology.

1.5 CONTRIBUTION OF THIS RESEARCH

This research develops understanding of the complexity of the links between local conditions, information systems, and organizational change and the impact of information technology in the environment where it is used. This situated case study illuminates how the different aspects that comprise these phenomena are constructed. For example, it shows how the change process is shaped by the different aspects that surround it, such as by people holding

beliefs, values, and political positions when acting in their daily work life, and trying to make sense of the information systems by using them. The way in which decisions about use are based on discourses of power, underpinned by specific political or technical rationales, is another factor shaping the events studied, as are economic and political aspects of the relevant national and international contexts. Investigation of each of these aspects provides understanding of the complexity and significance of the *here and now* of the use of information technology in a social context, specifically of projects aiming to introduce information technology in social contexts in which rationality is not the prevailing rationale. It can also guide practice and shed light on assessing the risk involved in the type of project that confronts the institutional values of an organization.

The research contribution does not aim at generalizations: but seeks to develop an understanding of the relevance of considering local conditions in practice through an interpretive perspective. Therefore, it aims to show that social aspects cannot be considered only as one of the variables of the system, like 'human factors' as one among other abstract variables. Practitioners have to consider the role of actors whose behaviour is influenced by specific mental frameworks, and how these change – or need to change – to obtain the desired benefits from the introduction of information systems. Practitioners should also be able to assess the feasibility of certain projects in which the introduction of a system implying a clash with the institutional values of the organization.

The research contributes to theory building through the identification of the two types of rationales that are commonly present in any implementation of information technology in modern society: the political rationale that follows the social order of local conditions, and the economic rationale whose foundation rests in scientific knowledge. These two forces act in a dialectic process to build the social construction of any organization and its use of information systems. It is not one or the other, but the coexistence of both ideological forces in tension that has to be recognized and managed. The identification and management of both these forces will allow a use of information systems appropriate to the indigenous conditions of each case, and bring about the desired benefits of the use of information technology. Such recognition discards the possibility of defining a universal recipe for the use of information systems. Instead, it urges practitioners to address each situation in its specificity when considering the enabling potential of information technology. By identifying the impact of local conditions on information systems, the research intends to

create a better understanding of the limitations of technologically-deterministic approaches that take little account of local conditions and the high risk of the strategies involved.

2   LITERATURE REVIEW

This chapter is a review of the literature dealing with research efforts in information systems that recognize the hybrid nature of these systems as a social process (OECD 1988) with both technical and social components (Land, Mumford, and Hawgood. 1980) (Land and Hirshheim 1983) (Mumford 1983a) (Westrup 1998). Such research has emphasized the social dimensions of information systems, which include leadership, political structures, people, and motivation. It has also recognized the use of information technology as an intervention in organizations to transform their processes and work practices (Avgerou 2002). Although the social nature of an information system prevails in any situation where information technology is implemented, the specificity of the social setting in developing countries represents a major challenge. As this thesis focuses on a case study in a developing country, the review begins with this issue.

2.1   INFORMATION TECHNOLOGY USE IN DEVELOPING COUNTRIES

In order to create appropriate information systems, there is a need to understand how the social context influences the use of information technology and how organizations use information technology within their own circumstances (Avgerou 2002). This is especially relevant for developing countries (Korpela 1996) (Ojo 1992) (Van Ryckeghem 1992) because: "While there is not a universal 'culture of developing countries', local practitioners in developing countries need to devise appropriate ways of coping with the features of the local cultures" (Ojo 1992: p.108)

For most developing countries, hard currency is not easily available and unfulfilled social needs compete for resources. This highlights the particular importance in these countries of trying to ensure that investments in information technology deliver tangible benefits (Korpela 1996) (Sahay 1995) (Van Ryckeghem 1992). However, the majority of information systems research has been carried out in industrialized countries with different social settings and rationales to those that prevail in developing countries (Avgerou 2000).

Research carried out in various African nations shows that traditional social arrangements prevail in the way organizations operate (Ojo 1992) (Van Ryckeghem 1992). This kind of adaptive feature of any human society has led many researchers to identify the need for flexibility in information systems. Such flexibility is vital if benefits from using information

technology are to be achieved in the socio-cultural contexts of organizations in developing countries (Bada 2000) (Calitz 2000) (Ojo 1992) (Robey 1988) (Walsham 1992). Information systems research carried out in developing countries has reinforced the finding that information technology is not value free (Lind 1991) (Woherem 1992) because it incorporates models of reality derived from the contexts in which information systems are developed. These models are generally imbued with Western values, which are not necessarily universal (Lind 1991) (Lind 2000) (Walsham 1988).

Research has also acknowledged information technology's potential for helping to promote economic growth in developing countries, but its realization depends largely on acquiring the ability to appreciate local conditions and develop applications to address them. Local conditions consist of a variety of dimensions, including specific social and economic settings, cultural values, and technical issues such as the availability of equipment, lack of trained and experienced personnel, the reliability of power supplies, and telecommunications infrastructures. Insufficient financial resources and different national and organizational rationales can also be significant local influences (Bada 2000) (Korpela 1996) (Lind 1991) (Madon 1994) (Walsham 1988). Lind (1991) recognizes that computer-based solutions which work in one organization in a specific country will not be applicable in another organization or country if a different rationale prevails, he introduces the concept of 'computer model fit', to reflect the applicability of a system within a specific context. An evaluation of the applicability of any information system should therefore consider the cultural characteristics and social values of the environment (Galliers, Madon, and Rashid 1998) (Robey 1988), which can reveal the level of risk when a system created in the West is implemented in a developing country.

To understand the use of information technology in developing countries, there is a need to review the research undertaken in information systems that has followed one of two main perspectives:

1.　　The 'technical-rational' research stream. This has an analytical approach and addresses organizations in terms of variables in interaction with their environment, with the aim of constructing a comprehensive model. It developed from the positivist tradition of cause-effect explanations, with a technically-deterministic perspective that seeks to build universal prescriptive guidelines driven by the business and managerial

concerns which have prevailed in the research agenda of this perspective (Avgerou 2002).

2.   The socio-technical viewpoint. This research approach takes a systemic perspective that recognizes knowledge as a social construction, with the objective of gaining understanding and insight into the complexity of information systems within their specific contexts. It also seeks to guide practice on the premise that each case has to be addressed in its own specificity to be able to obtain the expected benefits from information technology investments.

2.2   THE TECHNICAL-RATIONAL PERSPECTIVE

The technical-rational perspective on the impact of information technology in organizations has been influenced mainly by contingency theory from organizational studies (Lawrence and Lorsch 1967). It has focused primarily on the normative goal of achieving an ideal model of an organization, defined as a set of variables that can fit the conditions of its environment. This research approach has been dominated by academics from business schools and has been developed through the use of a rational model of organization, which treats information technology as a strategic resource that enables organizational change. It argues that organizations must undergo a process of transformation in order to survive in the changing global environment (Economist. 1990) (Hammer and Champy 1993).

2.2.1   Technological Determinism

The idea of 'technological determinism' emerged from technical-rational research. This sees the introduction of technology in organizations as inducing predictable changes in job redesign, procedures, communication among areas, flows of information, structures, cultural values, power relations, etc. Its key concern is the 'correct' management of information system activities, a task implying the need to manage the various aspects that have to be addressed in order to obtain benefits from investments in information technology. These aspects do not relate to any specific condition, but are addressed as if they are context free and have universal validity. The approach refers generally to the different technical platforms that have to be considered or the activities that need to be undertaken, such as end-user computing, networking, the organizational structure of the information technology unit, data management, planning, and training (Agarwal and Sambamurthy 2002) (Awad 1988) (Laudon and Laudon 1998). Over time, this kind of research has incorporated additional

topics to address the new needs created by the development of technology and its impact on organizations. In providing guidance on how information technology has to be used in an organization to obtain benefits from the investment in it (Coe 2001), this perspective tends to divide up relevant factors for analytical purposes although all these aspects are intrinsically linked in real life (Walsham 2001).

As this line of research is focused on the elements that have to be addressed in the process of harnessing information technology potential, it also covers the social dimension – but considered as just one variable among others (Keen 1987) (Lucas 1989) (Sprague and McNurlin 1993). Nevertheless, it has illuminated important aspects of the process of implementing information systems, for instance by recognizing the need to consider information technology not as an end in itself but as a resource that provides a service to support the other activities of the organization (Long 1989) (Lucas 1989). Some authors from this viewpoint have provided frameworks that try to help understand the use of information technology in organizations over a period of time. They usually describe the process as linear and defined by the different phases that all organizations have to go through in harnessing the potential of information technology. This research trend is based on a retrospective analysis of organizational cases that seeks to infer general practical guidelines based on actual experiences (Galliers and Sutherland 1991) (Kovacevic and Majluf 1993) (Nolan 1979).

The technical-rational research stream recognizes that obtaining benefits from information technology investments requires the restructuring of organizations in order to prevent them ending up with systems which, like 'electronic pens', focus only on the automation of manual procedures. It has also emphasized the subversive character of information technology, because of its potential to challenge the *status quo* and create new standards for organizational operations. This forces organizations wishing to survive in the new competitive environment to question what they are doing, and how and why they do it, and to consider alternatives approaches using information technology as an enabler.

2.2.2 Business Process Reengineering

Information technology's potential for enabling the redefinition of business processes is exemplified by the concept of 'business process reengineering'. This has deep roots in, and

was widely developed by, management consultancy companies in the 1990s. Its ultimate expression was encapsulated in the idea of using information technology to totally restructure or 'obliterate' traditional business processes (Hammer 1990). Here, information technology is seen as an autonomous driver of organizational change (Davenport and Short 1990) (Kovacevic and Majluf 1993) and the core aspect studied has been the enabling character of information technology to structure organization operations in new ways. However, this view of information technology as a driver of organizational change (Chandler and Holzer 1988) (Drucker 1988) (Peters and Waterman 1982) has paid little regard to the specificity of the social context.

The term 'business process reengineering' encompasses various meanings, but is usually packaged in a way that is easy to explain because it avoids the complexity of the social dimension implicit in both developing information systems and in organizational change. Business process reengineering also encompasses the idea that organizations can be shaped through practices of managing organizational culture, which also tend to ignore the complexity of social and cultural phenomena (Anthony 1994).

Critics of business process reengineering argue that it is: more rhetoric than actual achievement (Jones 1994); a process that is not cost or risk free (Kirk, Grover, and Teng 1994); and an approach that fails to consider social factors such as the political nature of organizations (Angell and Smithson 1991) (Grint, Case, and Willcocks 1996) (Keen 1981), culture, power, and motivation (Bjorn-Andersen, Turner, and Turner 1994). It also does not take account of social inertia, as it assumes that processes and the behaviour of workers can be defined from scratch in any organization. The capacity of business process engineering for transforming an organization has been challenged by showing that a more integrated perspective is required in the redefinition of a business. This recommends first formulating a clear vision of the type of organization that should be built, then using information technology as a driving force, not as enabler of change, to achieve that vision (Bjorn-Andersen, Turner, and Turner 1994). An argument has also been raised about the constraints that information technology can impose on organizational restructuring, for example because enormous investments in infrastructure 'legacy systems' are forcing compromises in the way business processes adapt to new systems (Broadbent, Weill, and St Clair 1999) (Henderson 2000).

2.2.3   The Ideal Model of a Global Company

Another important area that has been researched within the rational perspective is the way a global company should operate (Bradley, Hausman, and Nolan 1993) (Ives, Jarvenpaa, and Mason 1993) (Ramarapu 1995). The enabling potential of information technology has been identified as the answer to the challenge that organizations face in terms of new competitive threats and uncertainties on a global scale. This research has provided guidance on the use of information technology to help face those challenges, which has been expressed in terms of developing a unique and universal solution. This ideal model requires organizations to 'downsize' in order to adapt and respond quickly and effectively to new threats in the market. The approach aims to maximize performance within the whole organization, across all activities and functions, in order to create a chain of value. It does this by co-ordinating the different entities of an organization with the enabling capabilities of information technology (Davenport and Short 1990).

Most of the research that deals with the transformation of organizations enabled by information technology is centred in the idea that sharing knowledge can empower workers (Rockart 1991b) and transform organizations into information-based enterprises (Drucker 1988). Critics of this view claim that the impacts of information technology in organizations are just refinements of past management practices of control, not the empowerment of employees (Kraft and Truex 1994).

Porter (1980; 1985) outlines a model to direct the transformation of the organization to achieve superior performance in relation to its environment. His core concept is the idea of 'value chain', which describes the sequence of activities that contribute to value creation within an organization. These come from both the organization's providers (upstream) and its clients (downstream). A drawback of this model is that its prescription for the optimization of value chains expects these to be done independently from each other, which ignores the adverse effects they can produce when they work in conjunction with each other. Nevertheless, the model recognizes that the enabling potential of information technology to transform organization needs to consider the environment within which it is implemented. It also challenges the *status quo* by inviting creative thinking in restructuring organizational efforts that take account of the specific conditions of each organization, not according to a predefined model.

Within this perspective, the concept of the global enterprise as the new form of organization is addressed as the outcome of the enabling potentiality of information technology (Bradley, Hausman, and Nolan 1993) (Leavitt and Whisler 1958) (Leavitt 1983). In organization theory, the global model strives for: a flatter structure than traditionally used; management by business line and products; cost-centre orientation; and flexibility in taking decisions with the assistance of an intensive use of information. This model of an 'organic' organization with few rules, undefined responsibilities and authorities, and communication in all directions is presented as the alternative to the 'mechanistic' or 'bureaucratic' model, which has well-defined responsibilities, a well-defined hierarchy of authority, and many rules and procedures (Galbraith 1972). The bureaucratic model has an implicit pejorative connotation of being outdated and struggling for survival in an 'information society', where flexibility and the capacity to respond are the key characteristics needed to operate successfully in the new environment (Drucker 1988) (Scott Morton 1991).

2.2.4 Moving Towards More Flexible Organic Organizational Structures

The global company is identified as having certain typical organizational features, including the 'horizontal', the 'network', and the 'platform' (Ciborra 1994) (Daft 1995). The common characteristic of these new forms is the central definition of strategy as being carried out through projects operated by self-managed teams, which are empowered with access to information and decision-making authority and with autonomy at an operational level. This type of organization is managed by professionals who are integrated into multidisciplinary teams, usually working by projects. Heavy use of information technology supports the structure of the organization by offering access to data (Madnick 1991). The organization structure is based on a process perspective that promotes cross-functional boundaries, downsizing, and eliminating 'unnecessary activities' that do not make a value-added contribution (Hammer 1990) (Rockart 1991a).

The literature about this aspect of the rational perspective promotes the ideal of an organically structured model that can sustain the survival of organizations in the changing environment enabled through the widespread diffusion of information technology. The concept of an organic organization carries the idea of flexibility, and the related research defines 'best practices' in using information technology as a link to achieving improved

competitive advantage (Ives, Jarvenpaa, and Mason 1993) (Ramarapu 1995). The notion of best practices has been backed by vendors of software packages, for example 'Enterprise Resource Planning' packages that are supposed to include the best international business practices. This research stream considers technology as a driver of organizational change. The hermeneutic-free ideal model embedded in these packages is seen as the summary of best practices and standards of operations, but pays no attention to how local contexts affect the process of implementation, the actual operation and use of the systems, and whether a package is compatible with the organization's values and way of doing things.

In organizational theory, the efforts to transform organizations have been evaluated in accordance with the goals being sought. The general aim has been to transform organizations by building flatter organizational structures and becoming task driven instead of bureaucratic (Beer, Eisenstat, and Spector 1990), as well as by reducing reliance on managerial authority, formal rules, and procedures. These changes attempt to promote work teams, the sharing of information, and delegation of responsibility and accountability to lower levels of the hierarchy. Although most such projects have not achieved their goals, research has not been able to find out whether this is caused by the model used, the way the process of change has been carried out, or both (Kanter, Stein, and Jick 1992); little regard has been given to the specific social conditions of the organizations involved, particularly if they are not entirely driven by market imperatives (Avgerou 2002).

2.2.5   Strategic Planning to Align Business and Information System Objectives

Another important aspect of the rational perspective has been the idea that information technology needs to be planned and masterminded by managers, based on an ideal vision of the goal to be achieved. This concept has been linked to organizational strategic planning, where the information technology function is aligned to the strategic objectives of the organization from a managerial perspective (Cash, McFlarlan, and McKenney 1988) (Kanungo and Chouthoy 1998) (Lederer and Sethi 1991) (Thorne 1988).

The theoretical underpinnings of this line of research lie in the assumption that successful organizations have a fit among different variables, such as strategy, structure, environment, management process, and technology (Chandler 1962) (Lawrence and Lorsch 1967) (Miles and Snow 1978) (Rumelt 1974). A number of 'success cases' of strategic information

systems that have given a competitive advantage to organizations have been cited, including the one at the American Hospital Supply Co. (Venkatraman and Short 1990) and the American Airlines reservation system called SABRE (Copeland 1988).

This perspective proposes an alignment between information technology and business objectives which acknowledges that the business aims can be redefined by the technology's ability to enable new ways of carrying out the operations of an organization and its relations with business partners. Its main value has been in explaining why the development of an information system has to be aligned to the business strategy – and not be seen as an end in itself – if the enterprise is to benefit from its use (Henderson and Venkatraman 1989) (Kanungo and Chouthoy 1998) (Kovacevic and Majluf 1993). The recognition of the strategic nature of information technology has also brought an understanding that this alignment implies an awareness of the transforming potentialities of the technology in relation to both the internal structures and processes of the organization, and its 'functional integration', the company's position in the market with regard to relations with both clients and providers (Bradley, Hausman, and Nolan 1993) (Henderson and Venkatraman 1993).

Research taking this view has been oriented towards prescriptive solutions about the type of arrangements organizations must make in order to use information technology effectively as a strategic resource, and has been supported by the work of practitioners and consultants in developing countries. It has allowed identification of the main trends that have ended as market standards in the use of information technology in different economic sectors, including prescriptions for rearranging operations and the kinds of investments organizations have to undertake to remain in the market, such as 'just in time' in manufacturing operations or effective customer-response techniques for supermarkets (Bradley, Hausman, and Nolan 1993) (Rotemberg 1991).

Such research has also enlightened practitioners about information technology's potential for permitting organizations to operate in new ways that could not have been possible without it, as well as the need to recognize the technology's strategic character in allowing the manipulation and transmission of enormous volumes of data to support decision making. These studies have revealed the perverse character of information technology in challenging the status quo. The problem with them is that, again, they are context-free and do not explain the difference between the successful use of information technology and those projects that

failed to produce expected outcomes (Kraemer and King 1990). They also do not recognize that the implementation of information technology on its own will not necessarily bring the necessary organizational changes in terms of changing people's work habits in using information to back decision making (Volkow 2000).

2.2.6 Limits of Strategic Planning

In the technical-rational concept of strategic planning, the term 'strategic' comes from the military arena and is associated with the idea of goal-driven control (Cash, McFlarlan, and McKenney 1988) and the capacity of an organization to survive (Angell and Smithson 1991). Information technology is seen as a strategic resource which can provide competitive advantage – but only if it is managed in a way that supports the organization's strategy (Henderson and Venkatraman 1989) (Kovacevic and Majluf 1993) (Martin 1983). The characteristic of being strategic is not something that can be given to an information system, even if it is aligned to business objectives.

The assumption of planning as purposeful action has a tradition situated in the prominence of abstract and rational thinking in Western culture (Blackler 1992), but there are researchers who argue that organizations do not operate in accordance with the rational perspective of strategic planning (Ciborra 1991) (Orlikowski 1996). This research shows that the cases where an organizational transformation did happen were mainly those in which the change started at the periphery of the corporation and were led by local managers, not masterminded by the CEO (Ciborra 1991). Such a transformation is often achieved by a combination of local and corporate initiatives, rather than just one of these approaches.

The enabling capabilities of information technology as a main agent in promoting organizational change (Leavitt and Whisler 1958) has gained wide acceptance. Nevertheless, research has pointed out that the technology can also act as a tool to constrain its use (Davies and Mithcel 1994). The technology's role has generally not been sufficiently studied, although some research is making it clearer that restructuring and downsizing using information technology do not, in themselves, create a new type of organization (Klenke 1994). There is also the need to understand how local conditions can shape information systems development and the process of changing the organization.

In one case study of the transformation of a traditional company into a new form of organization, there was a recognition that information technology played an important role in enabling the organizational change (Bjorn-Andersen, Turner, and Turner 1994). However, this research revealed that change took place not as a preconceived master plan, but as a process of endless evolution. In this case, key aspects of motivation, co-ordination, and allocation of resources were solved *ad hoc*, producing pragmatic results through a process in which local and global needs were being reconciled as the transformation evolved. Nevertheless, the vision of how the new organization would look like was essential, as was the role of leadership in the process of change (Bjorn-Andersen, Turner, and Turner 1994). Emergent forms of organization research stress that sense can be made of new arrangements only by analysing them within the social, political, and economic circumstances in which they are socially constructed (Kraft and Truex 1994).

Various scholars have disentangled the non-rational features of human behaviour in organizational change using terms such as situated change (Orlikowski 1996), muddling through (Lindblom 1959), and improvisation, tinkering and serendipity (Ciborra 1996). Such research has shown that successful strategic transformations involving information technology can be achieved without strategic planning. For example, a deep analysis of the most famous cases of strategic use of information technology revealed a totally different explanation to the one based on a masterminded strategy that leads the organization in pursuit of pre-planned aims (Ciborra 1991).

This research challenges rational ex-post reconstructions of so called 'success cases' because, even if they provide understanding about important variables of the process of change, they cannot capture the complexity of social transformation and can prove irrelevant as normative guidance to address reality (Ciborra 1998). The analysis described by Ciborra (1998) reveals that so-called 'strategic systems' were developed to address the specific needs of a particular area of the organization, and were not the outcome of a plan masterminded by a strategic manager. The actual potential of such a system is typically identified after its development had begun, and the eventual use that emerged was then promoted as the type of system that became publicly known as a successful case of the strategic use of information technology.

The challenge posed by such research supports the view that competitive advantage can truly arise only from the specificity of each organization's cultural features, which are embedded

in its information systems. It argues that the use of information technology has to develop in an *ad hoc* way, addressing the needs and indigenous conditions of each organization (Ciborra 1991). According to Ciborra (1998), any information systems implementation involves technology 'drifting' in a process consisting of frequent adaptations, the re-creation of the initial solution, and unexpected outcomes. This view highlights the importance of a more flexible approach to information systems development based on a social perspective that will enable and support such improvisation in the use of information technology, as explored in the next section.

2.3   THE SOCIAL PERSPECTIVE

The social perspective on information systems has been influenced mainly by the socio-technical approach in organizational theory and other social sciences, particularly sociology. This has its origins in the research of the Tavistock Institute (Trist 1951) that emphasizes the social choices in the use of technology within a specific environment (Land and Hirshheim 1983) (Mumford 1983b).

The socio-technical perspective has strongly advocated the use of participative methods in developing information systems (Checkland 1981) (Land, Mumford, and Hawgood. 1980) (Mumford 1983a). It aims to elucidate the nature of the social change process entailed in information systems implementation by recognizing the embedded institutional features within a context that enables and constrains the use of information technology (Blackler 1992) (Davies and Mithcel 1994) (Orlikowski 1992). The approach also recognizes the social nature of technology and regards an information system as both a social system (Checkland 1981) (Hirschheim 1988) (Robey 1988) (Walsham 1988) and a political system configured by different groups of people with diverse, and even antagonistic, interests (Angell and Smithson 1991). It does not consider the managerial process as a rational activity of masterminded control and co-ordination, but sees it mainly in its communication role in an unstructured reality (Ciborra 1991) (Lindblom 1959) (Orlikowski 1996).

This perspective has no 'ideal model' to pursue. Its key concern is to understand the social dimension of information systems, with the aim of guiding practice. It focuses on the process of transformation, not as the end in itself but in terms of the emergent properties that arise within the local conditions where it takes place (Ciborra 1994). This recognizes the

importance of the way information systems development is influenced by contingent conditions, rather than through the planned character of organizational change. Another of its propositions is that of 'situated change', which identifies the daily practices and accommodations users make to improve their job coherence in their particular environment (Orlikowski 1996).

This view also sees improvisation as a major factor in the construction of organizational reality as situated performance (Ciborra 1996). It considers that one of the important ways in which an organization adapts to the changing environment is through improvisation that happens at all levels. Decisions are then seen to be contingent and have meaning in specific conditions. Planning is still perceived as making sense, but it is dealt with as the highest aspect of a complex process of knitting together situated decisions that try to make sense of daily work and circumstances, which are in permanent flux. Change is thereby treated as a dynamic process (Ciborra 1996).

Researchers within this perspective have used various theoretical backgrounds for their studies of information systems. For instance, Unger's theory of social reconstruction has been employed as a framework to explain the need to understand the role of information analysts as facilitators of the process of change (Blackler 1992). Other theoretical backgrounds that been drawn on to explain the impact of social aspects on information systems include the concept of emergent forms of organizations (Kraft and Truex 1994) and institutional theory (Silva and Backhouse) (Van Der Blonk 2000). The theory of 'structuration' has been used to explain the dual nature of information technology (Orlikowski 1992). Anthropology has also been applied in seeking a better understanding of how information systems are implanted into specific social contexts (Dahlbom and Mathiassen 1993).

Walsham (1993) emphasizes the study of context and process within five different theoretical approaches:

1.   Computers and Cognition: seeks to build an understanding of computers and their relationship to human action and cognition, focused at an individual level.

2. Phenomenology and Hermeneutics: treats the study of information systems as a process of interpretation of the significance and potential meaning they hold, from the perspectives of both the designer and the user.

3. Soft Systems Methodology: based on the idea that organizational intervention has to consider how different individuals and groups construct specific interpretations that are contingent and do not hold a universal status.

4. Critical Theory: aims at the emancipation of the individual, rather than describing and understanding the phenomenon, by developing methodologies that promote open communication and recognize explicitly the existence of structures of power and control in organizations.

5. Post-modernism: focuses on the immediacy of events and the importance of considering contingent conditions, challenging the idea of specific perspectives or future vision, particularly a vision based on the ideal of upward linear progress.

Walsham (1993) advises that theory is important because of two aspects: as a synthesis of implicit practical knowledge and a means to communicate the knowledge. Theory is a way of seeing and not seeing, which influences what researchers choose to study (Pettigrew 1983). The aim is not to search for correct theories, but to develop a coherent understanding of the phenomenon that can help make sense of it both to other researchers and as a guide to assist practitioners with their interventions in organizations (Walsham 1993).

The theory of structuration has been of much value in information systems research. This states that a social process is constructed by human actors whose actions are enabled and constrained by structures, which are the rules and resources human agents use in their everyday life. These structures mediate the way humans interact, and these actions affect other structures by modifying or reinforcing them. Technology is created and 're-created' when it is used by humans to fulfil some actions (Orlikowski 1992). Although technology has embedded structural features, its use is not deterministic as it can be interpreted differently in different social settings with distinctive structural properties. Local social structures can be reinforced or altered by the use of technology, and the way it is used will depend on the structural features of the technology and of the social setting.

Structuration therefore highlights a dual nature of technology that can both enable and constrain the way it can be used. The context is then seen to take a predominant role in the

outcomes of projects that involve the use of information technology (Orlikowski 1992). Such research indicates why the character of information technology is not ideologically free, by recognizing that it has particular structural properties ingrained with specific values. Avgerou (2002) identifies a basic distinction between theories derived from technology determinism, which assume a predictable relationship between changes in an organization and the implementation of information technology, and the theories that recognize some sort of interrelation between the social context and the technology. While this helps to highlight and explain the connection between information systems and the environment where they are implemented, further research is needed to establish an understanding of the impact of local conditions and of the values embedded in the technology.

2.4 INSTITUTIONALISM

Organizations are considered to be functional structures of means and ends from the rational perspective, which de-emphasizes their political and social nature (Zucker 1983). Institutionalism provides a theoretical base to study processes of change within a social environment. It has been used as a framework to study the way characteristics of a specific social context affect the transfer of a trans-societal model of organization to nations striving to modernize and become part of the international world economic order (Westney 1987). 'Institution' in this theory refers to the established authoritative, rule-like procedures in society – the taken-for-granted norms and rules producing patterned ways of acting (Scott and Meyer 1983).

2.4.1 The Key Institutional Factors

Institutional factors include values and common understandings that shape people's actions. They are not consciously or explicitly articulated, but are deeply ingrained in their minds. Such factors constitute unconscious bases of authority, legal dogmas, divisions of roles, and styles of doing things (Blackler 1992), which create a false necessity and consistency in an ideological-closed system (Anthony 1994). They encourage conformity in terms of taken-for-granted behaviour, by promoting appropriate and meaningful behaviour, values, and shared meanings within an organization. These reinforce the institutionalization of such values, as they conform to the patterns of a closed social system where values are constantly reinforced through social acting in accord with the system's legitimacy.

Institutional factors come from both the organization and the environment (Zucker 1987). Within the environment, institutionalization implies a reproduction of social facts, and within the organization it implies the generation of common meanings. From this viewpoint, social arrangements or projects that are not supported by the institutionalized context may fail regardless of their technical excellence, because of their inherent hostility to the environment (Blackler 1992).

Early institutionalists suggested that organizations are historically-produced social systems whose formal structures and processes are sustained by systems of shared meanings (DiMaggio and Powell 1991) (Meyer and Rowan 1991). An organization's origins determine the values, symbols, rituals, and myths that are widely shared by its members. These aspects can change over time as a result of the efforts of members of the organization in trying to make sense of new circumstances (Zucker 1991). The degree of stability depends on the extent to which the members' actions have a shared value and meaning and an accepted legitimacy. Cultural persistence happens in highly institutionalized environments, but an organizational transformation can take place through the 'de-institutionalization' of meanings by the loss of their legitimacy. Three mechanisms of institutional change have been identified: coercion through force or persuasion; imitation through voluntary acquisition of specific features of 'successful' organizations; and normative professional conduct (Avgerou 2002).

2.4.2 Addressing Social Issues at Micro and Macro Levels

The explanation of the social order in sociology is generally addressed at macro and micro levels. The macro refers to the social structure or institutions and the shared values that conform to the social homogeneity of specific social settings. The micro level concerns human actions, preferences, and motivations – and how they are socially shaped. These two levels are described by Peter Berger, Brigitte Berger and Hansfried Kellner (Berger, Berger, and Kellner 1973: p.18) as "the dialectic between objective givenness and subjective meaning" because there is always something outside that confronts the consciousness of the individual. This consciousness is a web of meanings that allows the individual to act in her or his environment, and these shared meanings are 'reality definitions' that structure a particular social setting (Berger, Berger, and Kellner 1973). Structuration theory identifies the macro as 'structure' (institutional properties) and the micro as 'agency' (ongoing human

interactions) (Orlikowski 1992). Social context as such is visualized at a macro level by the social institutions and at a micro level by human actions, and these two are intrinsically linked.

The analysis in this thesis of the Pemex case study will focus on the macro level, specifically the character of the social environment. The impact of information technology and social environment is studied in two senses: how the social environment influences the use of information technology, and how that environment is affected by the use of information technology. The analysis is based on the need to study organizations as located in their societal contexts (Friedland and Alford 1991) and information systems in their organizational settings (Madon 1993) (Ojo 1992) (Robey 1988) (Van Ryckeghem 1992) (Walsham 1988).

Zucker (1983: p.1) points out that "organizations are the pre-eminent institutional form in modern society" and Lawrence (1967) that the survival of an organization depends on its capacity to adapt to its environment. The institutional approach recognizes that the external environment determines the development of the organization. Within the organization, institutionalization operates upon a conformity that is rooted in the taken for granted of values and acts of people within its social environment. Institutionalization within the external environment of the organization leads to the adoption of common policies and procedures (Meyer and Rowan 1977).

Organizations are identified as entities by different aspects, such as their specific values, professional roles, and structures of authority, and are subject to the supervision of their activities by authorities (Avgerou 2002). Participants in an organization are usually not conscious of the values that shape their acts and the common understanding between them is seldom explicitly articulated; they typically do not even consider that their actions imply specific values and conformity – it is just 'the way things are', so has come to be seen as an objective part of a world in which acting differently is almost unthinkable (Zucker 1983) (Zucker 1987). The formal structure and processes of organizations are maintained by powerful 'myths': shared assumptions about the organization's functionality and necessity, which may not be based on efficiency (Meyer and Rowan 1991).

Some researchers using institutional theory have differentiated between institutions of the environment that affect the organization and the institutions within the organization. Culture

34

is conceived of as a collective socially-constructed consciousness of an objective reality (Wuthnow, Bergesen, and Kurzweil 1984). A particular social setting does not necessarily imply homogeneity in the sense of a distinctive institution, but rather the coexistence of various institutions – each with specific values and norms.

The institutionalized beliefs, rules, and roles become the taken-for-granted way of doing things and of perceiving the world, within a shared framework of understanding called a shared cognitive system (Meyer and Rowan 1977). Bell (1973) has proposed the idea of 'axial' principles to specify the primary logic of such an organizing frame of society. Berger, Berger, and Kellner (1973) defined three types of shared cognitive systems: technological production; bureaucratic administration; and pluralization of 'life-worlds'. The first two are the primary institutions of modernity. The most pre-eminent has been the bureaucratic form. Its pervasive character arose from its foundation on formal rationality (Berger, Berger, and Kellner 1973) and the efficiency gains it brought to industry (Zucker 1983).

Meyer and Rowan (1977) identified the role of rationalized formal knowledge in modern societies as a key aspect that shapes social understanding. Such knowledge is expressed in various ways through rationalized myths. This proposition implies a variety of institutional environments based upon institutionalized beliefs, some of which derive from myths. In this sense, a social environment does not have a homogenous character but is rather a cluster of diverse institutions within which some have greater prevalence than others.

(Meyer and Rowan 1977) make a distinction in institutionalized environments between those they call 'technical' and 'institutional'. The technical term refers to sectors in which a product or service is exchanged in accordance with market rules, where the efficiency and effectiveness of the control of work processes is highly rewarded. The institutional setting is characterized by a prevalence of rules and requirements that organizations have to follow in order to gain legitimacy (Scott and Meyer 1983). In any institutionalized environment, as in a bureaucracy, the aim is to establish the correct structure and processes compatible with the quantity and quality of the output. Means and ends become entities that cannot be separated; if anything prevails, it is likely to be the means (Berger, Berger, and Kellner 1973).

These different institutionalized environments are not treated as if they conform to a clear-cut dichotomy, but are seen as organizational dimensions because the presence of one does not

imply the absence of the other (Meyer and Rowan 1977). Some organizations are subject to the institutional pressures from the environment. Scott (1990) also advises that there can be various institutionalized belief systems from which organizations can choose. Organizations are not regarded as passive recipients of the influence of their environment, but as entities with the capacity to choose strategically which route to follow (Child 1984). The legitimacy of the choice would be determined by the level of cultural support for it (Meyer and Scott 1983).

2.4.3   The Institutions of Modernity

The driving force of modernization has been the incessant struggle for increasing productivity: 'doing the same with less' to achieve cost reduction in the production and distribution of products and services in society. In the technological mode of production, the edifice of modern science and technology lies behind every activity. The intrinsic features of this type of knowledge are: abstraction; measurability; "componentiality"[1], and reproductivity (Berger, Berger, and Kellner 1973). All elements of knowledge from this standpoint are related to specific contexts of social life and can represent specific institutions. One of the main features of the technological mode of production is the assumption of maximization: "For both technical and economic reasons the logic of the production process always tends towards a maximization of results. There is therefore a built-in innovative tendency describable, as the case may be, in terms of 'bigger and better', 'more and more cheaply', 'stronger and faster' and so on (Berger, Berger, and Kellner 1973: p. 40). Different methods and institutions carry the rationale of technical production, and so information technology can be seen as a carrier of the rationale of the technological mode of production.

The economic rationale works upon the idea that humans are rational entities who, given equal circumstances, will show consistent behaviour and struggle to deploy the least effort to achieve a given goal. This line of analysis has been influenced by neo-classical economics, which states that individuals make independent, rational choices to maximize utility, without taking into account cultural considerations (Friedland and Alford 1991).

The values of rationality are institutionalized in society through the concept of the 'market'. This shapes the understanding of society and the actions of people, which then reinforce –

---

[1] Characteristic of any entity that can be broken into various components to make it manageable.

36

within a closed system of values – those values embedded in the market concept (Anthony 1994). As the economic rationale is based on institutionalized values, it shapes the way people perceive the social environment and how their actions should be channelled towards specific goals. People acting in accordance with these values, although not by consciously conforming to them, reinforce the institutionalization of those values as the way things have to be done. There is not an explicit acceptance of choice of such values. The logic in operation here is articulated through the various expressions of formal knowledge that have rationality as their basic principle.

The order of rationality arises mostly from 'hard sciences' expressed as economic/technical rationale. The goals defined by such a economic/technical rationale are presented as the optimal conditions to be achieved (Berger, Berger, and Kellner 1973). They are difficult to challenge because they are presented as the only and best way to proceed although, at least until the 1980s[2], they usually did not consider eventual costs and risks. The economic rationale promotes efficiency and effectiveness as universal common goals to all organizations. These are to be achieved following normative prescriptions of standard arrangements that are 'best practices' in accordance with business theory or engineering practice. In business theory, economic rationale is identified with the reduction of costs, profit maximization, and striving for improved productivity. The technical rationale is identified with the engineering normative prescription of how operations have to be carried out on the basis of scientific explanations.

The bureaucratic dimension constructs a distinctive order to suit the indigenous conditions for each social scenario, which vary between different settings. Unlike the fundamental logic of the economic/technical rationale, the key determinants for bureaucracy can be something other than productivity, thereby allowing its "peculiar genius" to unfold (Berger, Berger, and Kellner 1973: p.45). The rationale of the bureaucratic dimension is also reinforced by norms and values not explicitly articulated, which produce a common understanding of how operations can be performed without following the logic of economic/technical rationale. The foundations that legitimize these values arise from the political sphere and from local cultural features in which the daily actions of people are immersed.

---

[2] It should be noted that the book by (Todorov 1997) was published at the beginning of the 1970s when the environmentalist movement had not yet taken off.

Various characteristics of the bureaucratic rationale have been identified, including: an 'orderliness' where everything is ordered in categories into which everything can fit; an emphasis on classifying rather than analysing phenomena; an underlying principle that everything can be organized; and a prevalence of procedures versus goals (Berger, Berger, and Kellner 1973). The limits to these characteristics are drawn by the needs of the technological requirements. Operations are structured within the bureaucratic rationale without an awareness of how arrangements came to be structured in this way; these have just become 'the way things are done and have to be done'. This is how the bureaucratic social order has been shaped historically and why social inertia has enabled it to prevail over time.

The bureaucratic dimension is not optimal in terms of technical universal prescriptions, as the operations are carried out in a way that fits the interests of local cultural practices and political groups. People do things in the way they do because that is how things have been done, or because a person perceived to be in a position of power or legitimacy says they must be done that way. The political and social conditioning is so embedded in daily operations that people cannot see alternatives to the ways operations are carried out – they are just the way they are, have been, and always will be.

In addition to the technological and bureaucratic paradigms, a plurality of life-worlds is the third prevailing institution in modern society identified by (Berger, Berger, and Kellner 1973). These life-worlds, which arise from aspects such as profession, geographic location, etc., are the social orders that give meaning to human existence within a particular reality. The rationale of this dimension structures a social order, a *dictum* of how things have to be done. This follows a logic derived from indigenous conditions, including social and political arrangements, to give a legitimacy grounded on historic ancestry.

2.4.4 The Application of Institutional Theory in this Thesis

The research for this thesis focuses on providing an understanding of the cultural aspects of the environment in one developing country, Mexico. It acknowledges that people act in accordance with their cultural values, many of which are different from those existing elsewhere. These values structure their behaviour as a taken-for-granted way of acting. The research also builds on the understanding of how the identity of a particular culture is

emphasized when it is in confrontation with another culture – as anthropologist have shown in studies of the conquest of Mexico[3] (Todorov 1997) – in order to investigate the role that cultural confrontation plays as part of the forces that can challenge the de-institutionalization of certain values.

The Pemex case study is analysed using the theoretical framework of institutionalism, together with the concept of situated organization change. This analysis seeks to identify the impact of the social context on the process of organizational change and information systems development, as well as how the use of information technology affects the context and the process of organizational change. It takes the economic/technical and bureaucratic dimensions identified by (Berger, Berger, and Kellner 1973) and (Scott and Meyer 1983) as the two main institutions of modernity, because they appear to prevail in both the national and organizational contexts of this case. Modernization has been the rhetoric of the post-revolutionary governments in Mexico, and Pemex has been the symbol on national sovereignty and the foundation of the country's economic development.

Institutional theory allows the analysis of the process of organizational change to address the social, cultural, and political characteristics of the environment in which the organization operates, and how Pemex has developed in its own distinctive way of doing things over time, in accordance with the particular characteristics of its organization and environment. This longitudinal process allows observation of how certain values are de-institutionalized as new groups with different values come into the administration of the company, as a result of political changes at the national level in Mexico. Institutionalism then provides the theoretical base for the analysis of the interaction between the environment and information technology use in Pemex as an ongoing process of transformation within a specific cultural, social, and political context.

---

[3] (Todorov 1997) describes how the Spaniards identified themselves as different to the local cultures they encountered in America. For Pemex, the identity of the group's culture is also characterized by difference, in this case mainly in terms of the oil workers versus the newcomers entering the company with every change of administration.

3 METHODOLOGY

This research involves the in-depth study of Pemex, a large oil company in Mexico, with the aim of understanding the effects of local conditions on the use of information technology and organizational change. A longitudinal perspective was adopted to account for the modernization efforts of Pemex and its use of information technology: the research was carried out at intervals over four years. The phenomenon studied has a double nature, social and technical, but with its social aspect being the predominant (Hirschheim, Land, and Smithson 1984).

This kind of study requires an adequate method that can both address the complexities of the case and be suitable for the theoretical basis of the research (Galliers 1992) (Pettigrew 1983). For this case, an ethnographic method and a contextualist approach were employed, which entail the deep analysis of a unique situation. Even though each particular instance of information technology utilization is unique in itself, the experiences of different organizations in various countries share common aspects. For instance, the issues that are revealed by the analysis of the Pemex case are common to the many organizations in developing countries struggling to redefine the ways in which they operate, through the enabling potential of information technology. Achieving the benefits potentially offered by this technology in developing countries is a complex process heavily influenced by local conditions (Korpela 1996) (Madon 1994). A particular challenge in developing countries is that the technology is being imported into contexts that are very different to the one in which it was originally designed in industrialized countries (Danowitz, Nassef, and Goodman 1995) (Woherem 1992) .

The use of quantitative and structured methods has often proved very valuable in tackling the technical dimensions of information systems. However, an appreciation of the important political dimensions and the diversity that are part of the nature of information systems as a social phenomenon require an understanding of the unique aspects of each case, which is best done through an interpretive approach. The qualitative approach adopted in this research recognizes the various rationalities in the assumptions and orientations of how research is carried out (Pettigrew 1983). The aim is the construction of knowledge, the rigour of which is provided by the logical construction of the arguments, the relevance of its use in

understanding the social reality, and the insights it provides to guide future practice (Checkland 1981) (Pettigrew 1983) (Walsham 1993).

Ethnographic research focuses on exploring the nature of a particular social phenomenon, using unstructured and semi-structured data. Such research employs detailed case studies, whose analysis requires the explicit interpretation of the meaning and functions of human actions, expressed through rich descriptions of what took place and participants' explanations of those events (Atkinson and Hammersley 1998). The recognition of different cultures is important in ethnographic research, which acknowledges that the descriptions of cases are reconstructions, and therefore interpretations of events that reflect the social historic context in which they were produced and the inscribed values of the observer (Pettigrew 1983) (Walsham 1993). The participant observation required by ethnographic research implies interaction and reciprocity of perspective between observer and observed in the shared social and cultural field. It is in the description of the observed phenomena that the interpretation of the observer is privileged in structuring the understanding of the case through the observer's theoretical concepts.

The contextualist approach therefore recognizes the subjective character of the researcher as observer. The researcher addresses the understanding and structuring of the phenomenon under study using theoretical frameworks to make sense of it. The aim of the researcher is to build or construct a theoretical understanding of the phenomenon in its complexity within a holistic perspective, and to disentangle the links between context, process, and content of change (Pettigrew 1985). In Pettigrew's words:

> "Given history and social processes the chance to reveal their untidiness. To understand organizational change examine the juxtaposition of the rational and the political, the quest for efficiency and power, the enabling and constraining forces of intra-organizational and socio-economic and political context, and explore some of the conditions in which mixtures of these occur". (Pettigrew 1985: p.15).

Contextualist analysis addresses the dynamics of change in vertical and horizontal dimensions. The vertical dimension refers to the interconnections between different levels of society, as their transformations affect or interact with the process of change of the organization studied. In the case study in this research, the relevant levels are the international economy, the national political and socio-economic conditions, and the local energy sector. The horizontal dimension of analysis refers to the sequence of interconnections of change in time: past,

present, and future. This approach addresses context and action as mutually affecting each other. The history of an organization is seen not just as a sequence of past events, but as a set of conditions shaping its present and future. The process of change is constrained by context, and is shaped by it. The contextualist approach has been used in research to study the changing process in a number of organizations (Pettigrew 1985) (Pettigrew, Ferlie, and Mckee 1992), for example in investigating the role of information technology in the process of change in a public organization responsible for rural development planning in India (Madon 1994) (Walsham 1988).

The contextualist approach allows us to identify those factors in the social context that affect the process of change of the organization, and in the use of information technology in particular. The research at Pemex was undertaken using the contextualist approach because it offers the possibility of linking theoretical development with practice (Pettigrew 1983). It is an approach that focuses on the dynamics of change, not of change as a *fait accompli*. The approach leads to the study of the process of change and its relation to the context where it occurs. This process is seen as comprising continuous interdependent events in time, recognizing the will of managers to transform organizations to meet their ideal models as well as the way power relations emerge in the process. For the case studied, this relation between 'human will' and the structure of power of the organization is of particular importance because the authorities made explicit their determination to transform the organization into the ideal model of a global company, which involves the power play of different groups for or against it (Pettigrew 1983).

The study's objectives have been to: examine the way in which Pemex has been changing as an organization; how Pemex has used information technology; and the links between these two aspects of the process of change and the context – that is, the environment in which the organization has changed and has used information technology. The analysis also aims to understand how the use of information technology has affected the process of change of the organization. Thus, contextualism provides a useful framework for studying the interaction of organizational change and information technology use within the local conditions of Pemex.

Information systems first allowed the integration of Pemex as a single organization, and then its restructuring as a corporate group. As we need adequate theories to make sense of this interaction, Chapter 2 explored the theoretical background of institutionalism, a theory

offering an effective method of identifying the impact of local conditions on the use of information technology in the organization. At the same time, the duality of technology recognizes that technology both embodies structural properties and is socially constructed by the actors through the meaning they attach to it when it is used and institutionalized (Orlikowski 1992).

The research will address the institutional factors that have affected the process of change and the use of information technology in Pemex. These include pre-established patterns of values and behaviour that shape social processes in conformance with those values and behaviour (Zucker 1987). The nature of local conditions as characterized through institutional factors is shown to be one of the important dimensions of the multifaceted and complex process of changing the organization and using information technology, and of the values embedded in the technology.

The core time period studied is from the creation of Pemex in 1938 to the middle of the 1990s. The contextualist approach deals with past events not as a linear outcome of planned actions but as the complex confluence of social, technical, political, and environmental dimensions. That is why the context and the process of change and of using information systems are presented together within two chapters (5 and 6), each of which corresponds to the two historical periods into which the research divides the longitudinal study carried out – from the 1940s to 1981, and from 1982 to the mid 1990s. As already indicated, this case treats Pemex's environment as referring both to its national and international context. The emergence of this organization and its change process are intrinsically linked to the political and economic conditions of Mexico, its relations with important industrialized countries, and the development of the international oil market. The research therefore includes a rich description of the economic and political conditions of the country during the period studied. In particular, the major effort to change the organization was undertaken by Pemex through its process of modernization during the 1980s and 1990s, as described in Chapter 6.

The processes studied relate, especially, to pressures from external factors; for example, in the arena of foreign policy the main pressure was to liberalize the national energy sector and allow the participation of foreign investment (Hollings 1993-94). Also, the collapse of the international oil price put enormous pressure on Pemex to address the inefficiencies that were publicly perceived to be a major problem. A third international environmental pressure can be

identified in the growing trend to follow new forms of organization: the ideal models, the so-called 'best international business practices', that companies believe they have to follow if they want to achieve efficiency (Chandler 1962) (Cross, Michael, and Sampler 1997) (Drucker 1988). Such trends have also implied specific ways of using information technology that must be followed in order to become a global company.

The national context has particular significance for Pemex because the organization is a state-owned company whose development has been closely linked to the country's modernization efforts. In both historical periods examined in Chapters 5 and 6, national economic policies were based upon the development of Pemex, which is the biggest and most important organization in Mexico in terms of assets, value of production, employment, and fiscal income.

The links with the national economy are multiple and complex, so the analysis takes account of the prevailing economic policies of the central government. The period to the early 1980s was characterized by the pre-eminence of a welfare state as a generator of demand, distributor of wealth, and creator of employment. The second period, to the mid 1990s, is characterized by a neo-liberal government with policies favouring privatization, downsizing of bureaucracy, trade liberalization, and restrictions on state intervention in the economy. The process of change at Pemex is addressed as continuous and dynamic, with its present outcome anchored in the way it developed in the past and was shaped by the different modernization efforts undertaken by the various administrations throughout its history.

The contextualist approach addresses the way the dynamic of change is both constrained by social structures and enabled by them. In the Pemex case, information technology is addressed as a core factor that plays a constraining and enabling role in the dynamics of the change process. The case explores both how information technology use has been conditioned by the organization's process of modernization, and how its use has affected the process of modernization of the organization. It disentangles how the local conditions in which Pemex has operated have led to particular uses and outcomes of information technology implementation, and how such uses reinforced the process of modernization. The research provides a way to interpret the relation between context, process, and outcome. Within this, the use of information technology is considered as part of the process of changing the

44

organization within the path of modernization, which involves the introduction of rationality into local conditions in which a different rationale prevails.

This process of change has been shaped by the development of Pemex as an integrated state-owned oil company, the modification of its organizational mission, and significant institutional factors that have affected the use of information technology. The content of the change is the type of transformations that the use of information brought to the organization, from the early simple automation of manual procedures to the later redesign of work processes targeted at introducing an economic rationale as the driving force guiding the company's management practices. The content of change also refers to how these changes affected the process of change of the organization.

This study traces two types of change at Pemex: the development and implementation of major information systems throughout the recent history of the company; and the major organizational transformations that the company has been going through. It then examines the interaction between these two processes of change. For example, it describes the automation of the financial functions that enforce, to a great degree, the standardization of those procedures that later facilitate the introduction of an economic rationale into the organization.

3.1 RESEARCH DESIGN

Pemex was chosen for study because of its importance within Mexico's economy and its particular conditions as a leading-edge user of information technology in a developing country. Pemex is well-known to all Mexicans because it is part of the country's national identity and the foundation of its industrialization (Meyer and Morales 1990). This means the organization is directly linked to the political trends of a country immersed in a process of modernization, and its process of change has been publicized widely through the media. These factors emphasized that Pemex would be a privileged place to study the phenomena of interest to this research.

It is widely believed that the various efforts of restructuring led by consultants and the significant investment in information technology within an ideological framework of modernization aimed to assist Pemex to achieve the best way of doing things by following what organizations in industrialized countries have done. The initial challenge for this

research was to understand this belief, which was widely promoted by the business school ideology and implicit in official communications and media reports.

Personal connections helped the author to gain access to Pemex. She had worked for the company fifteen years ago, for thirteen months in the personal advisors' office of the General Director. This job resembled that of an external consultancy with working facilities on the premises. It gave an initial understanding of the conditions of the company and provided the motivation for, and interest in, studying its later historical development.

Pemex's split in 1992 from being a monolithic company into a corporation with four subsidiaries was widely covered by the national media. Together with the researcher's background knowledge of the company, such publicity helped to highlight the relevance of the case for the purpose of exploring theoretical perspectives of information systems development and organizational change in the contemporary context of a developing country. Little consideration was given to local conditions in the rhetoric of the official announcements that contained the concepts of modernization, acting as a global company, and computerization. The company undertook a major restructuring and heavy investment in information technology with a very different perspective to the way in which information systems had been used in the past. Nevertheless, even brief experience in the company and casual knowledge of its history suggested a very strong organizational culture, with well-rooted links between the company and the socio-political conditions of the country.

The first step in securing access to the company for the case study was an interview with the Financial Director of the corporate group, to present to him the research objectives and ask for his support. He immediately showed interest in the research because of the problems he was having with the company's financial information systems. A working contact was made with the chief information technology officer of the corporate group, who provided the researcher with an office in the executive area of his department. This first stay lasted for a period of just over two years, from March 1994 to April 1996, involving daily attendance.

The chief officer and all his staff were very supportive and provided all the types of help needed to facilitate the research. They made available official documents of the history of the company and of the organizational structure of Pemex. They also provided advice on 'who's who' in the company and the roles they had in the past, including the names and biographies

of people holding relevant posts, which helped to define the list of people to be interviewed. The chief officer demanded a work programme for the research. This comprised the fieldwork for the research, which involved participant observation, semi-structured open-ended interviews, and group discussions. The researcher also had the opportunity to attend three demonstrations of systems in use in financial areas and two applications under development – an executive information systems and the system 'one-stop shop' for contractors.

Detailed notes of the interviews were taken. The interviews were not taped because recording was perceived as intimidating for the interviewees. In the local culture, people are suspicious of being recorded for fear that the opinions they express might be misused. Possibly this feature arises from the non-democratic social environment that has prevailed in Mexico for many decades.

The research programme had an initial list of thirty people to be interviewed, from the financial, information technology, and operational areas of the company. That original list was altered in accordance with recommendations made during the interviews of additional people who would provide important information on certain aspects of the process studied, although some of the people suggested were no longer in the organization.

During this stage, interviews were conducted with:

- Present and past personnel involved in the information technology activity at all levels. The aim was to trace the history of information technology use within the organization. Interviewees were encouraged to make critical judgements about past events.
- Management and administrative personnel from the company at various levels and areas, including users of the systems. These interviews sought to understand how non-technical people were involved in the systems development and their views about the information systems and the various efforts undertaken to restructure the company.

- Pemex's Contractors. The objective in these interviews was to understand how third parties perceived the changes taking place in the organization and their impact on the contractors.

The research did not use a structured questionnaire. However, interviews were guided by a list of questions (Table 3.1), particularly with interviewees employed by Pemex. The guiding questions helped to provide multiple perspectives on developments by proving common reference points for considering the same events in different interviews.

Table 3.1 Questions Used to Guide Interviews

> - Please describe your vocational training and experience in the organization.
> - How has central government policies affected the company's information systems?
> - Describe how information technology has been managed in the organization.
> - Which have been the most important factors that have influenced the use of information technology in Pemex?
> - Can you identify different groups of information technology experts in the organization and describe their positions?
> - Do you think the corporate systems [called institutional systems within Pemex] fulfil the objective of providing reliable information?
> - In your opinion, why was Pemex restructured?
> - How was the major restructuring that split the company carried out?
> - What was the role of information technology in the restructuring process?
> - How is the organization after the restructuring process?
> - Has there been a significant change in the way the organization uses information technology after the restructuring of Pemex? Explain.

Most of the interviews were very long, some lasting more than four hours, and were usually carried out over more than one day, especially if the person interviewed had spent a long time in the organization. People were very keen to be listened to, and they augmented the information they provided at the interviews with documents or diagrams. During this two-year fieldwork, around forty people were interviewed, among them:

- Finance Deputy (Under-Director)
- Chief Information Technology Officer

- Three technical information technology officers

- Three software developers

- Personal assistant to the chief information technology officer (manager)

- Information technology officer of the Industrial Transformation Sub directorate

- Systems manager of the Industrial Transformation Sub directorate

- Budget Manager of Refinery

- Human Resources personnel (four)

- Planning Sub-directorate of Pemex Gas

- Operation Sub-directorate of Pemex Gas

- Planning Sub-directorate of Refinery

- Systems Officer for Operations of Refinery

- Personnel at lower levels of the Corporate Finance Sub directorate (six).

At the end of this fieldwork, the researcher structured the history of Pemex and its use of information technology, and validated the description of events with different people. Some of the people were still working in the company and others had left it. The research questions were refined to accommodate the understanding achieved by the fieldwork. During the last year of this period, the company initiated the process of development of an integrated financial information system.

The Corporate Directorate's decision to use the software package SAP R/3 initiated a process of negotiation for its acquisition and tendering for consultancy companies to implement it. A new opportunity was presented to continue this research through links with one of the contractors. This was of value, as the researcher needed to study further the process of change in one of the subsidiaries, although she had collected a great amount of data at the corporate headquarters about its function. She decided to focus on the production and exploration business unit, *Pemex Exploración and Producción*, because of its strategic and economic importance. That subsidiary is, in itself, the biggest company in Mexico and the provider of the oil export revenues to the national treasury.

This second stage of fieldwork lasted one and a half years. In this period, fifteen interviews took place with personnel from the human resources, legal, and acquisitions areas of *Pemex Exploración y Producción*. The interviews lasted, on average, three hours. The researcher

49

attended six workshops organized as part of the process of tendering for the selection of the consultants who were to implement SAP R/3.

The aim of the workshops was to analyse the processes and flows of information within and between the principal functions of the company, and to identify the problems being faced with respect to both information systems and organizational aspects. The participants were middle-level managers from the financial and operations areas in both the production and exploration business lines, and the interviews with them lasted five hours on average. On some occasions, there was an opportunity to ask the workshop participants specific questions and receive suggestions of names of additional people to interview.

In this phase, the researcher visited one of the operational sites outside Mexico City, which had been selected as the pilot in the organizational restructuring process of this subsidiary. She undertook two interviews there, one with the leader of the project and the other with the information technology manager for the area. The visit provided the researcher with the opportunity to observe the workings of an information systems centre outside Mexico City, which helped to envisage the new type of organization Pemex aspired to become. Later, the researcher participated in group discussions with the consultants who were selected to implement SAP R/3, specifically with the leaders of the project for implementation and change management.

In the last six months of the fieldwork, the researcher undertook interviews with top-level managers of other subsidiaries of Pemex, and also senior managers who had previously worked for the organization. These included four ex-General Directors, the first information technology manager of Pemex, and the Finance Sub-director (who had launched the open-systems strategy and corporate financial systems in the mid 1980s).

The aim of the interviews with the former General Directors was to contrast the officially-stated mission during their period of administration with the outcomes of information systems development projects and organizational change efforts. The interviews sought to understand how these senior executives had came to join the organization, what goals the President of the country had entrusted to them, their corporate policies, how they solved their information needs in order to fulfil their managerial responsibility, and the role information technology had played in it. The General Directors clarified the historical circumstances of their time

and tended to take a defensive attitude against any possible criticism. They were willing to provide their version of the events, which emphasized their good will and attempts to do their best within the limits of the circumstances. These interviews reminded the researcher of the critique Handy (1985) makes in relation to the bias that specialists and consultants take to address the analysis of the problems of an organization.

The main problems the General Directors faced were directly related to the political sphere, and information systems were discussed only on prompting by the researcher. Their accounts of the development of computer-based systems usually referred to the state of the art of information technology at the time, emphasizing the technical aspects and reflecting the government rhetoric of modernization. Moreover, discussion on information technology tended to reflect a defensive attitude – as if they were being forced to deal with a subject they had not mastered and about which they did not wish to expose their lack of knowledge.

The research also included a review involving restricted access to historical books, internal documents, and official publications. In addition, the researcher's long stay in the organization allowed a thorough observation of: the organizational style; informal flows of information (the *radio pasillo*[4]); and official communications devices, for example posters and bulletins. Until recently, the administration provided very little official communication to the staff. The news provided by the *radio pasillo* could be simple gossip about the situation of a local work place, or major official decisions such as top management appointments or policies emanating from the corporate group. The *radio pasillo* worked with enormous efficiency, often enabling oil workers to have news before the General Director.

During the fieldwork, the researcher found that chats in the corridors and shared comments were an enriching source in helping to understand cultural values and the relations between groups. Sharing coffee breaks and even birthday celebrations with the personnel also gave an insight into the strong and fraternal commitment between the oil workers, despite their different interests. While the researcher was in the corporate office, there was a change of public administration which allowed observation of the actual dynamics of an event that usually takes place about every six years. Being able to see the official communication

---

[4] *Radio pasillo* can be translated as 'radio corridor'. It is the name that oil workers give to the informal flows of information which are carried out on the premises.

devices like posters and pamphlets, including the scribbles made on posters by the staff, was also an important way to sense the reaction of the staff to the efforts undertaken by the administration to change the organization.

Everyone interviewed was very generous with their time, and gave rich descriptions of the events and their personal views on them. A typical response was that this was the first time somebody had taken the time to listen to what the interviewee had to say and shown an interest in understanding their experience as a valuable contribution. The role of the researcher seemed unusual to most of the personnel of the company, as she was considered as neither an insider nor as alien as the consultants. The generosity with which people expressed their ideas and feelings suggested that the researcher was not perceived as being threatening, she was not met with the hostility that was often the case with the consultants. Some of the technical personnel were able to provide valuable feedback on the documented reports of the historical development of information systems in the organization.

The description of the case study should be regarded as a social construction, a possible interpretation of the events structured by the researcher using the data gathered during the field work, the bibliographic research, and her own theoretical and cultural background (Pettigrew 1983) (Walsham 1993).

4   CONTEXT OF CHANGE

This chapter describes the context for the process of organizational change at the Mexican oil company Pemex. It starts by presenting the ideological framework within which the development of Mexico as a modern nation is situated. This provides an overview of relevant economic, social, and political developments to help identify the local conditions that shaped Pemex as an organization. The economic policy of the central government has determined the country's energy policy, so this is an important aspect of the environment within which Pemex and its internal policies have developed. The chapter concludes by exploring the characteristics of Pemex as an organization that has been shaped by the national context, including observations based on the research which shed light on aspects such as labour unions, motivation, and the use of information systems.

The national context and Pemex's process of change of the organization and its information systems development can usefully be divided into two main periods. The first covers the development of Mexico as a modern nation and the emergence of Pemex, which extends to the early 1980s. In the latter decades of this period, the state played a leading economic role as the generator of demand. Neo-liberal economic policies predominated during the second period, from the early 1980s onwards, which can be identified as the new age of modernization. These periods also correspond to the two different stages of the organizational process of change. The first encompasses the development of Pemex as a state-controlled, vertically-integrated[5] oil company. The second covers its emergence as a market-orientated corporation managed as a set of subsidiary companies structured on business lines.

This chapter focuses on describing important aspects that help to describe and explain the national and organizational contexts which have shaped the development and use of information systems at Pemex. Table 4.1 summarizes some key early moments in the first period that lay the foundation to what is discussed later in the chapter. More detail is provided on the first period in chapter 5 and the second in chapter 6 in these chapters' examination of the processes of change, including time-lined summaries of events at the start of each chapter.

Table 4.1: Some Key Historical Events to 1940 Relevant to the Mexican Oil Industry

- 1901: President Porfirio Diaz issues oil law allowing concessions to foreign companies.
- 1906: Government contract with two foreign companies allowing oil products to be exported free of tax.
- 1910: Mexican Revolution begins against the dictatorship of Porfirio Díaz, who stayed in power from 1877 till 1911 and defended the interests of the oligarchy. The revolutionary forces fought to give the right over the land to the peasants, universal suffrage and to prohibit the reelection of the president.
- 1917: New Constitution passed, including Article No. 27 stating that the exploitation of national oil resources had to be carried out by the government.
- 1921: End of the war of revolution. Start of emergence of Mexico as a modern nation.
- 1925: Recognition of past oil concessions, accompanied by a demand for their confirmation.
- 1935: Creation of the National Union of Oil Workers of the Mexican Republic, which came to be in conflict with oil companies over the negotiations of some clauses of the collective contract.
- 1938: Defiance by foreign companies of the mandate of the National Supreme Court, which ended in the expropriation of foreign oil assets by President Lázaro Cárdenas through nationalization decree and the creation of a new national oil company consisting of three entities responsible for export, production, and distribution; theses entities became known as Petróleos Mexicanos with its acronym Pemex.
- 1940: Elimination of the triple structure and creation of one vertically integrated state-owned company that came to be a symbol of national sovereignty.

4.1 IDEOLOGICAL FRAMEWORK

4.1.1 Process of Modernization

Since the 1960s, a massive diffusion of information technology has been a common feature of most countries. Through this pervasiveness, information technology has affected almost every aspect of society (OECD 1988). Many organizations throughout the world have embarked on projects to automate their operations, which have regarding information technology as a vehicle for modernization. Various researchers have suggested the need to consider the social aspects of the process of implementing information technology in order to obtain maximum benefits from its use (Angell and Smithson 1991) (Keen 1981), (Ciborra 1987) (Land and Hirshheim 1983) (Mumford 1983a) (Walsham 1993) (Scott Morton 1991).

---

[5] A vertically-integrated company controls all operations adding value to the products or service it supplies to the market. In the case of oil, this includes exploration, production, refining, and petrochemical operations.

Many organizations still embark on information technology projects in the expectation that their investment in hardware and software will be transformed directly into the modernization of their operations and structures. Implicit in the concept of modernization motivating these initiatives is a belief that the organization will become more efficient and effective through the use of information technology. However, this often underestimates the significance of local conditions in shaping the outcome of applying this technology.

Until recently, modernization was presented as an unchallenged goal in most countries, and was regarded as synonymous with the notion of progress (Sachs 1992) (Berger, Berger, and Kellner 1973). This sees modernization as being closely tied to the process of industrialization and economic growth driven by the use of technology (Berger, Berger, and Kellner 1973), which has been associated with the belief that the application of science and technology in daily life provides a value-free 'best way of doing things'. The scientific explanation of life and society represented by this perspective is often presented as rigorous, universal, and objective – and therefore as something that can be imposed over local cultural traditions, which usually call for metaphysical explanations or are identified as biased towards the political interests of indigenous groups (Touraine 1990) (Giddens 2000).

The process of modernization accepts the homogenizing nature of modernity that, in turn, presents itself as the one ideal way to structure society, with an assumed superiority over all other models (Berger, Berger, and Kellner 1973). The process has been extremely significant in the rapid industrialization of Western society in the twentieth century, which has brought enormous wealth in terms of material well being (Polany 1957). Modernization also implies the assimilation of one culture into another, with the Western culture becoming pre-eminent (Bauman 1990). The process of modernization represents just one historic period of humankind, although it has been presented as if it were mankind's inexorable destiny, and the possibility of alternatives still remains. In recent times, for example, it has been pointed out that contemporary society is facing the worst threats in its whole history, threats that do not arise from natural phenomena but are related to science and technology, for example the threat from global warming (Giddens 2000).

4.1.2 Historical Background of the Process of Modernization

The origins of modernization date back to the Enlightenment in the eighteenth century, which made 'reason' the unquestionable philosophical answer to life (Touraine 1990). The transforming power of reason is expressed through technology, scientific practices, and the forces of the market (Polany 1957). Rationalism remains the prevailing philosophy of Western culture (Giddens 2000), which generally aims at discovering 'truth' as the single correct explanation of phenomena (Berlin 1992).

4.1.3 Modernization and the Emergence of Nations

Modernization is seen as the growth and diffusion of a set of institutions rooted in the transformation of the economy by means of technology. Various countries around the world were incorporated into this process as they emerged as nations, with the primary institutions of social change being the bureaucracy and technological production (Berger, Berger, and Kellner 1973).

The ideal of modernity has been exported to non-Western countries and helped shape the concept of 'development' (Berger, Berger, and Kellner 1973), a term conveying the dual notion of economic growth and social welfare that was seen by the first colonizers as an ideal for everyone in all parts of the world. 'Developing' countries were expected to move along the same track as industrialized ones in order to achieve the common goal of economic and social transformation. This was measured in terms of economic parameters, mainly the level of production per capita (Sachs 1992). The process of development was not limited to economic growth; it also involved the incorporation of institutions associated with modernization, as a way of legitimizing the new nation states (Westney 1987).

Freed colonies developed their own processes of modernization. The culture of each country was produced by a mix of the culture of the colonizer, the international trends towards modernization, and the local cultures of indigenous people. Culture is understood as the values and traditions that give common identity to a group of human beings (Wallerstein 1990) (Mowshowitz 1980). These elements serve to provide cohesion among members of a group, and also differentiate them from other groups who do not share them. Different cultures overlap in space by sharing, or not, specific values. The concept of culture is applicable at different levels: local, organizational, national, or trans-national (such as a

religious group). A group can be identified as belonging to different cultures at the same time, depending on the features it shares or not. The dynamic nature of culture has to be understood, and how a culture can assimilate or discard values (Anthony 1994).

Pemex as a state-owned company is immersed in the local culture, but at the same time it operates in a global context. The most recent efforts undertaken to restructure the company were aimed at transforming it into a global company able to address the conditions of globalization. The next section explores further the meaning given to the concepts of globalization and culture.

4.1.4   Globalization and Culture

Since the early 1990s, the massive diffusion of information technology has contributed to the emergence of the concept of 'global culture' in referring to the process of the globalization of culture (Featherstone 1990). The study of globalization seeks to understand how the world becomes 'united' or not. It depicts the history of the world as a process of sequential 'mini-globalizations', each involving the incorporation of territories and the assimilation of cultures (Robertson 1990).

The term 'globalization' has diverse meanings. For Walsham (2001), it refers to the increasing interconnection of societies in terms of their economic, political and cultural life. For Robertson, it is the compression of the world and the consciousness of the world as a whole (Walsham 2001). For Bauman (1998), globalization divides as much as it unites; it encompasses a process of progressive spatial segregation, separation, and exclusion both within the society of a country and between countries (Bauman 1998).

Globalization is intimately related to modernity and the diffusion of information technology, and in many cases is seen to be tied to neo-liberalism ideas (Aguilar Monteverde 2002). While globalization for some authors represents the diminished sovereignty of nations (Ohmae 1990) in an integrated world economy, it allows companies to have global choices for locating their facilities (O'Brien 1992). Other authors, for example (Clark 1997), argue that nation states should pursue the protection of society against the drawbacks that arise from this process (Walsham 2001). Giddens relates globalization to the notion that we all

live in one world viewed as a whole (Giddens 2000), where globalization can be seen as the latest stage of a common process (see figure 4.1).

Figure 4.1: The Process of Modernization
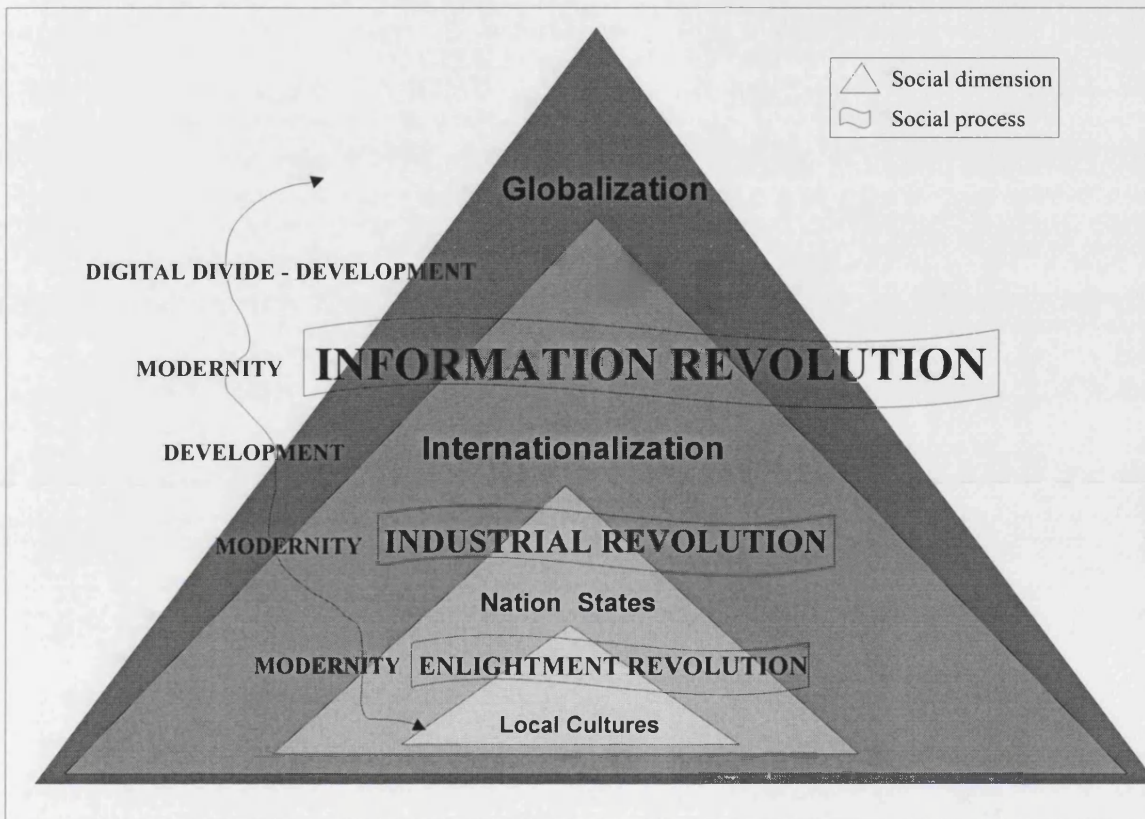
Although globalization has its roots in the industrialization of the world, it is a revolutionary process that does not have an exclusively economic character as it also entails political, technological, and cultural processes. It is not only a process external to the individual but a phenomenon that affects the intimacy of human beings (Giddens 2000).

Culture can be understood as "the sense of summarizing the ways in which human groups distinguish themselves from others. It represents what is shared within a group, and presumably simultaneously not shared (or not entirely shared) outside it" (Wallerstein 1990: pp.31-2). It is not possible to talk of 'global culture', as one talks of the culture of a country or a society. The global culture, or better named 'globalization of culture', should be seen as a process in which the ideal of modernity is incorporated systematically into local conditions as 'best practices'.

The indigenous features of each particular locality resist, turn back, and even influence the cultural global flows (Worsley 1990). As shown in figure 4.1, the globalization of the world can be regarded as a new dimension on top of international cross-border interaction, indicating a permanence of continuity and stability within the change (Walsham 2001). The process of globalization emerged with the massive diffusion of information technology that has enabled a redefinition of the reality in which organizations operate, including a redefinition of the meaning of physical distance. Information technology has driven globalization (Bradley, Hausman, and Nolan 1993), leading to an intensification of global economic competition which has opened an increasing gap between the development of different nations (Castells 1999).

The concept of a 'global company' used intensively by various disciplines is tied to the image of a worldwide corporation that allocates its production facilities anywhere in the world, profiting from the best investment conditions through sales of its products in most countries. The global company also emerged as a model of an organization with standard procedures that have to be followed in order to cope with changes of the environment (Klenke 1994) (Bjorn-Andersen, Turner, and Turner 1994). These changes are linked to the enormous capabilities offered by the uses of information technology, which allow new ways of operation that were not possible without it (Checkland 1981). The key objectives pursued by such organizations are: global efficiency; national responsiveness; and the ability to develop and access knowledge on a worldwide basis (Bradley, Hausman, and Nolan 1993).

In the global organization, information systems become a primary concern because the decision-making process is devolved down to the lower levels of the organizations, with the higher levels responsible for just defining the frames of decisions. The model of a global company is based on the capabilities that information technology offers in handling information, and its organizational structure is built through networks working with the infrastructure of resources available and the formal hierarchy (Eccles and Nolan 1993).

Organizations throughout the world are striving to transform their way of operating to follow this model of a global company. Steps towards this are usually taken with the advice of consultants, imply heavy use of information technology, and generally mirror 'best international practices'. Research in this area is typically conducted in settings of private

companies in industrialized countries, with limited attempts to understand these processes in developing countries, especially in public organizations that do not conform to the market rationale, of which Pemex is an example.

It is within this ideological context of modernization and the ideal model of a global company that this research seeks to position the social setting of Pemex's change process. Within this, two main cultural dimensions need to be identified: the globalization aspects representing the homogenizing influence of modernity; and the local conditions of the indigenous cultural background, both of the country and the organization, that encompass specific features which shape local identities through their prevailing set of values. For Pemex, the unchallenged goal of modernization supported its restructuring efforts to the beginning of the 1980s; since then, it has tried to become a global company on the assumption that this transformation is needed to make it work more effectively and efficiently in the new era of globalization. Throughout all these developments, little regard was given to local conditions that, as explained in chapters 5 and 6, had enormous influence in the organization.

4.2 NATIONAL CONTEXT

The specific characteristics of Mexico are described here to sketch out the national context in which the organizational change took place at Pemex (see also table 4.1). This is necessary because the historical development of the country and its specific political and economic circumstances affected the process of organizational change.

4.2.1 Mexico: General Geographical, Historical, Political and Social Background

The territory of Mexico has an area of 1,967,183 square kilometres, according to the Mexican National Institute of Statistics, Geography and Informatics (INEGI). Its northern border is with the United States (see figure 4.2) and is around 2000 kilometres long; to the East are the Gulf of Mexico and the Caribbean Sea; to the West, the Pacific Ocean; and to the Southeast is Guatemala and Belize. Mexico is a country of great contrasts, with a varied geography and climate. In the North, there are vast desert areas; in the Southeast, tropical rain forests; and huge valleys with a mild climate in the centre. Chains of mountains cross the whole country, restricting agricultural activities (Mendez 1998).

Figure 4.2: Mexico Geographic Location
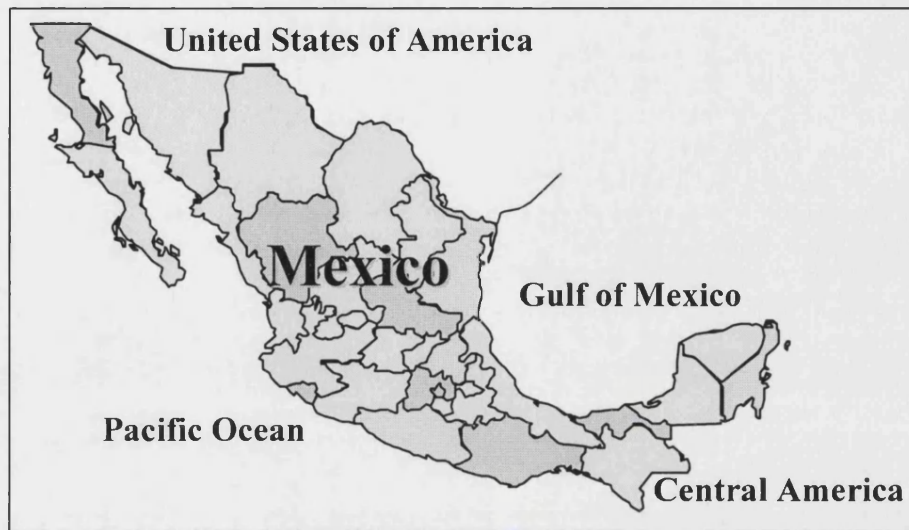
The national currency is the peso and the main economic sectors are oil, silver, tourism, and agriculture for export. Mexico is highly industrialized; it is one of the twenty richest nations in the world, but it is still considered a developing country due to the disparity in the degree of development and social conditions between geographical areas and population groups. There are big differences between the standard of living of the rich and the poor, and in the state of the infrastructure of different regions.

The population of Mexico in February 2000 was estimated to be 97.5[6] million people. A majority of these are from various ethnic groups referred to as 'Indians' or of mixed Indian and Spanish ancestry (known as *mestizos*). Historically, the Indians groups have been socially marginalized and excluded from national processes of modernization. In particular, the special character of the *mestizos* has been identified as a major cultural feature of Mexicans whose origins were an act of rape, who lack a father figure, and have feelings of permanent displacement with little sense of emotional security and belonging (Paz 1981) (Ramírez 1977). Generally, the lives of Mexicans are guided more by traditions than principles, by pragmatism rather than ideology, and by power rather than law (Riding 1989).

Spain conquered Mexico in the sixteenth century and its colonial rule lasted 300 years. The Spanish introduced Christianity to the country. Today, 90% of the population are Roman Catholics and Spanish is the official language. The population is highly concentrated in the

---

[6] XII General National Census - INEGI.

urban areas, with Mexico City containing over 18.3% of the country's entire population. One out of four habitants lives in the metropolitan areas of Mexico City, Guadalajara, and Monterrey, the three biggest cities of the country. The employment distribution in 2000 was: agriculture 16%, industrial 28%, and 53.1% services[7].

The other important influence comes from the United States, mainly through the pattern of economic consumption and industrialization that typifies modernization drives. Mexico and the United States have important economic links that have been reinforced through time; for example, in the early 1990s they signed the North American Free Trade Agreement, together with Canada. Mexico provides cheap labour and raw materials, mainly oil and vegetables, to the American economy. The United States exports capital and half-finished goods to its Southern neighbour. Mexico has enormous unemployment[8] and a large underground economy which in 2000 represented 9.6% of the total production of the economy[9].

Mexico's history has stamped its culture with two distinctive features, popularly referred to by the Spanish words *caciquismo* and *malinchismo*. The *cacique* is a political figure: a strong local leader, the "owner of land and souls" who rules through his own law and usually represents the autocratic, often despotic, power structure that prevails throughout Mexican society. *Malinchismo*[10] is the common attitude of Mexicans in valuing and privileging what comes from abroad over what comes from local sources. This feature is present at all levels of the society, and is seen within organizations when suggestions from consultants are emphasized over proposals made by the company's own employees. The power of science and technology as carriers of modernization is reinforced within this cultural scenario. Their merit and superiority are taken for granted and never challenged, due to their alien character as something coming from abroad.

Mexico does not have a democratic tradition; open discussion and diversity of opinions are not generally tolerated. Even though elections have been held since the end of the revolution

---

[7] Estimated figures from the XII General National Census INEGI.
[8] Officially the unemployment rate was 2.2% in 2000 according to Encuesta Nacional de Empleo Urbano from INEGI. But other studies suggest in 1998 it reached 21.8% (Calva-Mercado 1999).
[9] Sistema de Cuentas Nacionales de México, INEGI.
[10] The word *malinchismo* is derived from the proper name, Malinche, who was the Indian mistress of Hernán Cortés, the Spanish conqueror. She was a noble Indian who spoke several languages and, thanks to her help, Cortés was able to defeat local peoples. The term encompasses the negative connotation of 'traitor'.

in 1921, from the early 1930s only the *PRI* [11] party ruled the country until a real political opposition emerged in the nineties, with an opposition party, *PAN*[12], winning the general elections in July 2001. Most Latin American countries have considered the political system of Mexico to be a 'soft dictatorship' (*dictablanda*[13]), because its government managed to control its labour without the open repression that has been a feature of other nations of the region. The Peruvian writer Mario Vargas Llosa offered this description of the Mexican political system:

"the perfect dictatorship, the permanence of a Party, not of a man, a Party that is unmovable, a Party that gives enough space to criticism, as long as it serves its interests, because in this way it shows that it is a democratic party; but suppresses by any means...the criticism that somehow endangers its permanence." (Hollings 1993-94: p. 95).

The historic lack of democracy in Mexico has not just been in the political arena, but in the social sphere people have also not felt free to discuss matters or to give their opinions in order to avoid personal conflict, fear of hurting the feelings of others, or putting themselves at risk.

The government has profited from this situation by launching all its programmes and policies with no public debate or evaluation. Most of the time, policies are presented as the 'best way', supported by scientific and technical arguments. Risks and costs involved in any decision are not discussed openly, or sometimes not even considered at all. Often policy definitions or new projects are kept strictly confidential until the day that they are actually launched.

The 'scapegoat' mechanism is another prevalent cultural feature; if things do not go well, the person identified as being responsible is dismissed. This 'blame culture' does not allow for learning from mistakes and encourages people to avoid taking decisions, in case they make errors and risk losing their job. Scapegoating is also used as a weapon in the struggle for power between groups, as a way of getting rid of 'undesirable people'. There is a common saying in the government: 'people should not move if they want to appear in the picture'. An

---

[11] Partido Revolucionario Institucional (Institutional Revolutionary Party).
[12] Partido Acción Nacional (National Action Party).
[13] The term dictatorship in Spanish *dictadura* is formed by the words: *dictum* and hard. To compose the term *dictablanda*, the word meaning 'hard' has been changed to one meaning 'soft'.

attitude of risk avoidance therefore prevails in some public organizations, where things happen without open and transparent decision-making processes and clear definitions of areas of responsibility.

Since the late 1970s, the top tiers of government have been held by young professionals who have undertaken post-graduate studies abroad, mainly in the United States. They are known as the 'technocrats' and largely support the economic policies recommended by the International Monetary Fund (Ortiz Wadgymar 1997). Masters and doctorate titles are the source of authority and legitimacy, but work experience is not. These young professionals have usually little or no work experience outside the academic world, and claim power through the attitude that they know what is best and the past has nothing good to offer or to be learned from. In this sense, both the country as a whole and the organizations within it have lost important knowledge because of the low value placed on historical memory and experience. This attitude is also strengthened by the publicly-known corruption of some members of past administrations, often called 'dinosaurs'.

4.2.2   Historical Background of Petróleos Mexicanos

The presence of oil in the region was known by pre-Hispanic cultures, who burned it in rituals and ceremonies, used it as pigment, and employed it in medical applications. During the colonial period, royal legislation established that the King of Spain owned all the mines, fossils, or any 'juices of the earth'; only he had the right to award concessions to exploit these resources. After the war of independence from Spain, all rights belonging to the crown were assigned to the new nation of Mexico in 1821 (México. 1940) (Villegas Moreno 1988). This link between national policy and energy affairs that has remained until the present day.

Successive governments of the new nation maintained these rights. In the middle of the nineteenth century, a royal government, with the Archduke Maximilian of Austria as ruler, realized the economic importance of natural resources and issued an Imperial Decree declaring that nobody had the right to utilize any of these resources without a formal concession from the authorities. It was not until 1884 that the country abandoned its nationalist tradition in legislation regarding natural resources. The government at that time, inspired by the economic liberalism, issued a new code that gave the owner of a plot the

rights over both the land and the resources underneath it (México. 1940) (Villegas Moreno 1988).

In 1901, the liberal government of Porfirio Díaz issued the first oil law that allowed federal authorities to grant concessions to oil companies established in the country. The concessions given for exploration over areas of land belonging to the state proved to be very advantageous to the companies, providing: franchises; tax exemptions for imports of machinery and all items required for the activities of the companies; fiscal allowances; and the right to take ownership of the land if oil was found (Villegas Moreno 1988).

Apart from a stamp tax, the capital invested in oil production was exempted from fiscal obligations for ten years. This legislation also established that companies, even if they were foreign owned, were legally Mexican and had to comply to local laws. In 1906, the government signed a deal with two foreign oil companies that allowed them tax-free exports of all types of oil products for a certain period of time (México. 1940). In exchange, the companies agreed to carry on with investments in the country. Some oil companies enjoyed this type of preferential treatment for a very long period – they did not pay export taxes until 1917, or import taxes until 1935.

The start of the Revolutionary War in 1910 saw the beginning of a time of great uncertainty, with foreign companies paying secret agents in all oil producing areas to destabilize the revolutionary governments (Duran 1982). The popular political movement claimed that natural resources were the nation's wealth. In 1917, a new Mexican Political Constitution was promulgated. Its 27th Article stated that the exploitation of hydrocarbons was an activity to be carried out solely by the government of the Republic[14]. In 1918, a new decree on oil affairs established that the exploitation of natural resources could be made only through concessions granted by the government.

The legislative changes tended to be more restrictive towards the activities of the foreign oil companies. Succeeding laws established limits to the areas of exploitation and created a levy of 5% on future probable production. These changes in the law intensified the problems that

oil companies had with the governments that succeeded Porfirio Díaz (Meyer 1982). There are many instances of abuse by the oil companies, such as their intervention in Mexican political affairs and in international campaigns to discredit the country. In 1925, during the government of Plutarco Elías Calles, a new oil law was promulgated that recognized the legitimacy of the oil concessions signed in the past, but established that the oil companies should ask for a confirmation of their concessions. This new law also established that all concessions were terminated after 50 years, without exemption (México. 1940) (Meyer 1982).

Workers in the different oil companies tried several times to organize themselves into a national union. These efforts mainly faced the companies' disapproval (Prevot-Schapira 1982). In 1935, the workers finally succeeded in establishing the National Oil Workers Union of the Mexican Republic with the support of the government. The Union proposed a collective contract for the foreign oil companies and agreement in principle was reached on most of the points, except for the workers' demand for fringe benefits. The companies claimed they could not cope with the economic demands of the workers. The government tried many times to find a negotiated solution but the oil companies refused to compromise. The conflict ended in the Supreme Court, which dictated a settlement favourable to the Union. Even then, the foreign companies refused to comply (México. 1940).

4.3 ORGANIZATIONAL CULTURE: 'MAKING A CROCODILE FLY'

The culture of the organization, 'the way we do things around here', gives a sense of identity to a company. An organization is a dynamic entity, and so is its culture. There are authors (Warner 1989) who distinguish between 'climate' and 'culture', the latter being the enduring features of the organization that change only because of major internal or external dynamics (Anthony 1994). For some companies, the founder becomes the key determinant of the character of its organizational culture (Schein 1992).

In the case of Pemex, the characteristics of its culture were determined by the events around the decree of expropriation in year 1938 that gave birth to the company. From the origins of Pemex, it is possible to trace the features of its culture and follow the way they have evolved.

---

[14] Article 27 stated: "...it is up to the nation to direct the control of the oil and its products, no concessions nor contracts will be granted for its exploitation, because the nation will do it directly, through the institutions

It is the biggest company in Mexico with installations scattered throughout the country, reflecting different sub-cultures. The size of the company and its economic importance has been the determinant of the political strength of both the company's management and its workers' Union.

Pemex's status as a state-owned company provides the general institutional context in which its operations are carried out. Its activities are regulated by the central government. The mission of the company has been, until recently, centred in its original *raison d'être:* producing the oil that the Mexican economy required. The events that followed the expropriation produced an organization strongly characterized by cohesion. The former foreign owners organized a campaign to discredit the new enterprise as being a group of 'burglars' with no technical knowledge (Sampson 1988). This view had some truth, because all the engineers who worked for the international oil companies were foreigners, who left immediately after the expropriation. The Mexican workers had to continue the operation of the oil wells and distribution centres, while the new corporation had no managerial experience.

The whole process by which Mexicans took responsibility of oil operations in their country was carried out with a very profound patriotic feeling. The workers participated in this with a deep sense of pride, wanting to prove to the world that Mexicans were able to carry on producing and distributing oil in an organized way (García Hernández 1971). However, this was done with minimum considerations to efficiency or to the rationality of Pemex's operations. This 'sense of being' – of approach and behaviour – became embedded in the culture of Pemex, which became a bureaucratic organization with a reputation for red tape, inefficiency, and abuse. Things were done and goals were achieved, but at very high costs.

The irregularities and abuses had been the cost of keeping Pemex run as a tight vertically-integrated organization and hierarchical power structure with no major industrial relations conflict. It was commonly stated that managers gave orders, and their personnel obeyed, regardless of the feasibility of the command. Workers did the best they could, but if it was not possible to achieve what was expected, they would just make up data, as long as they could say 'the order was fulfilled'. For example, during interviews for this research oil

---

created by the nation for that purpose."

67

workers commented that among them they share a joke about the boss ordering them to make a crocodile fly. They will do it, they will make the crocodile fly; just not too high.

The Union comprised groups with leaders who have been able to negotiate benefits in their own personal interest. This structure worked to keep the labour force under control and allowed the company to achieve its production goals, defined unilaterally by the central government. The energy policy of the country has always been dependent on the economic policy of the government. This feature was reinforced by the nationalization of the oil industry in 1938, which led to decisions regarding production levels being directly determined by the financial needs of the central government.

The ways in which the Mexican government has exerted control over Pemex are summarized in table 4.2. The power of the General Director was directly linked to the nature of his relationship with the President, who appointed him, and to his political ability to negotiate with the Union and with government authorities, especially with the rest of the cabinet. This feature permeated the power structure of the whole organization and made personal relations highly valued, in the sense of 'who you know' and 'who knows you' determines 'who you are'.

Table 4.2: How the Mexican Government Exerted Control over Pemex

• Appointment of Pemex's General Director and senior management.
• Definition of the company's goal.
• Determination of the prices of products.
• Taxes on revenues.
• Budget approval.
• Total control over finances.
• Audit of all company operations.
• Data required for National Accounts.
• Legislation over financial, human resources, and procurement policies.

The public administration changes every six years in Mexico, and with it the appointment of the General Director of the company. The organizational culture of Pemex has been influenced by these periodic political changes. Since 1976, every change of administration has meant a massive influx of white-collar managerial staff as personnel *de confianza*. During the interviews in this study, several middle manager stated that the massive influx of

these personnel had resulted in a break up of both the structure of public-service careers in the company and the technical legitimacy of top managerial posts. Oil workers despised the privileges the newcomers gave themselves and the way they sometimes made decisions without consulting internal technical experts about the impact of their decisions. On the other hand, newcomers often despised the oil workers and considered them all corrupt and inefficient, which is why they did not consult them when reaching decisions.

These two perspectives were clearly identified in the case study when analyzing the origins of the personnel interviewed. One culture belonged to the permanent staff, the oil workers, whose jobs were linked to operations and who stayed in the company regardless of the changes of central government and the company administration. The second culture belonged to the group of senior administrators who come into office temporarily with each change of public administration, usually staying in Pemex for around six years.

The culture of the permanent staff can be linked with the origins of the company and the need to produce oil to keep the Mexican economy running. These predominantly male oil workers have strong fraternal bonds; they help each other as a family, respecting strong hierarchical values. Until 1988, they enjoyed job security. The culture of each 'temporary' management group, in contrast, has been determined by the economic policies of the public administration in power at the time. For the oil workers, every change of administration implied new temporary management with whom they had to cope. Each team appointed by a new General Director knew that were likely to be in the post for the six years of the presidential period. Oil workers expressed in their own words: "we know it is just a matter of time, they will leave the company sooner or later".

A 'syndrome of the conquest'[15] was repeated within Pemex each time the public administration changed. The new group in power identified everything that came from the past as evil, and built its church on top of the pre-Hispanic pyramids, enforcing their own values. The 'new gods' were intolerant of past practices and values. Even technical professionals become vulnerable to the influence of the currently prevailing political *dictum*

---

[15] The term 'syndrome of the conquest' is used as a parallel with the conquest of the Aztec Empire by the Spaniards in the sixteenth century. The Spaniards demonised every aspect of the pre-Hispanic cultures and were intolerant of any manifestation of the culture and religion of the Indians. They built their churches on top of pre-Hispanic temples.

when they were appointed to senior managerial posts. "To avoid conflict and keep their posts, the technical managers have to comply with the political line of the group in power," commented a senior Pemex manager.

Until the beginning of the 1980s, the two cultures of the permanent and the temporary groups were able to co-exist more or less at ease. They did not have key conflicting values, with both groups sharing a common vision of the mission of the organization: producing oil as an ultimate goal, without other considerations. Every new administration brought its own managerial style, with its particular values and flair, in seeking to improve efficiency and bring the financial situation of the company under control. In practice, their work was determined mainly by political interests, and at the same time they had to comply with central government or their direct boss to maximize their personal political capital.

Some of the interviewees in this study felt that the values of these two cultures have been radically different since 1982. The cultures of the more recent temporary management groups were aligned with the latest fads of strategic planning and business theory[16]. The corporate culture of the group that arrived in 1982 created a severe conflict because it challenged the oil workers' style of operations, and their basic values of job security. In the early 1990s, half the employees of the company were made redundant. The group that promoted the managerial perspective of strategic planning gained enormous power and tried to change the organization, following an economic rationale based on advice from foreign consultancy companies.

Many of these senior managerial groups managed to stay in the company through various changes of administration, while sustaining an enduring economic rationality. They were appointed to the highest posts; until the end of 1999, the General Director was the main strategist of the process of change. Some of the junior managers learnt to respect the competence of oil workers, and felt they had themselves been 'petrolized'. At the same time, many technical experts from the oil workers identified themselves with the need to change the organization to make it work more efficiently; they said that they have been 'smurfized'.

---

[16] The researcher had access to documents, mostly developed by external consultant, that clearly showed this feature, for example in the restructuring efforts to change from a functional to a cost-centred organization.

A distinction can be made between organizational culture and corporate culture (Anthony 1994), with the former being the 'way we do things around here' and the corporate culture referring to the values that the authorities want to introduce as an ideal mode of operation. This distinction proved particularly relevant in Pemex's case, as there has been an explicit effort from authorities to change the traditional ways of doing and thinking about things in the organization. Oil workers share the feeling that the new programme incorporates the implicit judgement that things were not carried out properly previously and that a better way would be to follow the ideal model of a global organization that incorporates the 'best' international business practices. This effort tried to mirror the reorganization of other oil companies, such as British Petroleum (Cross, Michael, and Sampler 1997).

The project to manage culture at Pemex has been led by consultants with a rational perspective, and has been separate from other efforts to change the organization. In organizational theory, research has sometimes dismissed such efforts as an irrelevant simplification of the complexity of the phenomenon. The simplification allows consultancy companies to market such services easily to managers, as an all-in-one solution (Anthony 1994). For some of the interviewees, the real effects of these efforts will still be open for questioning when the next administration comes into power. The feeling of the oil workers towards the consultants is illustrated by an anecdote related by one of them. As she was standing in the entrance hall to one of the main buildings of Pemex with colleagues, when some oil workers passed through the consultant's group they started to say in an ironic tone: "money, money, money".

After the split of the company in 1992, the separation and clash of the two cultures persisted and most efforts linked to managing the corporate culture were still regarded as being alien to the organization. The oil workers considered this as one more 'business text-book recipe' with which that they had to cope. In the most recent change efforts studied, some consultants said that they have become more conscious of the need to work with the oil workers in their workplaces. They tried to operate as facilitators to promote negotiations between the different groups, but the feeling of some oil workers was still one of contempt, typified by phrases like: "Who are they to tell us how to be, and what we should do?" The management demonstrated its commitment to sharing with employees the benefits of changing the organization by bringing in new working hours. In the old timetable, there was a three-hour lunch break, after which staff came back for an evening session in the office that lasted late

into the night. The new schedule gave an hour-and-half lunch break, with staff leaving the office at 6:00 P.M. To enforce this change, lights in the buildings were switched off at this time.

Table 4.3 summarizes the researcher's analysis of the aspects of Pemex's operations that exhibit dysfunctionalities typical of a public organization.

Table 4.3: Key Dysfunctionalities in Pemex's Operations

• Periodic turnover at senior managerial levels.
• Lack of transparency in the operations of the company.
• Absence of coordination between operational and administrative functions.
• Predominance of informal flows of information in the operational areas and in their relationships with the administrative functions.
• Lack of data regarding costs.
• Definition of the operational goals from outside the company with no direct relation to the actual needs and conditions of the company, only to that of the current public administration .
• Managers forced to put their personal 'political capital' before technical efficiency.
• Recruitment made through personal contacts.
• National scale of operation providing a source of vulnerability to industrial relations conflicts.
• Modernization as an aim in itself.
• Centralization of decisions without regard of their impact on operations at the local level.
• Excessive power of Trade Union leaders at all levels.

4.3.1   Role of the Labour Union

The role played by the Trade Union in the development of Pemex is central to understanding the institutional features of the company.   The National Union of Oil Workers was established to unite workers against the foreign oil companies. It was in conflict with the collective contract that brought about the expropriation, and the national power of the Union and its support from the wider national labour movement allowed President Cárdenas to defeat the foreign oil companies.   The oil workers led the process of nationalization together with the government authorities.   When this crisis passed and the company's operations were running normally, the conflict started to increase between the workers and the central government and their new management (Prevot-Schapira 1982).

Trade Union leaders have had great power at all levels in Pemex. The oil workers' leaders wanted the administration of the company under their control, for which the nationalization of the Mexican railways in 1937 was a precedent in which the Union kept control of the new company. But oil policy was a different affair for the government, who considered oil to be a strategic resource that had to be managed at a national level to support the economic development of the country. As it was unable to have total control of the company's administration, the Union channelled its efforts towards labour demands (Meyer and Morales 1990).

At the time of oil nationalization in 1938, the Union demanded the fulfilment of the collective contract it was negotiating previously with the foreign companies. This was not possible due to the economic difficulties that brought about the expropriation, but control, the Union's control over recruitment enabled it to increase the number of oil workers from 15,895 to 23,073 in the 18 months after nationalization. This situation was unacceptable for the government and it demanded a reduction of the company's labour force. The government wanted to have direct control over personnel recruitment. The conflict became a national economic problem, until the national labour authorities gave power to the government to manage the company's recruitment policy; subsequently, the Union regained this power (Meyer and Morales 1990).

In 1942, the government and the Union signed the first collective contract. However, differences remained; for instance, in 1946 the President used the army to prevent a strike. In time, some of the Union leaders became staff in Pemex's – employees *de confianza* – and split from the Union. The Union was composed of various groups, some of which had considerable autonomous local power, mainly due to the geographical dispersion of company operations and the local political structures of the *caciquismo*. At first, the election of Union leaders was a democratic process linked to the different local structures of power. However, over time, the Union became a tight hierarchical organization of power groups. The top Union positions were rotated among the most powerful local leaders of the strongest oil regions of the country. By 1947, the oil leaders had reduced their ambition to manage the company. In exchange, the government gave them the power to manage the 'Mexican oil system' that was integrated through the economic, social, and geographical areas of the country where there was oil activity.

The Union developed a parallel power base to that of the company's authorities (Prevot-Schapira 1982). One of the most important foundations of this Union power was the authority given to them by the government in 1947 to recruit the personnel of the company and to participate as a contractor or intermediary for other companies in the development of projects for Pemex. It became a pre-requisite for contractor companies to hire workers via the Union. In the allocation of project contracts, the Union was given preference after the evaluation of the proposals, if other circumstances were equal. Most of the labour force of Pemex (both personnel with tenure and *transitorios* under temporary contract) belonged to the Union. *Transitorios* had to pay fees to the Union even if they were not entitled to receive the privileges and benefits of Union membership (Meyer and Morales 1990). The permanent workers enjoyed job security until 1994, when 90,000 workers were made redundant; nevertheless, all the workers who were sacked received statutory compensation.

After difficult negotiations, the authorities and the Union agreed quotas for different types of recruitment. It was established that not more than 10% of workers should be personnel staff *de confianza* and under 5% could be *transitorios*. This set a tight limit to the recruiting capacity of the company and it had to rely on a small group of technically-qualified bureaucrats dedicated to managing the administrative decisions of the oil sector. The rest of the labour force of the company was in the hands of the Union. The workers were automatically signed up as members of the Union when they were hired, without having a choice; thereafter, their fees were deducted from their salaries. The privileged treatment given to the oil workers compared with the rest of the national labour force strengthened even further the Union leaders' power of manipulation (Prevot-Schapira 1982).

There were several attempts to organize a Union for technical staff, which would have enforced promotion policies in accordance with professional qualifications and experience, and avoid favouritism and nepotism in the appointments to technical posts. However, neither the General Director of the company nor the federal labour authorities accepted this. In the early 1970s, 3,600 workers were transferred from being staff *de confianza* to becoming permanent oil workers, with compulsory membership of the Union (Meyer and Morales 1990).

All these events demonstrated the will of the company's authorities to maintain the hegemony of the Union. This relationship between the leaders of the Union and the company

worked because all labour conflicts were managed by the Union to avoid disruption of the industry. The Union developed a nepotistic system of 'self-recruitment' within which posts were inherited by members of the worker's family and new workers were recruited from among relatives of people recommended by Union leaders. During the research interviews, personnel repeatedly complained about such excesses from the Union leaders.

In 1961, the company gave the Union the power to provide labour to Pemex's contractors. These workers were called 'shaved heads', *pelones*; like *transitorios*, they were not members of the Union but depended on Union leaders to be hired on a temporary basis by the contractors. They had to pay a fee to the Union each time they were hired, but did not receive back any of benefits of Union membership (Meyer and Morales 1990). The Union therefore managed all the oil labour force, including highly-qualified technical staff, general white-collar personnel, and blue-collar workers. The power of patronage that the recruitment system gave the Union leaders meant that the personnel recruited were sometimes not properly qualified for the post or were not needed at all. This situation created problems for managers, who stated several times during the interviews that they did not have the qualified personnel to achieve the expected level of performance.

The ratio of workers with tenure to *transitorios* was not stable, ranging from 32.5% of the labour force in 1961 to 40.4% in 1973. This agreement was beneficial to the company as it could contract workers as needed. The Union also gained because it received fees from the *transitorios,* and manipulated them to its own interests. For example, it could ask them to work for the Union's enterprises for free in exchange for a promised tenured post in Pemex. In the early 1960s, the *transitorios* organized themselves to demand their de-casualization and stop this excessive manipulation by Union leaders. In 1967, the Union created a new category of membership of *super-numerario* for the *transitorios* that allowed them to obtain tenure automatically after having worked six years under this type of contract. To make this agreement work in its own interest, the Union redefined its mechanisms of control (Meyer and Morales 1990).

Another important source of Union power was its linkage with the national workers' movement. During the period of the process of expropriation, the support given by the national labour movement to the President proved decisive in his campaign against foreign companies. The leaders of the National Oil Union had been promoted to the top posts of the

national labour movement and the Union's ability to solve internally problems among its factions helped it to develop as a hegemonic power. Conflicts between its leaders were avoided through the rotation of senior posts between the leaders of the most powerful regions (Prevot-Schapira 1982).

In their fight for power, union leaders exceeded their strict role as negotiators with the company and started to develop wider activities, such as social development in the oil regions, transport co-operatives, warehouses, building societies, shops, and schools. Most of these activities were the responsibility of the company, but the Union's control over their development reinforced its economic and political power (Meyer and Morales 1990).

The oil workers environment was a feudal one. The legitimacy of local leaders in the different installations of the company had usually been developed through their proven technical competence and their experience in the organization. The managers of the plants were very powerful; it was recognized by the local people that they were 'owners of lives and land'. The power of the local managers was linked to the political power of the Union, which went back to the period of expropriation. This meant that the Union was so powerful that it could disrupt the operations of these plants. "The Union leaders traded posts as if they were their own personal assets, and behaved as owners of the company," complained a manager.

The Union had three regions of power. The northern region became the most powerful in the 1960s under the firm leadership of Joaquín Hernández Galicia, *La Quina*, who was General Secretary of the Union from 1961 to 1964. He used a combative rhetoric against the company authorities, although he was able to negotiate benefits for his members without any real confrontations. The strength of his leadership was founded in paternalism towards the oil workers. He made the Union compete with the company in providing welfare facilities to oil regions (Prevot-Schapira 1982) and was publicly regarded as a patriarch – hated and feared by many, sanctified by those whom he helped[17].

---

[17] There are plenty of anecdotes about how people waiting at La Quina's office to seek an audience to ask him for all types of favours, even personal ones. For instance, when one woman went to complain about the drinking problems of her husband, La Quina told her: "Go home, I will take care of this fellow"; and so he did, as it was said that the husband stopped drinking after La Quina had a word with him.

La Quina became the director of the National Oil Workers Union's Programme of Social and Revolutionary Projects when he left the General Secretaryship. In his new post, he controlled the finances of the Union, which became one of the most powerful in the country. The new General Secretary was Salvador Barragán Camacho, La Quina's close friend, and they joined forces to eliminate any internal opposition within the Union. Union leaders were initially elected through votes assigned for individual candidates. This was later modified in 1973 to a system based on electing groups of people identified with certain values, known as *planillas*, who formed power factions within the Union that could not be challenged by anyone else. It became a coercive system to control members' votes.

As the Union became a contactor for the company, it also had enormous vested interests in other economic activities in the oil system. Union leaders in the oil regions ruled local economic and social life, granted personal favours to workers leaders in exchange for their future political support. The government provided the Union and its bureaucracy with enormous power in exchange for their support in securing the stability of the company that was the foundation for the economic development of the country. In time, such arrangements became the source of the government's greatest weakness. "Union leaders were so powerful that were able to blackmail even the President to get their own way in negotiations," stated one former Director of the company.

The oil boom that started in the late 1970s cemented the Union's power. The rapid expansion of the industry reinforced the Union recruitment system and gave it even more strength than before. There was very active recruitment during that period, mainly of *transitorios,* whose their numbers increased by 156% between 1974 and 1982. The Union's presence grew with this. In the period 1970 to 1976, 89.6% of Pemex's labour force belonged to the Union; by 1982 this proportion had increased to 94.1% (Meyer and Morales 1990). The Union was in practical controlled of projects to develop the company's oil export infrastructure.

Thanks to the hegemony of the Union, the company did not face labour conflicts that might have hampered its expansion. The working relationship established between the Union and the company authorities ensured that the expansion programme of the national industry was carried through without labour problems. The workers' support was rewarded through the privileges gained by the Union, which was able to negotiate far better working conditions, such as reducing the working week to 40 hours and obtaining social security benefits for

transitorios (Meyer and Morales 1990). Prevot-Schapira qualifies this arrangement as a "loyal relation" with total solidarity among both parties (Prevot-Schapira 1982).

In 1977, at the beginning of the oil boom, the Union was given 40% of all drilling contracts. It then negotiated an increase in the number of posts with tenure and was given 2% of the value of all the contracts awarded to third-party companies, as a direct contribution to its treasury. The Union enforced its practices of selling posts, with the price of a tenure costing an average 70,000 pesos in 1977, increasing to 200,000 pesos in 1982. The company also signed a Training Programme through which the Union provided scholarships to oil workers for attending training schemes intended to assist their promotion. In 1980, the company gave the Union the rights to 'slop oil', the remains of oil from storage tanks, which Union leaders sold to American companies. Pemex also supported the Union in the creation of an oil transportation company with a fleet of 18 ships, to which it gave contracts without fulfilling the requirement to issue a public tender (Meyer and Morales 1990). The Union also strengthened its position at the national political level when five of its leaders became part of the national Congress in 1988.

Enormous financial resources to develop the Union's welfare programmes came from: the fees from its members (workers with tenure, *transitorios*, and the *pelones* workers of the contractor companies); sale of the slop oil; and receipt of the 2% of all Pemex's investment projects carried out by third-party contractors (Meyer and Morales 1990). With all these resources, the Union was able to build itself an image of generosity and paternalism. Several oil workers openly recognized during interviews that this powerful structure worked because leaders splashed privileges and benefits on the closest members of their groups.

An ex-General Director of the company acknowledged in an interview that the members of the administration who came into post in 1982 had open conflicts with the Union, which were made evident through industrial accidents linked to technical sabotage. The measures taken by the new administration in attempting to improve efficiency in the company, and the government's moral crusade of renovation, challenged the Union's privileges. For example, an official decree was published in 1984 stipulating that all contracts entered into by Pemex should follow a strict process of public tender. It specifically mentioned that any Union committee wishing to participate in Pemex's public tenders should follow the procedure and register as a contractor.

This decree marked the disappearance of the Union's role of broker or intermediary with third party contractors, which had given it enormous power. The company signed contracts with foreign oil transport companies and abandoned those with the Union's transport fleet. The ex-General Director of the company responsible for the decision stated that it was taken on the ground of choosing the best price. This conflict with the company brought internal differences among Union leaders. A member of the central committee was put in prison on charges of fraud. He denounced the internal corruption of the Union and the inability of the authorities to control their leaders' power. A human resources manager during an interview pointed out that this broke the Union's hegemony and the tacit loyalty pact among its leaders.

In this new situation, the Union hindered, passively and overtly, programmes carried out by the authorities in their search for efficiency and productivity. For instance, when there was a huge explosion at a Pemex gas storage facility in 1984, the Union used the lack of maintenance of the installations as its major argument against the authorities. Technical accidents proliferated thereafter; the media argued these were cases of sabotage. The conflicts with the administration worsened, until the General Director resigned in 1985.

Relations with the Union subsequently improved through negotiations with Francisco Rojas, the General Director appointed in 1985. The Union was granted a reduction in the numbers of the personnel *de confianza*; maintenance budget allocations were increased; and a deal was struck regarding the contracts for the services of the Union's transport fleet. An ex-General Director recognized that the concessions granted by the authorities showed the power still held then by the Union.

In 1988, the government challenged once and for all the power of the Trade Union. It used the army to imprison the leader with the greatest power, La Quina. The new Union leaders were people identified with the political position of the government. Since then, the authorities have been able to reduce the number of staff at Pemex through various restructuring initiatives, with no major labour conflict. However, in some cases during the process of changing the organization, the authorities had to negotiate with the workers to avoid disruption of production.

4.3.2 Work Motivation at Pemex

When Pemex was founded, the motivation for work arose primarily from patriotic values. This can be understood only within the context of the process of expropriation and the cultural background of the oil workers, who mainly had no professional training and were from rural areas (García Hernández 1971). When these conditions changed as the organization developed, work motivation needed other foundations. These sometimes had to be vested in personal interests not compatible with social ethical values.

A top manager explained that the organization did not have a human resources structure built on meritocracy, as this was not promoted by the relationship the company had with the central government. He said that when the company was created the central government "sent mixed messages to its administration regarding efficiency". The company had no system of rewards or punishments to motivate the efficiency of personal work. Its oil workers tried to do things better just for the sake of their personal satisfaction and professional ethics. Whether or not work could be carried out more efficiently to reduce costs and increase profits made no difference to the company or any of its employees. Because of their engineering background, workers generally considered that "the technical and middle managerial staff with professional careers had the values of economic rationality and technical efficiency firmly installed during their vocational training". The company had no system of evaluating workers' performance. The nepotism built on the Union's power structure also hampered the struggle for efficiency.

Within the political environment of the organization, Pemex's oil workers performed their jobs in accordance with their professional values, following a technical rationale and trying, as they repeatedly expressed it: "to do things as best we could". Most of the senior and middle managerial levels from the operations areas had been trained in the national institutions for higher education created by the post-revolutionary government, especially the National Polytechnic Institute. The prevailing ideological perspective in Pemex was of engineering, with absolute male domination. Women were found in clerical jobs or middle administrative functions, with very few at managerial levels; that was evident when visiting any work place.

The job security enjoyed by oil workers in the past allowed them to exercise decision making without compromising their professional values, but only at certain managerial levels. "The actions of the professional oil workers were able to follow the technical rationale in accordance with the values of efficiency," stated a top manager during an interview for the study. However, because higher-level appointments in Pemex were mostly political, even technical managers promoted to higher posts had to compromise professional values in order to safeguard their political capital. The oil workers were aware of their privileged position in the labour force of the country. Nevertheless, most of those interviewed had mixed feelings regarding the role of the Union, due to the overt and known abuses by some of its leaders, and they themselves may have been victims of such abuse.

The internal processes undertaken within Pemex to define policies have followed the tight, totally centralized hierarchical power structure of the organization. Until recently, there were no official communications regarding managerial decisions, and the operational levels got to know about changes to be implemented only through the informal channel of the *radio pasillo*. "The senior hierarchical levels defined the changes without prior consultation," complained several managers during interviews. The more junior managerial levels were expected to obey the orders of their immediate superiors as defined by the organizational chart, which used to have a large number of layers. Since the early 1980s, the structure has been flattened through various organizational restructuring processes, as several official documents showed. However, the oil workers interviewed felt the hierarchical culture has prevailed in the areas of operations, and seniority achieved through experience was still respected as a source of legitimacy and provided political prominence in the organization.

During the administration of Adrián Lajous, who became General Director in 1994, an effort was made to promote official communication of the different policies to be implemented, such a Total Quality Management campaign. Oil workers usually considered such methods alien, at best, or manipulation in the worst case, as shown in the following anecdote. In the premises of the corporate group there was a poster promoting Total Quality Management that said, in large red letters: "We are all quality"; underneath, there was a handwritten answer made with a clear sense of mockery: "Really!"

The lack of participation by oil workers in decisions usually ended up with their passive retreat. "They will not overtly object, for it is not worth risking their political capital or their

jobs," stated a human resource manager. Even by 1997, after all the processes of change that had taken place over the previous twelve years, some workers were still waiting for the new fads and fashions that would eventually come with the next change of administration.

4.3.3 Information Systems in Pemex

Information systems development in Pemex was identified largely with the central information technology unit, located mainly under the Financial Directorate. The process of developing the company's mainstream use of information technology in Pemex, linked to the administrative functions, is described in chapters 5 and 6. The technical and main strategic information systems of the organization are described in chapter 7, which deals with the content of the change. An appreciation of the role and development of the technical and strategic systems is an important part of understanding the case study and the outcome of the overall process of change as they were developed by areas of the company other than the central information technology unit, followed their own particular style, and were usually not linked to the mainstream organizational use of the technology headed by the financial function. One system even opposed the mainstream use of information technology in an open confrontation, as highlighted by the manager leading it.

5 PROCESS OF CHANGE: FIRST PERIOD

This thesis divides its research into the process of change at Pemex into two historical periods, within which specific differences are identified at three levels: Mexico's economic development, Pemex's organizational change, and its use of information systems. The presentation of these three aspects is done together in this and the next chapter in order to build a coherent understanding of how they are intrinsically related. The two distinct periods have a common denominator: the rhetoric of modernisation and use of scientific knowledge to support policies. This indicates how the processes of changing an organization and developing its information systems are not suspended in space and time (Pettigrew 1983), but are contingent on the specific circumstances of where and when the change happens.

This chapter covers the origin of Mexico and its early development as a modern nation up to 1981. Neo-liberal economic policies predominated during the subsequent second period, to the mid 1990s, which is identified as the new age of modernization in Chapter 6. These two periods correspond to the two different stages of the organizational process of change.

5.1 HISTORICAL CHART FOR FIRST PERIOD, 1901-1981

Table 5.1, like table 6.1 at the start of chapter 6, charts key events in Mexican history, the Mexican oil industry with particular reference to Pemex, and in the development of information systems in Pemex; table 5.1 refers to the first period studied, from 1901 to 1981, while table 6.1 focuses on the second period. As well as locating the events in time, the table aims to help the reader follow the process of change in the case study and to understand the relation between national development, organizational change, and information systems. The last column in the table includes references to key events in world history, some of which had a direct impact on the development of Mexico.

Table 5.1: Historical Events Relevant to Case Study, 1901-1981

Year	Mexico[18]	Mexican Oil Sector/Pemex	Information Systems	World
1901	Liberal parties were dissolved. Strike in Río Blanco.	President Porfirio Diaz issues oil law allowing concessions to foreign companies.		

---

[18] The change of public administration in Mexico is on the first day of December of the previous year identified in the table.

Year	Mexico[18]	Mexican Oil Sector/Pemex	Information Systems	World
1906		Government contract with two foreign companies allowing oil products to be exported free of tax.		
1910	President Porfirio Díaz re-elected. Francisco I. Madero a revolutionary leader promulgated San Luis Plan against re-election. Mexican Revolution started.			
1911	President Porfirio Díaz resigned. President Francisco I. Madero elected			
1913	President Francisco I. Madero assassinated. President Victoriano Huerta elected.			
1914				First World War starts
1917	The Mexican Constitution was passed.	Article No. 27 stated that the exploitation of national oil resources had to be carried out by the government.		Russian Revolution.
1918				End of First World War
1921	End of Mexican Revolution. Start of emergence of Mexico as a modern nation.			
1924	President: Plutarco Elías Calles.			
1925	Bank of Mexico (central bank) founded	Recognition of past oil concessions, accompanied by a demand for their confirmation.		
1928	President: Emilio Portes Gil.			
1929	Plutarco Calles founded the Party of the Mexican Revolution (PRI).			Major world economic crisis begins (The Great Depression).
1930	President: Pacual Ortiz Rubio.			
1934	President: Lázaro Cárdenas.			Adolph Hitler became fuehrer of the Third Reich in Germany.

Year	Mexico[18]	Mexican Oil Sector/Pemex	Information Systems	World
1935		Creation of the Union of Oil-workers of the Mexican Republic. Labour conflict with oil companies over the signature of the collective contract.		
1938	Oil industry nationalization and expropriation of private companies' assets.	Creation of the national oil company with three entities responsible of export, production, and distribution. Petróleos Mexicanos (Pemex) had responsibility for production and general management of the oil sector.	17 companies with different managerial styles and information systems.	British and American embargo on trade with México.
1939				Second World War starts
1940	President: Manuel Avila Camacho.	Elimination of the triple structure of the national oil company and creation of Pemex as integrated company. Mission: Producing oil for the national economy. Pemex became a symbol of national sovereignty, with a Board of Governors including government cabinet members, Pemex managers, and Union leaders. First General Director (GD): Efraín Buenrostro.		Hitler captures Paris.
1945				End of Second World War Creation of UNESCO, UN educational, scientific and cultural organization.
1946	President: Miguel Alemán Valdéz. Internal oil prices frozen to subsidize the industrialization of the country.	GD: Antonio Bermúdez. Development of Pemex as an integrated oil company. Mission: Produce oil and oil products for the national economy. Pemex non-profit oriented. Exports only surplus oil production ('slop oil').		1st Computer, ENIAC.
1950				Korea War starts
1952	President: Adolfo Ruiz Cortines.			
1953				End Korea War
1954	Peso's Devaluation.	Pemex faces difficult financial situation.		Mao Tse Tung became leader of China.

Year	Mexico[18]	Mexican Oil Sector/Pemex	Information Systems	World
1958	President: Adolfo López Mateos.	GD: Pascual Gutiérrez Roldán. Cut backs in exploration activities. Heavy drilling activities. Participation of private investment in Petrochemical operations promoted.		Cuban Revolution.
1960	Nationalization of the electricity industry.	Pemex finished honouring its financial commitment for the nationalized assets of foreign oil companies.	Use of single-register machines to process data payroll.	Creation of OPEC group of oil-producing countries[19].
1964	President: Gustavo Díaz Ordáz.	GD: Jesús Reyes Heroles. Strong nationalistic leadership. Administrative reforms.	Relationship was established with computer experts from the National University.	Creation of UNCTAD, UN trade and development commission.
1965		Creation of the Mexican Institute of Petroleum to promote research in technical areas of the oil industry.	Office of Mechanization and Computing established.	USA enters Vietnam War.
1966		Oil exports are stopped.		Indira Gandhi became leader of India.
1967			First mainframe used to process payroll system.	Seven Days War in Middle East.
1968	Olympics in Mexico City Students repression in Tlatelolco			
1970	President: Luis Echeverría Alvarez. Fiscal expansionary policies. Mexico hosted Soccer World Cup Championship.	GD: Antonio Dovalí.		Salvador Allende elected President of Chile.
1971		Pemex imported oil. Decree of Pemex Organic Law that increased the number of members of the Board of Governors. Pemex faced severe financial crisis.		

---

[19] OPEC consists of Algeria, Ecuador, Gabon, Indonesia, Libya, Kuwait, Iran, Iraq, Nigeria, Qatar, Saudi Arabia, United Arab Emirates, and Venezuela.

Year	Mexico[18]	Mexican Oil Sector/Pemex	Information Systems	World
1973	Oil prices within Mexico increased.			OPEC oil embargo. International Oil price rises to $2.8 per barrel. End of Vietnam War.
1974		Pemex able to export oil surplus.	Information technology strategic planning.	International oil price: $10.84/b.
1976	President: José Lopez Portillo. Peso's devaluation. Internal oil prices increased. Economic Adjustment Program.	GD: Jorge Díaz Serrano. Heavy investment in exploration and production. 76,000 workers employed.		Mao Tse Tung died in China. General Franco died in Spain.
1977	Oil boom started.			
1978	Expansionary economic policy. President Lopez Portillo presented the World Energy Plan at the UN.			Iranian Revolution. International oil price: $12.7/b.
1979		Oil boom. Oil production: 2.2 million barrels a day. Oil exports: 1.1 millions barrels a day; 56% of Pemex's income. Oil spill of Ixtoc offshore oil rig. 108,000 workers.	*Gerencia de Informática* under the Finance Direction.	Second Oil Shock. Iran-Iraq War. International oil price: April, $14.55/b; October, $18.00/b. Margaret Thatcher became Prime Minister of Great Britain.
1980			Basic Information Unit Institutional Database developed on a mainframe.	International oil price: April, $28.00/b.; October, $30.00/b.
1981	Mexican Debt Crisis. Peso's Devaluation.	Pemex reduces its oil prices by $4.00 per barrel, causing Díaz Serrano resignation as GD. New GD: Julio Rodolfo Moctezuma Cid.	Executive Information System (the Control Room Project).	International oil price: April, $32.00/b.; October, $34.00/b.

5.2   THE NATIONAL CONTEXT

5.2.1   Early twentieth century: Mexico's Emergence as a Modern Nation

Mexico as a nation was founded at the end of the War of Independence from Spain in 1821, but its emergence as a modern nation can be identified with the end of the War of Revolution in 1921 (López Gallo 1973), when Mexico was organized as a federal democratic republic with three powers: the President, the Congress, and the Senate. The President is elected every six years, with no possibility of being re-elected. The official party, the *PRI*, controlled the political life of the country for 70 years, until the late 1990s. During this period, the government developed a strong Presidentialism: almost every aspect of the nation's life was ruled by this political figure. The people had very little power to evaluate the quality of the public administration or hold it to account.

Mexico has strived to have a place within the international community ever since it first emerged as a nation. Although Mexico has its own local culture, as a modern nation it demonstrates features that identify it as being what is regarded as a 'developing country'. In the early twentieth century, the country underwent a process of heavy modernization under General Porfirio Díaz, whose dictatorship lasted for three decades. This process, which had a strong French influence, developed the economic infrastructure of the country with the heavy participation of foreign investment. The economic policies of that period were identified with the liberal perspective (Históricos. 1981). The regime ended with the War of Revolution, from 1910-1921.

After the end of the Revolution, there was a period of political and social upheaval, but gradually the tendency towards economic and political stabilization prevailed. Post-revolutionary governments defined the economic development of the country within the path of modernization, with the quest for modernity as the foundation of all their policies. In the 1930s, the Mexican economy had two periods of recession. The first was due to the impact of the Great Depression in the international economy; the second was caused by the embargo brought about by the nationalization of the oil industry, carried out by the socialist-oriented government of President Lázaro Cárdenas (Contreras 1980). His administration established the economic, political, and social foundations that later allowed a prolonged period of growth with relative stability. He fostered the institutionalization of political movements for

the working and rural classes, helped with the creation of chambers of business, and carried out one of the nation's most important programmes of agrarian reform (Shulgovski 1977).

5.2.2   1940-1970: Economic Dynamism, Social and Political Stability

Between 1940 and 1970 the Mexican economy showed a period of great dynamism, accompanied by social and political stability. The government implemented an agrarian reform programme and an import-substitution policy to compensate for the effects of the Second World War and to promote the industrialization of the country (Solís 1981). Mexican Gross Domestic Product (GDP) grew at more than 6% annually. There was a major shift in the significance of different economic sectors in terms of their contribution to the GDP. In 1940, agriculture contributed 23.2%; industry 31.0%; and services 45.8%. By 1967, these figures were: 15.8% for the primary sector; 36.7% for industry; and 47.5% for services[20]. The government undertook a very ambitious spending programme during this period, including its direct participation in the economic life of the country, such as implementing complex subsidy programmes and tax exemptions to stimulate investment in industry. Public investment was directed towards infrastructure development.

The import-substitution policy established an extensive framework of protection for the domestic industry, which developed at the expense of a captive demand base and isolation from foreign competition (Solís 1981). This allowed companies to obtain high profit margins. In principle, this protective trade policy aimed at preserving the consolidation of the national industry, but even when Mexico's industrialization progressed, the level of protection did not decrease. Mexico became dependent on half-finished and capital-goods imports, provoking continuous annual balance-of-trade deficits. These were initially financed with agriculture exports and tourism income; however, these revenues rapidly proved insufficient and structural limits hindered sustained growth. The economy had developed an infrastructure of very inefficient industrial plant, leading to the availability of goods combining poor quality and high prices, with the burden being borne by the captive national consumers.

By the end of 1940s, Mexico faced a balance of payment crisis that eventually resulted in a devaluation of the peso by approximately 40% between 1948 and 1949. The devaluation and

---

[20] National Institute of Statistics, Geography, and Informatics.

favourable economic effects of the Korean War released the pressure on the balance of payments. Nevertheless, internal prices continued to grow faster than world prices; the government took advance actions to prevent capital flight by devaluing the peso by 30% in 1954 (Solís 1981). Social peace prevailed. The government controlled the trade union movement through national labour organizations, whose leaders (*líderes charros*) totally supported government policies.

The industrialization of the country continued to be based on import substitution, although rhetorically the government stressed the importance of promoting exports. The balance of trade registered deficits that needed to be financed. The agricultural sector met this need by earning foreign currency and supplying food and raw materials at low costs. An agrarian reform programme promoted the migration of rural population to the cities, providing low-cost labour for industry. Throughout this period, the government supported the development of public universities and polytechnics. These institutions became centres of excellence in research and teaching, thereby providing the professionals that industry required.

The Stabilizing Development Programme implemented by the government during the 1960s fostered a high rate of economic growth, averaging 6.5% during the 1960s, together with price stability with an average annual inflation rate of 3.6%. This period has been called the 'Mexican Miracle'. The economic growth rate slowed down towards the end of the 1960s, when pressures of unemployment appeared in urban areas. At the end of the 1960s and beginning of the 1970s, the political *status quo* in Mexico was challenged by various political movements, principally from students at public universities. The army severely repressed these movements, which came to international attention with the killing of 400 students[21] at the start of the 1968 Olympics in Mexico City (Poniatowska 1997). Only minor guerrilla movements, located mainly in the mountains of the southeast of the country, remained active throughout that decade. With the repression of the student movements, the state changed its policy towards the public universities and they were brought under closer government control. Although some disciplines remained centres of excellence, in general the academic reputation of public universities decreased. After this period, private-sector institutions of higher education flourished and became the major providers of qualified professionals in most academic disciplines.

---

[21] This was the official figure, but people knew that the number of deaths was much higher.

5.2.3   1970-1981: Economy Expansion and Stability, Oil Boom and Crises

In the early 1970s, the administration of President Echeverría undertook a fiscal expansion policy to address social welfare problems; this stimulated demand through increased public spending, but was not accompanied by an equivalent growth in income. The resulting public sector deficits were financed initially by expansion of the money supply and later by incurring foreign debt. Inflation was rekindled from various sources. A crisis in the agricultural sector, due to the stagnation of its production, led to increasing raw materials prices that resulted in growing costs for industry and pressure on salaries from rising food prices (Cordera and Tello 1981). There was also pressure on internal prices from imported inflation that resulted from the 1973 international oil shock and the consequent international monetary crisis, as Mexico was an oil importer at that time. This faced the country with economic and political problems: the government and the private sector broke their mechanisms of compromise, which provoked a reduction of private investment, flight of capital, and the loss of government credibility – culminating in a general crisis in 1976. The peso was further devalued, ending a long period of exchange rate stability (Tello 1993).

In December 1975, President José López Portillo became President of Mexico and implemented an economic stabilization programme to balance the external deficit. This ended in 1978 when he began a large-scale programme to exploit the nation's recently discovered oil reserves, which saw the beginning of a phase of accelerated economic growth financed by foreign loans. Foreign currency income increased at an average rate of 45.3% annually from 1978 to 1981 (Tello 1985). During these years, when the economy grew at an 8.6% average annual rate, economic expansion created bottlenecks in various sectors of the economy, with oil becoming the heart of the national economy (Gutiérrez 1982) (Bueno 1982). The government liberalized imports to relieve the restrictions on economic growth and to take advantage of the high oil prices in the international market. Mexican imports then grew dramatically, at an average annual rate of 43.6% from 1978 to 1981. Both trade and balance-of-payments deficits deteriorated (Cordera and Tello 1981).

The development of the Mexican oil production infrastructure was financed with foreign resources and did not stimulate internal economic activity because the technology and equipment were mainly imported, and at the same time the massive income from oil exports stimulated the import of luxury products. Some sectors of the government that were aware of

the risks of the 'petrolization of the economy' (Gutiérrez 1982) (Bueno 1982) wanted to promote the substitution of capital imports, but the President did not back them. The foreign debt increased from $10.9 to 433.4 billion from 1978 to 1980 and reached $58.1 billion in 1981 (Tello 1985). Mexican oil exports grew dramatically in this period, but foreign currency income was insufficient to cope with the external financial commitments of the country.

Pressure on the prices of basic goods increased because of the bottlenecks created by the growth in demand. Government economic policy maintained a fixed exchange rate and kept prices for basic goods and public services under control. These subsidies were also financed by external financial resources. The country's future was therefore mortgaged to the hard currency revenues that the government thought oil exports would bring. The economic policy of rapid development based on oil revenues was accompanied by a political discourse that maintained the oil was an asset of the country and its people, so this industry should bring benefits to all Mexicans. The population did gain from higher standards of living, but at the cost of high inflation rates (Gutiérrez 1982). The benefits were gained mainly by the middle-class urban population. When the flow of oil revenues collapsed in the 1980s, the structural problems of the Mexican economy reappeared with greater strength (Villareal 1988).

By the end of President Lopez Portillo's administration in 1981, international economic and market conditions had deteriorated. Interest rates in the international financial market increased, and with them the interest payments Mexico owed to international banks increased. The US dollar was revalued in the currency markets, which meant the real price of imports increased at a moment when they were running at a very high level in Mexico. The international oil market showed signs of a glut and a change in its structure, with the balance of power going back to the oil companies and consumer countries. The oil price collapsed and with it the financial underpinning of the Mexican government. The authorities were immediately forced to reduce government spending and borrow more in the form of short-term loans contracted within an adverse financial climate (Villareal 1988).

The obvious overvaluation of the peso and the generalized expectation of an imminent devaluation brought about a massive capital flight, of around 13 billion dollars in 1981. The government maintained its defence of the overvalued exchange rate, borrowing more from

foreign sources in highly unfavourable conditions. Deterioration of the balance of payments deficit reached a crisis point in February 1982, when the peso was devalued. The financial measures that the government introduced were not enough and the international oil conditions also changed dramatically, further reducing oil revenues. In August that year the government declared a virtual suspension of payments and the peso was again devalued. In September, the President introduced exchange rate controls and nationalized the banks because they were accused of promoting capital flight (Tello 1985).

The paradox of the 'Mexican Wealth' chimera was therefore clearly revealed by the early 1980s: the oil revenues that had promised Mexican economic progress had actually built a path to dependence, in which the export capabilities of the country were developed with foreign resources and the Mexican economy was tied to servicing an enormous foreign debt with its oil export revenues (Gurría Treviño 1988). The country ended up being the main strategic energy reserve of the United States, and the national economy was controlled by the fluctuations of the international oil market because most of Mexico's public financial resources came from oil exports.

5.3   ORGANIZATIONAL ASPECTS

5.3.1   Expropriation of Foreign Oil Companies

On March 18, 1938, President General Lázaro Cárdenas issued the law expropriating the foreign oil companies operating in Mexico by nationalizing their assets. Petróleos Mexicanos (Pemex) was founded as a result of the refusal of the oil companies to comply with Mexican Law. On the day of the expropriation, President Cárdenas gave a very long and moving speech in which he explained clearly the facts that had brought him to the "unavoidable decision", and he asked "the people of Mexico for their political and economic support":

> "The oil companies have refused to comply to the highest mandate of national justice, ... the Executive Power can face strong social pressures, ... if oil demand is not satisfied properly, ... it can provoke a crisis which is incompatible with the progress of the nation, ... that could even put at risk the very survival of the government; ... without economic power it could also lose political power and then chaos would come ... it is an act of economic emancipation. ... It has been said that the oil companies have brought enormous amounts of capital, this statement is exaggerated. The oil companies have always enjoyed very privileged treatment ... in the present circumstances the nation's progress and survival are threatened ... urging the only solution to this problem." (México. 1940: p. 35)

From a social science perspective, the viewpoint of the observer determines the explanation (Checkland 1981). The companies' point of view on these events was that the Mexican government wanted to reassert a dormant principle (Sampson 1988). From this perspective, as the government needed money to pay its defaulted foreign loans, post-revolution regimes had implemented various regulatory changes and tax increases that fuelled the conflict between the two parties. The United States government backed its companies in order to protect 'vital' American owned oil reserves in Mexico (Yergin 1991).

On many occasions, Washington's intervention was a real threat. The most important American interests and rights were often attacked and contracts and bargains were continually broken, so Washington saw instability, insecurity, banditry, and anarchy in Mexico. From the Mexican viewpoint, the oil companies represented 'Yankee imperialism', foreign exploitation, humiliation, and violation of sovereignty – as reflected in Sampson's (1988) description of the days after the expropriation which also indicated how the initial euphoria did not last long. The Americans, British, and Dutch boycotted the nationalization of the oil companies and publicly predicted that the 'Mexicans will drown in their oil'. The foreign countries considered that the new state-owned oil company was run corruptly and incompetently, without enough experts or engineers. Mexico was forced to pay financial compensation of $130 million for the assets nationalized (Meyer and Morales 1990).

Most Mexicans considered the nationalization of the oil industry to be a historic event that asserted the country's dignity. People of all social levels donated cash and goods to contribute towards payment of the financial compensation (García Hernández 1971). The foreign oil companies fuelled a campaign to break the financial stability of the country and the government was forced to devalue the peso. The companies declared publicly that the Mexicans would not be able to cope on their own. There was adequate reason to believe this, because the oil installations had not been maintained for three years, all the managerial staff were foreigners who left the country after the expropriation, and the companies took all the exploration maps (Meyer and Morales 1990) (Meyer 1981).

For the Mexican nation, the expropriation was seen as an act of courage, as it was for the workers who had to carry out the nationalization process. The Mexican workers had to order their foreign former managers to leave the offices and installations on instructions from their Union leaders that they received by telegraph (García Hernández 1971) (México. 1940).

When new orders from the Union leaders arrived, the local telegraph offices lit fireworks so that the workers in the installations could know the news immediately. There are anecdotes of how the workers faced this difficult moment with great courage. The attitude of the workers was in many cases rooted in the *macho* culture[22] of Mexico: *yo soy hombre y como macho no me rajo*[23].

The expropriation of the assets of foreign oil companies that brought about the birth of Pemex became the foundation of the organizational culture of the company. The characteristics mostly valued were courage, not giving up, coping with anything to achieve the goals of production, the feeling that the company was theirs, and pride in having the historic opportunity to fulfil the task of saving their nation. The government took on an enormous debt with nationalization, and was committed to honouring it. To achieve this, it had to create a new Mexican-owned oil industry – and in the months after expropriation it took a number of decisive steps towards that:

- On March 19, 1938, the day after expropriation, the *Consejo Administrativo del Petróleo* was set up to take charge of the provisional management of the financial assets of the expropriated companies (México. 1940).

- On March 31, the government created the *Exportadora Nacional de Petróleo* to manage all oil exports.

- *Petróleos Mexicanos* (Pemex) was founded as a one integrated company on June 7 as a decentralized institution with its own legal identity; it was vested with the oil assets and charged with the responsibility of managing the oil sector, including responsibility for production. Management of the newly formed company was a difficult task. This was partly due to the mixture of management styles, accounting practices, and operational practices at the sites that had previously belonged to different foreign oil companies, but also because of the lack of parts for maintenance and the difficulties of selling oil on the hostile international market. Technicians were unable to buy spare parts because of the embargo imposed by the United States, and Britain (Sampson 1988) (Meyer 1981). The only foreign countries that bought oil from Mexico were Italy, Germany, and Japan.

---

[22] The macho culture is based on the emotionless male figure of total power.
[23] "I am a man, and like a man I do not give up"

- On July 8, 1938 the national financial collection that had been organized to pay the obligations arising from the expropriation officially came to an end. The government then created a third company for the nationalized oil sector: *Distribuidora de Petróleos Mexicanos* with responsibility for oil distribution.

Management from the three entities that had become responsible for Mexican oil exports, production, and distribution participated in all the boards of governors of the three companies, together with ministers from the central government and leaders of the National Oil Workers Union (Meyer and Morales 1990). The process of standardizing the different administrative procedures used by the foreign companies also started on the day after expropriation, when a comprehensive inventory of the nationalized assets began. At the time of nationalization, the 17 foreign oil companies active in Mexico had around 13,000 employees who worked with various different types of equipment and followed different procedures. In the first months after the expropriation, production levels decreased. The overall mission of the new companies was to satisfy the local demand for oil and to keep the national economy running (García Hernández 1971). This was achieved through a reduction of oil exports. By the end of 1938, Pemex had returned to the former production levels; its main problem then became selling oil on the international markets in the face of the American and British embargo (Meyer and Morales 1990).

The National Oil Workers Union had a major role as a competing source of power to company management; it even strove against the government for ultimate control of the sector, as described in Chapter 4. In Mexico, national unions have always been powerful, but this Union's power was greater because of the strategic character of the oil industry. To avoid open labour conflicts, the Pemex authorities established a working relation with the Union that has proved very expensive over time, although it also actually advanced the aim of developing the industry (Meyer and Morales 1990) (Prevot-Schapira 1982). The role of the Union has great relevance to the evolution of information systems at Pemex because of the strong influence it has had over most of the company's operations and data flows. Any effort to modify the way the company controls information has therefore affected the Union's vested interests. The evolution of this difficult and complex relationship is described in section 4.3.

Once established as an organization, the history of Pemex can be divided into two periods, as it has been divided in this thesis between chapters 5 and 6. The first period, covered in this chapter, was the time when Pemex developed as a state-owned, vertically-integrated oil company, with the mission of producing oil as a public service. Its goals then were to provide the oil that the national economy needed and, later, to expand oil exports to generate the financial resources required for the economic development of the country. The second stage comprised the modernization of the company to transform it into a market-oriented corporation, where its mission was redefined to that of producing oil utilizing operational standards that conform to an economic and technical rationale. This process of change started with the modification of the political and legal framework that hampered the transformation of the company. Later, the company undertook restructuring efforts to change it into a global company. This second period is examined in Chapter 6.

5.3.2 Pemex as a State-controlled Oil Company, 1938-1981

At the start of this period, the administrative structure of the newly-nationalized Mexican oil industry consisted of three separate companies – covering production, exports, and distribution – but this was abandoned due to the political problems that arose among the directors. On August 8, 1940, President Manuel Avila Camacho centralized the responsibility of the national oil sector in Petróleos Mexicanos (Pemex) as one integrated company and this is the organization that existed until it was split in 1992 (Secretaría de Energía 1992) (Ortega San Vicente 1993). The development of Pemex is described below, classified according to the main features of the administrations of its successive General Directors[24].

5.3.2.1 1940-1945 Administration

Efraín Buenrostro became responsible for managing the assets of the nationalized oil companies when he was appointed General Director of Pemex in 1940. The unified company was empowered to control all operations related to the oil industry, with its main mission being to satisfy the internal demand within Mexico for oil and refined products in order to prevent the collapse of the economy. The board of governors consisted of five appointments made by the national President and four made by the Union. The President could remove at any moment anyone appointed to any post in Pemex, even the General Director; this vertical

structure of strict hierarchy and absolute power has been pervasive throughout the company and the Union (García Hernández 1971) (Meyer and Morales 1990).

The need for an international alliance in the Second World War put an end to Mexico's political conflict with Britain and the United States. The Mexican government compromised and agreed to pay interest on the nationalized assets (Meyer 1981). By the middle of the 1940s, Pemex's authorities were addressing problems not related to the effects of the expropriation, but they had difficulties coping with growth in the internal demand for oil provoked by the economic boom induced by the war. The government subsidized internal oil prices to foster the industrialization of the country. Financing Pemex's activities became the major managerial concern, mostly because credits came principally from foreign sources in a period when Mexico faced difficult relations with the main world economic powers (García Hernández 1971) (Meyer and Morales 1990).

5.3.2.2   1946-1958 Administration

In 1946, Antonio Bermúdez became the General Director of Pemex and stayed in the post till 1958. His major challenges were to develop Pemex as a vertically-integrated oil company with a centralized administration, and to keep relations with the Union under control. Pemex was responsible for providing resources for the national welfare state and was clearly defined as a non-profit orientated company. It became the symbol of the nationalistic rhetoric of the post-revolution government and of Mexican sovereignty. Its identity has been quite distinct from that of other state-owned companies in the country and the rest of the world (Meyer and Morales 1990).

During this period, the growth of the oil sector was still directed to the internal market, with exports restricted to the sale of surplus production. The company needed resources to invest in infrastructure development in order to: increase production and refining capacity; build pipelines for a national distribution system; and relocate refining and petrochemical facilities. These facilities needed to be moved closer to the centres of demand because export-oriented foreign companies had built their installations mainly on the coast of the Gulf of Mexico. Pemex also needed to generate sufficient income to pay both the financial compensation due

---

[24] The change of public administration is on the first day of December of the previous year.

to the foreign companies for the expropriated assets and the salaries of the workers, whose numbers kept increasing (García Hernández 1971).

The cost of variable capital was very onerous because the administration kept labour relations under control by giving its work force high salaries, excessive fringe benefits, and other social privileges (Prevot-Schapira 1982). The net revenue of the company was restricted both by the policy of subsidizing internal oil prices and the transfer of revenue to the national Treasury through taxes. The subsidized prices were a symbol of the public ownership of the company, a benefit to which all Mexicans believed themselves to be entitled. These forces shaped the perennially difficult financial situation the company has faced throughout most of its history (Meyer and Morales 1990).

The company administration had not considered exporting oil at that time because international prices were low and internal demand was increasing. There was also the fear of making the national economy dependant on oil sector export revenues, known as 'petrolizing the economy' (García Hernández 1971). The strategy was directed towards producing value-added oil products to foster economic growth and job creation. The main problem for this administration was managing the company's finances within a legal framework in which all major decisions of the organization regarding prices, budget, and production levels were defined by the central government; this situation was repeatedly confirmed by most of the middle managers who were interviewed for this research.

The burden of subsidizing internal prices for oil products was very high; it has been calculated that between 1954 and 1958 Pemex lost about $10 billion in income due to the low prices at which it sold its products to the internal market (Meyer and Morales 1990). This was equivalent to half its actual revenues between 1953 and 1958. The company was unable to generate the surplus needed for its investment programme and was financed with foreign resources instead. These resources were not easily available and most of the borrowings that the company was able to obtain in the international financial market were short-term credits with onerous conditions. Pemex was also forced to sign up to joint-venture projects with foreign companies to carry out drilling activities, as a condition for credit negotiations established by United States authorities (Meyer and Morales 1990) (Villegas Moreno 1988).

Bermúdez complained several times to the President that the constraints under which the company operated put it permanently in a difficult financial situation. In his arguments, he exposed the high costs of subsidies and other expenses on the company's budget, but he never considered the inefficiency of Pemex's operations (Meyer and Morales 1990). Even though its legal framework was based on the company being the symbol of nationalism with a social mission, the company could not isolate itself from the operational standards of the international oil industry that were driven by technological developments, exploration risk, and the cycles provoked by changes in market supply and demand.

There has been an ongoing debate in Mexico about how Pemex's operations should be evaluated. Some authors suggest that state-owned companies cannot be assessed by their capacity to generate profits, in the same way as private corporations (Kaplan 1994) (Labastida Ochoa 1983). They suggest that the evaluation of state-owned companies has to consider the social benefits produced. Others argue that, even in the context of its social mission, Pemex could have carried out its operations more efficiently: on many occasions the costs of the social benefits it has provided have been used as an excuse to cover the mistakes of its administration (Meyer, 1990). During his twelve years as General Director, Bermúdez strove unsuccessfully to achieve more independence from the government in managing Pemex.

The development of Pemex as a vertical-integrated oil company implied technical, financial, political, and managerial challenges. A reorganization was carried out, concentrating all the decisions under the General Director. At the beginning of his administration, Bermúdez had three organizational entities called divisions: technical production, administration and legal affairs, and trading. He later created a fourth, finance. The Union also unified the demands of all oil workers scattered throughout the country. Both the company and the Union became very powerful institutions at the national level, with the Union's power concentrated in the hands of its leaders (Meyer and Morales 1990).

During Bermúdez's administration, oil workers' salaries at Pemex were reduced in real terms, but the Union compensated for the loss by obtaining a great variety of fringe benefits that helped it to keep labour conflicts under control. These non-salary benefits were of various types, such as: mortgages for workers; school and hospital building; payment of supplements to the salaries of teachers who worked in the oil regions; provision of medical services

through hospitals and clinics dedicated solely to oil workers; premises for the Union; scholarships for relatives of workers; and co-operative shops (Prevot-Schapira 1982).

Pemex developed its particular state-owned company style to help solve a difficult equation. On one hand, its workforce felt itself to be the owners of the company with the right of involvement in managerial affairs. On the other hand, the administration's decision-making power was in a straightjacket; it had to comply in most affairs with the authority of the central government. The organization started to build a reputation for inefficiency, although ultimately it did fulfil its mission: providing cheap oil and oil products to the national market. From a technical perspective, Pemex's engineers had a good professional reputation; the company built a tradition of career development for its technical workforce, which is explained in section 4.3.

5.3.2.3 1958-1964 Administration

Pascual Gutiérrez Roldán headed Pemex's administration from 1958 to 1964. He strove to improve the financial situation of Pemex and achieved a reduction in gross revenue taxes from 21% to 12%. During this period, the oil sector continued to develop in the same direction and rhythm as in the previous decade. The goal of the company continued to be to provide, at subsidized prices, oil products for the development of the national economy, as well as being the symbol of Mexican nationalism. Pemex ceased exploration and Mexican companies were given preference in the allocation of contracts for drilling. The joint risk ventures with foreign companies were cancelled (Meyer and Morales 1990) (Villegas Moreno 1988).

Even if the government's political message was that the oil sector had to remain nationalized, this General Director promoted the participation of national private capital in the production of sixteen basic petrochemicals and the participation of foreign capital in producing secondary petrochemicals[25]. However, the company kept facing financial problems. Prices were controlled by central government policy even if Pemex's social goal did not necessarily require that it had to operate inefficiently and that prices should not reflect the cost of products. Nominal prices were kept unchanged during this period. In 1962, Pemex

completed the payment of its financial commitments arising from the nationalization of the assets of the foreign oil companies (Meyer and Morales 1990).

One manager explained in an interview that "there was a lack of planning and co-ordination of the operations of the company, and little exploration was carried out, which provoked the reduction of the number of years of known oil reserves of the company"[26]. Between 1959 and 1962, production increased from 168 to 202 billion barrels, and reserves from 4,348 to 5,150 billion barrels (Meyer and Morales 1990). This meant that the ratio of proven reserves to years of potential production decreased from 26 to 22 years, with a further deterioration of this indicator. To keep up with the growth of the internal oil demand in Mexico, the company had to increase its volume of production in prioritizing short-term requirements. It did so through the intensive extraction of crude oil, which went against technical best practice.[27] Too many wells were drilled, sacrificing the long-term optimization of production capacity and increasing unnecessarily the costs of production. The reduction of the sector's productivity demonstrated the company's inefficiency. During the period from 1958 to 1964, the extraction cost per barrel increased from 12.9 to 18.5 pesos, and refining from 7.62 to 10.67 pesos. The organization's public image of inefficiency intensified, and was worsened by the abuse of personal discretion in the exercise of power by some of the company's managers and Union leaders. This latter factor is more fully described in section 4.3 on organizational culture.

5.3.2.4   1964-1969 Administration

Jesús Reyes Heroles became General Director of Pemex in 1965. He brought only five people to the company with him, while leaving in their posts the technical staff who had developed their professional careers in the company. This was stated during the interview with the information technology manager of that period, who was no longer in the company. The General Director publicly recognized that Pemex was overstaffed and that the lack of

---

[25] The definition of primary and secondary petrochemicals was set in accordance with the need of the administration to comply to the legal framework of the Constitution, which established that all oil sectors involving primary petrochemical products should stay state owned due to their strategic nature.

[26] Exploration is a high-risk activity with long-term results because what are thought to be oil reserves frequently turn out be water deposits or other type of geological formation; it can take up to twelve years to produce oil from a project fortunate enough to identify exploitable reserves.

[27] Oil engineering techniques prescribe requirements to optimize the long-term production of oil deposits. These are related to the number of wells that can be drilled in order to manage the pressure of the deposit properly, and to allow the optimal extraction of oil.

planning for its development had created industrial bottlenecks, problems of co-ordination in project development, and mistakes in engineering calculations. "There were cases in which regional warehouses had stocks to supply the company with products for 25 years. In other cases, operations had to be stopped because a required piece of equipment was not in stock and it took a long time to procure it," stated the first information technology manager of Pemex. "He [Reyes Heroles] tried to reorganize the company to combat inefficiency through administrative reforms, but these efforts did not alter the vertical power structure."

For Reyes Heroles, the previous administration's opening up of opportunities for investment in petrochemicals to private and foreign capital was a sign of national weakness; his mission was to ensure the oil autonomy of the country. He stopped the construction of a refinery that was planned by the previous administration, and for which some of the equipment had already been bought, because of corruption: he discovered some top Pemex managers were among the contractors (Meyer and Morales 1990). Reyes Heroles' nationalistic perspective sometimes made his administration too restrictive. For instance, as he felt importing oil was a sign of the loss of national sovereignty, he once refused to import crude oil although the refineries were operating below capacity and the country was importing refined products. He promoted exploration projects in the Gulf of Mexico and restrained the over-drilling. He also restricted joint-venture exploration contracts with private companies and fostered the optimization of extraction through gas and water injection techniques. The deposits near the surface were exhausted and Pemex had to move to exploiting deeper deposits; the company started to drill down as far as 3000 meters, which implied higher exploration costs (Meyer and Morales 1990).

The Mexican Oil Institute was founded in 1965 to promote the development of the technological autonomy and sovereignty of the national oil industry. This research institute specialized in the oil sector; its aim was to provide training and to help the development of Pemex as a vertically-integrated company through the development of new engineering techniques. The Institute had an important role in the development of local engineering expertise whose professional quality was internationally recognized. During the interviews for this study, several managers pointed out that there was a considerable rotation of staff between Pemex and the Institute. According to a manager who had worked previously in the Institute, this organization was a "key factor in the development of technical expertise in the

national oil industry and a central component of the technical pride that has characterized the organizational culture of the oil workers".

During this period, Pemex moved its headquarters to a new property developed exclusively for it. This was called the Pemex Administrative Centre and was located in Mexico City, which came to be a clear symbol of Pemex's centralized management style. The premises were of a high standard and were a signal to the international community of the intended permanence of the organization[28].

Under this administration, the company's production kept being channelled to the internal market, still at subsidized prices. Pemex stopped exporting from 1966 to 1973. The level of oil production kept increasing, but the 9.9% rate of growth of the internal demand for oil between 1969 and 1972 was higher than that of oil production, at 4.1% (Meyer and Morales 1990). The lack of infrastructure for storage and distribution were factors that contributed to the crisis that later faced the oil sector. During an interview, a technical manager explained that the maintenance and rational development of the national pipeline infrastructure had been prevented until 1968, because it was only then that reliable drawings of the infrastructure became available. Gas was burnt due to the inadequate infrastructure available to process and distribute it. Pemex continued to finance its investment programme, operational costs, and the servicing of its debt by more borrowing because, by the mid 1960s, the company was able to negotiate long-term credits (Meyer and Morales 1990).

The company kept developing in its own peculiar style, with local managers having a very strong control over its data and decision making. It was during this period that the company started to use information technology to solve specific problems. The General Director, who was a major political and intellectual figure of the time with strong links with the National University, asked for advice on the use of electronic data processing technology from experts at the University, which had a very strong professional reputation. The intervention of these experts proved very useful and some of them were hired by Pemex and entered into the company's professional career structure, as the company's first information technology manager recalled when he was interviewed.

---

[28] Within the local political culture of that time, it was understood that a public organization's director had to provide it with a large building in the central area of the capital city in order to ensure its survival.

5.3.2.5 1970-1975 Administration

Antonio Dovalí became General Director of Pemex in 1970; he had a pragmatic approach and also had links with the academic world of the National University. He joined at a time when the company faced a serious crisis. To avoid the further deterioration of Pemex's trade balance, this pragmatic new General Director decided to import crude oil in 1971. Two years later, the first oil shock caused by the Arab oil embargo had a dramatic impact upon the future of Pemex. Its critical financial situation and the international oil crisis brought oil policy to the top of the Mexican Government's agenda.

The government created the Energy Commission, whose purpose was to produce a national inventory of oil resources; its members were national technical experts with good professional reputations, who had strong influence on the definition of energy policy. The Organic Law of Petróleos Mexicanos of 1971 had increased the number of board members at Pemex to six named by the government and five by the Union. The finances of the company deteriorated further, and in the worst years the government transferred extraordinarily large amounts of revenues to Pemex as returned subsidies. In 1972, this income represented 6% of its total revenues, and 4.7% in 1973 (Meyer and Morales 1990).

In 1974, new oil reserves were discovered in the southeast of Mexico. Given this potential to increase production, General Director Antonio Dovalí realized that exports were necessary to rescue the financial situation of Pemex. The company needed to fund its investment plan with savings and not through the contracting of external resources, which were increasing the public debt burden. He was able to negotiate the unfreezing of internal oil products prices with the government.

By the end of 1974, having satisfied the internal oil demand in Mexico, the company was able to export oil again. Nevertheless, there was still political pressure inside the government to restrain exports on nationalistic and technical grounds. A group of experts, headed by the former General Director Antonio Bermúdez, carried the debate to the public. They wanted to prevent Pemex becoming the main provider of financial resources to the government, insisting that the levels of production should be dictated by technical factors not political goals. The financial crisis at the end of President Echeverria's administration changed the direction of the oil policy (Gutiérrez 1982).

The internal price of oil was increased in 1973, then remained unaltered until 1976. The internal revenues and the currency income from oil exports promised a financial recovery for the company. In 1975, the government increased the tax on Pemex's internal oil sales and put a tax of 50% on its exports revenues to finance the public budget. The investment plans of the company therefore still required foreign loans, so the financial situation of Pemex did not improve (Meyer and Morales 1990).

5.3.2.6   1976-1981 Administration

Jorge Díaz Serrano, an engineer from the private sector with very strong links to the oil industry, became General Director of Pemex in December, 1975. His appointment meant a major change to the political nature of this post. He was neither a public servant nor a political figure; he had been until then a private contractor to Pemex, as he explained during his interview for this study. He was well known and respected in the oil sector for his technical expertise and entrepreneurial character.

The operational conditions of the organization changed dramatically during Díaz Serrano's administration. He brought 300 new people into the company, and since then the professional career path within the organization has lost its power as the sole source of legitimacy; some of the oil workers interviewed commented that the new arrangements favoured personal political relations. Most of the technical experts who had worked for the company in the past, and who were strongly identified with the nationalistic perspective, retired. Díaz Serrano became the only person with a voice in public administration who had expertise on oil matters.

A major difference between his administration and the previous ones was that the development of the oil sector stopped being linked to national industrial development (Meyer and Morales 1990) (Gutiérrez 1982). At that time, international oil prices were increasing. Díaz Serrano's administration was in a race against time to increase petrodollar revenue, in order to make Mexico an international oil producer. He was aware that the conditions of the oil market favouring oil producers would not last, so he had to maximize oil revenues and take advantage of those temporary conditions. For him, the expansion of oil production

capacity was a goal in itself. Not all members of the cabinet shared this view; some wanted to continue to translate the oil revenues into the means to industrialize the country.

Díaz Serrano announced a very ambitious investment plan for the company. The goals, as recorded in an official document, were to:

- increase oil production from 700,000 to 2.2 million barrels a day and increase exports to 1.1 million barrels a day;
- increase gas extraction;
- double refining capacity;
- triple petrochemical production;
- increase the distribution infrastructure; and
- promote exploration projects heavily.

These goals were achieved. Pemex brought its extraction capability from 800,000 barrels per day in 1976 to 2,550,000 barrels a day in 1981[29]. The goal of the organization was to increase production as rapidly as possible, with no other consideration. For the government, Pemex became the main source of financial resources. The President's aim was to finance the development of the country with petrodollars, which meant the economy had been petrolized (Gutiérrez 1982).

In 1981, the General Director announced a dramatic increase in oil reserves: to 72 billion of proven reserves, 58.6 billion barrels probable, and 250 billion barrels potential[30]. These increases were sometimes achieved through manipulating data, a practice known locally as 'data makeup' according to a manager involved in the development of an institutional data base at Pemex. The overall goal was to increase the political presence of Mexico in the international arena to obtain financial and technical support from the international community to continue with the investment plan. Mexico became the fourth largest oil producer in the world. During this period, the Mexican government had a very active foreign policy, which was not always aligned to American interests (Pellicer 1982).

---

[29] Official document, Pemex, 1981.
[30] *Ibid.*

By law, Pemex's investment projects have to be supervised by the Ministry of Energy[31]. But thanks to the personal relationship between Díaz Serrano and the country's President, López Portillo, the investment programme of the company was pushed forward with little regard for formal authorization mechanisms, stated a manager who had worked in the company at that time but was no longer in it. The goal had been to achieve a massive growth of production capacity in the least possible time. The vision and over-enthusiastic climate driving operations was expressed in the following official statement:

> "The extraordinary dynamics imposed on the activities of the petroleum industry by the administration of President Jose Lopez Portillo, supported by the richness of our subsoil and by the efforts of all the technicians, workers, and officers of the company, has made possible the design of a plan for the economic development of the country, for the present and for many years to come, without any energy restrictions."[32]

The goals were achieved quickly, but at a tremendous cost and with a further loss of control by the central administration of company activities outside its headquarters. The company's operations lacked co-ordination and planning, in the view of a technical manager interviewed. A dramatic publicly-known example of this situation was the construction of a 48-inch pipeline from the gas well of Cactus to the border of the United States, although relevant trade agreements had not been negotiated and the contract had not yet been signed – and was never actually signed This expensive distribution infrastructure was useless even for the original purpose for which it was built. There was a lack of strategy to define oil exports policy and no public debate as to how the oil revenues should be managed, although oil was a strategic national resource. This period saw the further reinforcing of the vertical control of decision making that had always characterized the oil sector.

The dramatic expansion of oil production provoked a variety of problems in all areas of the sector. For example, a severe spillage at an offshore rig called Ixtoc[33] in 1981 revealed Pemex's dependency on foreign technology. Foreign contractors carried out the drilling for the expansion effort, but did not assume financial responsibility for accidents. Public opinion

---

[31] At the time of Díaz Serrano's administration, this was called the Ministry of National Wealth and Industrial Promotion.
[32] *Ibid.*
[33] The Ixtoc, which went out of control in June 1979, has been described as the worst oil spill in history. It lasted 295 days, with the loss of oil calculated as 4 billion barrels.

expressed through the media was very critical of the lack of response of the company regarding the severe ecological damage caused by the oil spill.

Between 1976 and 1980, the number of employees at Pemex increased from 88,000 to 108,000, during which time the Union strengthened its power (Meyer and Morales 1990). With the oil boom, the cost of operations rocketed. The dramatic expansion of Pemex's facilities created a growth of demand for supplies and equipment that increased the cost of inputs. Stocks and inventories were managed poorly and there was a lack of control over the company's assets and development projects. The inherited inefficiencies were aggravated. The administrative systems were unable to cope with the oil boom due to the speed at which the programme was carried out, as was recognized by Díaz Serrano when he was interviewed for this study. The lack of adequate information systems made the programming and planning of activities an impossible task. Construction projects were delayed, resulting in an escalation of costs.

Oil workers described how many projects were carried out without the necessary budgeting and work planning. The situation was chaotic at the company's headquarters, although out in the operational sites there was some form of control structure enforced by local leadership, but managed with a great deal of personal discretion. This situation created political tensions with the central government authorities who were responsible for controlling the budget. In addition, the public image of Pemex was also problematic for two reasons: the lack of consistency in the information given to the media; and the publicly-known abuses of personal discretion in the use of power in allocating the company's resources by some of its managers.

As the goal of the company was to achieve a certain level of production regardless of any other considerations, the only financial data that mattered was the cash flow level, the income earned by exports, and the level of internal sales within Mexico. Costs were of no concern within the environment of abundance created by the oil boom and high output from the company's oil wells, as a manager involved in information systems development at Pemex observed in an interview. Operations could have been carried out more efficiently, but that was not seen as an issue that mattered. In fact, due to the richness of the wells, the company's figures showed productivity gains, as explained in an official document: "Proven reserves and crude production increased by 12 and 3 times respectively from 1976 to 1980,

while staff increased by an annual average of 5%. Consequently operating expenses, which in 1976 represented 54% of the total sales incomes, in 1980 represented only 31%."[34]

The dramatic development of Pemex has to be understood within the context of three elements: the international oil market; Mexico's relation with the United States; and the economic crisis of the Mexican government. The first oil shock revealed the vulnerability of the American internal oil market to a disruption of oil imports. From 1973 till 1979, OPEC managed increases in oil prices with a long-term perspective of protecting real income revenues while discouraging new explorations and diversification of energy resources, in order to prolong the control of the market from the supply side. The Iranian Revolution in 1978 and the war between Iran and Iraq brought about a second oil shock. International oil prices rocketed. Mexico became strategically important for the American economy because it was a major non-Arabic oil producer and shares a common border with the United States (Pellicer 1982).

The United States Government's Energy Plan identified the Mexican oil reserves as being of strategic national interest to America. At the same time, the oil price increases flooded the financial markets with petrodollars. The international banks were looking for investment opportunities and many were attracted by Mexico, a sovereign debtor backed with enormous oil reserves (Escobedo 1985). All of Pemex's investment plans were financed with loans raised in the international markets, many on a short-term basis, and were carried out with high levels of capital-goods imports (Meyer and Morales 1990).

The oil price was at its highest level at this time. Because most drilling was offshore, Mexico developed its oil industry through the use of expensive foreign resources and sophisticated imported technology. The tremendous productivity of the marine oil deposits compensated for the enormous cost of the development of the infrastructure needed to exploit them. Most of the oil was sold to the United States, although several attempts were made to diversify its customer base, noted Díaz Serrano during an interview. The company built a new office block at its headquarters in Mexico City, an enormous building of 42 floors similar to those of the oil multinationals, which came to symbolize the oil boom and the centralized decision making of the company.

---

[34] Official document, Pemex, 1981.

Díaz Serrano described how the international oil market showed signs of a glut at the beginning of 1981 – earlier than expected – which gave Pemex problems in selling its oil. As General Director, he faced the dilemma of reducing production or cutting prices. He chose the latter, bringing down the price by $4 without consulting the President or other members of the cabinet. Some ministers objected to what they perceived as the passive reaction of Pemex to market conditions and the unilateral decision from him that had by-passed Presidential authority. The central government retracted his decision: the President ordered a reduction of production and increased Mexican oil prices by $2. Oil sales fell, and Mexico was unable to sell 700,000 barrels per day. This meant that the country's oil revenues were abruptly reduced by $22 million a day, a situation which triggered legitimacy problems for the political leadership of the country. The public image of the company deteriorated even more following news published by the media regarding the way Pemex was managed: the arbitrary use of discretion and the abuse and corruption at all levels, including senior management and Union leaders. Díaz Serrano resigned.

In 1981, the President appointed a new General Director, Julio Rodolfo Moctezuma Cid: a public servant with a strong political background, good public reputation, and a very close friend of President Lopez Portillo. He remained in office until the end of the presidential term. The media considered that the President had wanted to save his reputation with this appointment. Moctezuma Cid's administration lasted about 14 months, during which there was much turnover of personnel at senior levels. It faced strong financial pressure from the country's treasury and had to sell oil at even lower prices than those of OPEC, with no consideration of the implications this could have on the international arena or on internal political affairs, explained Moctezuma Cid when he was interviewed.

Most of the managers with long careers in the company believe the oil boom was a lost opportunity to recover Pemex's financial situation. Internal Mexican oil prices were increased both in 1977 and 1980, but they deteriorated in real terms because the inflation growth rate was higher than the price rises. The company planned to generate enough revenue to fund its investment plans by 1982, thereby ending its dependence on foreign loans. In practice, the income of the company was higher than expected due to the effects of the second international oil shock. Pemex became dependent on its oil export revenues; for

instance, in 1976 exports generated just 16% of total sales revenues and by 1979 they had increased to 56%.

Real income doubled between 1980 and 1982, but the company's expenses also rocketed, due to the fiscal burden and growth of the costs of operations (Meyer and Morales 1990). In 1977, 63.4% of Pemex's expenses were channelled to operations and 35.2% to pay taxes. By 1980, in the middle of the oil boom, these proportions of financial resource allocation were reversed: operational costs consumed 31.1% of expenditure and taxes 57.5%. The external debt of Pemex continued to increase, with its worst surge between 1980 and 1982 when it grew from $925 million to $20.26 billion; this represented 32.7% of the government's external debt at the time. "The richness of Mexican oil reserves turned from being a blessing to become a curse, in less than 5 years," remarked Meyer and Morales (1990).

5.4   INFORMATION SYSTEMS AT PEMEX

5.4.1   Computer-based Information Systems

The history of computer-based information systems at Pemex also characterizes the development of Mexico's information technology. The company has been at the leading edge in the process of information technology diffusion nationwide. Because of its size and economic power, Pemex has been in a strong position to negotiate with vendors. This is illustrated by a quote from an executive of the company: "The computer companies do not sell to us, we buy from them". The introduction of information technology was related to the need to solve certain problems, and its use was undertaken by applying an engineering perspective and common sense. During the first historical period of this study, which is examined in this chapter, the specific problems for which information technology was used were usually focused on the need to process massive volumes of data, as was stated by the first information technology manager of Pemex when he was interviewed. The description of the use of information technology in Pemex in the following subsections was structured by the researcher using the data collected during the interviews and the official documents that this manager provided to the researcher.

5.4.2 Proprietary Systems and the Office of Mechanization and Computing

The single-register machines were used by the foreign oil companies. El Águila introducing the first one in 1928 (Cantarell and González 2000). The first types of computer equipment used by Pemex were such single-register machines, which were widely used by the 1970's to process the payroll and some financial data by simply automating manual procedures. Mechanical and electrical engineers operated these computers. Until the 1970s, the country did not have academic institutions offering vocational training in electronics or computer sciences.

In 1965, Pemex created the Office of Mechanization and Computing as a specialized unit to manage the information technology resources of the organization. Its organizational structure (see figure 5.1) consisted of a number of units:

- Administration Department: Management of human and material resources; administration of contracts for products and services.
- Operations Department: Computer operation and control of subcontracted maintenance services.
- Systems Department: Development and management of payroll and warehouse systems.
- Mathematical Computing Department: Development of highly specialized mathematical programming, such as forecasting and critical path analysis.
- Engineering Department: Development of technical engineering systems, such as calculations for the distillation towers.
- Offices at oil production centres outside the city, reporting directly to the Office of Mechanization and Computing's under-manager.

Figure 5.1: Organizational structure of Office of Mechanization and Computing
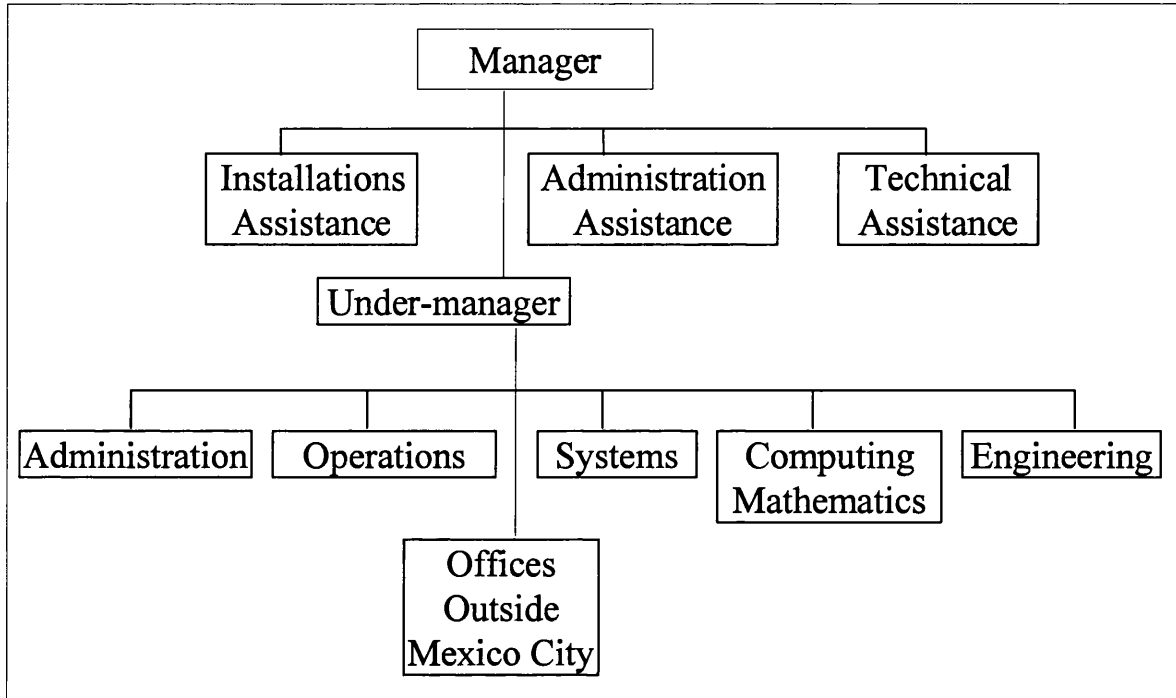
Source: Pemex

The Office of Mechanization and Computing had its headquarters in Mexico City, with seven other offices scattered throughout the country in the main oil production centres: Poza Rica, Salamanca, Azcapotzalco, Tampico, Cd. Madero, Reynosa, and Coatzacoalcos. The Office was located within the jurisdiction of the company's Under-Directorate of Administration. The responsibilities of this Office were to manage and co-ordinate information technology activities that had been developed previously in an ad hoc manner, described by an interviewee as "anarchic". Each local accounting office developed its own systems, using different information technology environments.

In 1967, Pemex's General Director, Jesús Reyes Heroles, had political problems with the workers related to payroll. As he was a political figure and an intellectual linked to the National University, he asked for advice from engineers with expertise in the use of computers within the University. They realized that the company had severe problems processing the massive amount of data needed for the payroll. Wages had to be paid every 14 days, and every work centre had its own style that depended on the local interpretation of the collective contract.

The main difficulties were that the payroll was never ready on time and personnel kept queuing in vain at the cashier's office, losing time from their working hours. Later, the people in charge of paying workers had to go to their offices several times in order to find the people who had not received their salary and give them their money. The wages were paid in cash, which created a high risk in having to carry around a large amount of payroll money. The project to overcome such problems was led by a chemical engineer who had worked for Pemex for six years as a process engineer and was also lecturer at the National University. He undertook the task with a team of twelve people. He used information technology because it was the appropriate solution to the problem.

The development of the system encountered severe difficulties, including opposition from some powerful forces. For example, the personnel responsible for measuring the amount of overtime worked were a key enemy. They were very powerful because they received commission from the workers in exchange for favourable readings. Most of them were very rich and had great local power; they therefore had a strong vested interest in preserving the *status quo*.

The technical staff worked out the proposed system's requirements analysis together with its users; the analysts did not want to impose their views, as the first information technology manager pointed out when providing his personal historical reconstruction of these events to the researcher. During the analysis phase, the users kept insisting that it was an impossible task to achieve a standardized payroll system for the organization. In an open sabotage campaign, the staff who recorded overtime readings destroyed payroll printouts from the computer. They even undertook legal action against the developers of the system. The authorities negotiated with the Union to make its leaders understand that the system would bring benefits to the workers because they would be paid on time.

After 3½ months, the project development team ran the payroll system for the first time in Mexico City, in parallel with the manual system operated with calculators. From then on, the wages were paid on time. The system was then taken to other work centres. The developers also faced problems in other locations, but with the experience of implementing it in Mexico City they addressed the implementation of the system in a different way. They talked to the personnel and explained to them what the changes would be and what benefits they would receive.

The information technology manager recalls that, in his opinion, the project team faced its worst situation in Reynosa. There, the personnel measuring overtime destroyed the equipment and openly threatened the analysts, asking them if they thought they were going to take their way of living from them so easily. The top manager of this work centre was advised in advance that problems could worsen, so he brought the army into the company's local installations to help sort out the problems. "The managers were 'hangman and knife' leaders, with strong characters willing to take tough decisions if needed, with the aim of modernizing the company," stated the first information technology manager. The posts of the personnel that measured overtime disappeared. The team involved in developing the information technology system learned with these experiences that such systems could not be imposed on workers. "The users have to be motivated; if they are not, they will just not use the system," as one commented.

Solving the problem of excessive spending on warehouse management was a major challenge posed by the General Director to the technical personnel who had expertise in the use of computers. It was a very difficult task, noted this same manager: Pemex had 95 major warehouses all over the country, each dealing with an average of 40 different products. When a requirement arose for a specific item, the warehouse personnel usually answered automatically that they did not have it in stock and that it had to be bought; that seems to have been a common practice as several oil workers described it in a very similar way. If the technical staff suspected that an item was in stock, they went and demonstrated to the warehouse personnel that it was actually there; but this was a very tortuous procedure. Sometimes, finding the item was a matter of trying different names because there were no standards for classification. The warehouse management problem deteriorated even more due to the buying procedures that required various steps to be followed, each needing specific paper work covering: the requirement notice; order details; public tender; and warehouse entry.

The warehouse project was led by the same chemical engineer who headed the payroll development. He decided to initiate the system in the Salamanca refinery because, as he commented, the chief manager was his close friend. The project team was extremely surprised to discover that there were 200,000 orders every year. It realized that warehouse staff did not check the stock levels before placing a new purchase order. In addition, the

same number of orders were generated each year, usually adding 10% to the previous year's quantities. The warehouses were saturated; in the project leader's perception, warehouse stocks in some instances could have lasted for 70 years at prevailing levels of demand. The staff of the warehouse had a strong vested interest in this process of placing new orders[35]. The General Director realized the magnitude of the problem and appointed more staff to the project. Although the analysts were repeatedly threatened, the team was eventually able to implement the new system. The managers of the warehouse then realized the benefits of controlling their stocks because they were able to reduce costs. The system remained in operation for ten years, from 1967 to 1977. At the time of the field work in the early 1990s, the researcher found that the technical staff involved in software development knew nothing about this past experience.

Pemex bought its first mainframe in 1967, which was installed in the Mexico City headquarters, where it processed the payroll for the head office. From then on, the company installed mainframes in different production and distribution centres throughout the country. All these computer-based systems were for payroll, aiming to automate the manual processes. At that time, no top manager of the organization wanted to keep the Office of Mechanization and Computing under his jurisdiction. The Office was seen as a risky 'hot potato', in the words of the first information technology manager, because of its technical complexity, high levels of investment, and shortage of trained resources.

Information systems management was totally centralized at the time because of the type of proprietary technology then available. The process of buying equipment for each project had to follow the procedures specified by the central government's procurement regulations. Each project was put out to public tender. The technology to be acquired and used depended on which vendor won the bid, decided on strictly financial considerations. Pemex developed a technological platform of islands of automation, in which each system operated on its own.

Managers who were responsible for information technology agreed, in interviews for the study, that the mainframe technology and restrictive buying procedures of the public sector explain why information systems management developed as a centralized structure. The information technology policy was defined by a section of the President's office. It specified

---

[35] Warehouse managers received commissions from the companies that sold products to Pemex.

that all procurements had to be authorized by central government. There was a central committee of experts (mostly engineers and mathematicians) who evaluated the projects. At first, it took them a week to give their verdict, but with time its decision making became slower and resulted in it becoming a bottleneck in the national diffusion of information technology (Noriega Blanco 1992). The regulations regarding imports of information technology were based on protectionist trade policies.

During 1974-75, Pemex made its first attempt to plan and structure systems development activities in accordance with a defined future strategy. A middle manager noted that users of the systems were neither consulted nor informed about this plan. Copies of the final plan were given only to senior managers. Users were usually not taken into account in any decisions related to systems development.

During this period, the users were captives of the dictates of the technical staff, with analysts defining the systems without user participation. "People carrying out the daily operations of the organization did not know how computers could help them in doing their jobs more efficiently," recalled a middle manager. According to him, the systems analysts felt they were the ones who knew 'the right way' to do things. Systems were therefore developed on the premise of 'blind faith' that the use of technology would help do things more efficiently. The company invested heavily in the development of its information technology capabilities without any evaluation of the projects. This middle manager accepted that many systems never brought about the expected benefits; in his opinion, up to 70% of the analysts' time was dedicated to maintenance. The need for more computer-based systems kept increasing, but when future procurement was planned the projections of processing capacity required usually fell far short of real needs.

IBM had a big presence in Pemex. Its equipment was very expensive, but in the opinion of top manager it was regarded by the technical experts as being 'the safe decision' because of its permanence in the computer market. Known as the 'Big Blue', IBM actually controlled the market and was *de facto* the company that defined standards. It also had a high reputation for providing good customer service. A manager heading an information technology area said that most times 'Big Blue' defined the conditions for systems, or imposed them upon Pemex. This situation changed in 1975, when this manager explained that "the power of IBM in the Mexican market was challenged once and for all".

At that time, Pemex wanted to create a system to transmit data between five work centres located at different geographical sites. The project to develop facilities for data communication was structured in such a way that all the information had to pass through Mexico City, which was defined as the central node. This was an important project because of its magnitude and the significance of data transmission between machines. It came to be known as the 'integral system' in the technical jargon of the company engineers. IBM won the tender for the project, based on the provision of various mainframe and telecommunication equipment. However, the contract was never signed because IBM insisted on imposing certain conditions that Pemex did not accept. The project was then undertaken with machines from Sperry and Burroughs, but the idea of data transmission was not carried out because of technical incompatibilities between the different brands of mainframes. The manager who described this project noted that, in the end, these computers were bought merely to satisfy the data processing needs for the automation of the manual payroll procedures for each work centre. In the opinion of a top technical manager, this project came to be the turning point in Pemex's procurement policy; it was when IBM lost as its customer this powerful organization that was the leading-edge user of information technology in Mexico.

5.4.3   1976-1981: Informatics[36] coordinated by the *Gerencia de Informática*

In 1977, according to official documents[37], programmes relating to the operation and development of the expanding oil industry needed support from information systems services. The General Director of Pemex at the time, Díaz Serrano, approved a restructuring of the Office of Mechanization and Computing, with the aim of building a structure that would be able to support the main areas of the organization. This official document stated that these areas required "efficient and effective support of computing technology applied to the solution of problems of information, engineering, financial management and planning". It also noted: "the informatics resources should be the channelled towards the optimization of the decision processes in order to increase productivity". This document forecast a growth in the demand for these services and advocated the co-ordination of the Informatics Office and user departments. The aim was to achieve effective participation of the users in planning and

---

[36] This research uses the term 'informatics' because it is the way the information technology capabilities are named in Pemex; it is derived from the French word *informatique*, coined by Nora and Minc (1978).

designing information systems. Most official documents present the ideas using the jargon of managerial techniques and the prevailing technical state of the art.

The official position also advocated a permanent evaluation of the informatics services and of the mechanisms for controlling the use of financial and technical resources within this activity. The aim of permanent evaluation, as noted in the official document, was to undertake an ongoing supervision of these activities in order to control them and understand the impact of these investments. The restructuring of the Office of Mechanization and Computing ordered by the General Manager resulted in the creation of *Gerencia de Informática*, at a higher level in the hierarchy under the Technical Administration Under-Director. This new unit (see figure 5.2) was responsible for co-ordinating the informatics services provided to six areas of the company:

- Primary Production
- Industrial Production
- Trading
- Administration
- Planning and Finance
- Projects and Construction

Figure 5.2: Organizational Structure of *Gerencia de Informática*

---

[37] Official document explaining informatics reestructuring strategy
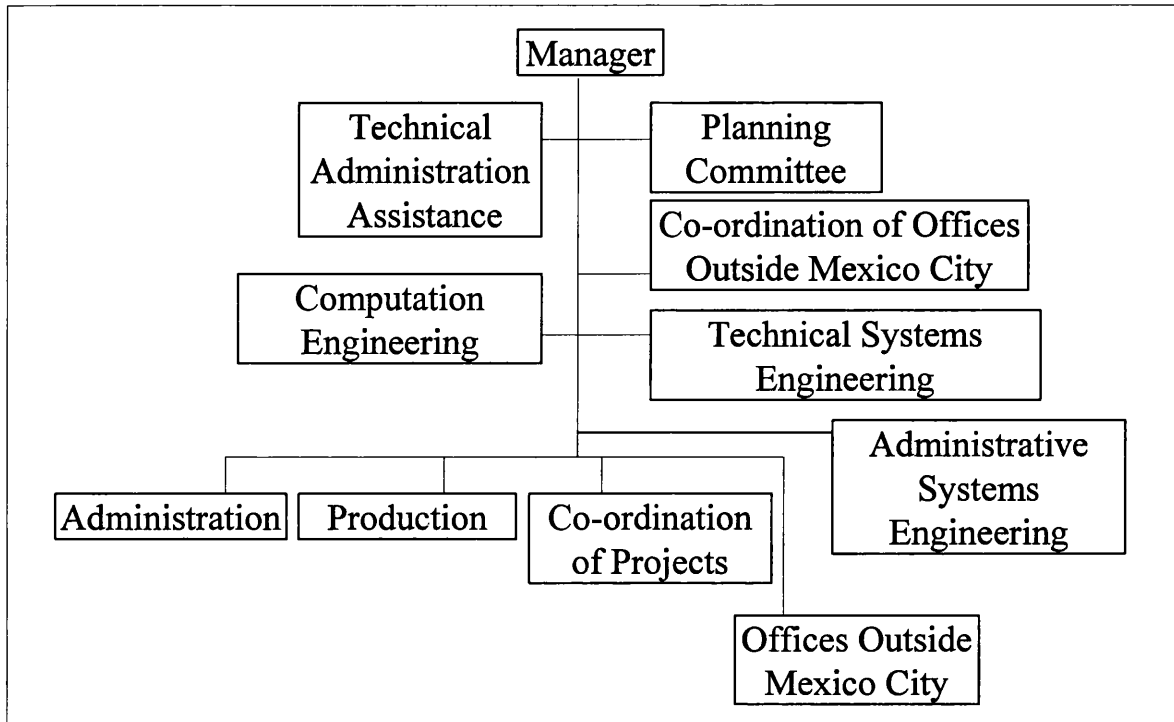
Source: Pemex

In 1979, responsibility for *Gerencia de Informática* was relocated to the Under-Director of Finance. The tight control by centralized information systems management provoked many areas of operations into creating their own informatics centres to satisfy their local information systems needs. Various users and mangers said that these activities were not officially recognized, and were usually disguised by names that made them appear as support areas. The *Gerencia de Informática* was unable to cope with the enormous demand for new information systems developments and the local areas could not cope with the delays in the development of the applications they needed. These centres were scattered throughout the organization, with no overall supervision or guidance. The systems were developed to address the needs of each particular area of operation, following peculiar *ad hoc* styles and ways of doing things using a variety of minicomputers with different operating systems. A technical manager stated that the diffusion of telecommunications capabilities triggered a fight for power between the *Gerencia de Informática* and the local centres. The head of the central function, who had an engineering background, was never able to accept the existence of the other informatics groups, as that would have been seen as giving up his technical supremacy.

In 1981, there was a great demand for personnel who had expertise in understanding both the business and technical aspects of developing information systems. To achieve this, the

company hired chemists, industrial and electrical engineers, and business administrators who were given a three-month course of structured analysis, technical design, and programming; every year, a group of about 45 new people was hired for this training. After their training period, these personnel were sent to the different work centres to develop and maintain the payroll or technical computer-based systems, according to their specialist area of expertise. A chemical engineer who had gone through this training explained this process to the researcher. Not all work centres had mainframes, so the smaller centres worked with remote-entry terminals, a modem, and an analogue terminal line. As these systems were too slow to deliver the payroll on time, the systems analysts had to rush by coach to the main work centre to have their data processed. The engineer noted that they used to call the system a "coach-driven decentralized process".

The oil boom was a success in terms of developing the physical infrastructure of the company, but it provoked chaos in the administrative sphere. The information systems for controlling warehouse management "were pushed into the background", according to an executive that headed the Financial Direction and who had left the company. He added: "The financial data was very limited and pedestrian, but the condition of information regarding operations was even worse; the least that could be said was that it was unreliable. The information systems was not compatible with the size and importance of the company".

In the last year of the oil boom in 1981, when the oil crisis started, there was a major effort to develop an executive information system as a 'control room'. The General Director who led that project stayed a very short time in the company. The project ended as another investment in information technology that did not bring the expected benefits to the organization. This failure stimulated the growth within the organization of a strong group of opponents to the mainstream informatics function. The differences between the local informatics groups and the *Gerencia de Informática* were usually related to definitions of technical standards and styles of systems development.

5.5 SUMMARY OF THE FIRST PERIOD STUDIED

During the first period examined in this chapter, Pemex continued to develop as an integrated state-owned oil company and the most important company in the country, with a management totally dependent on the political life of the country. It had built up expertise in using

information technology, but basically only in the financial areas of the company. The activities related to information technology were influenced by the process of learning about it within the company and by knowledge from elsewhere. In pursuing its prime objective of producing oil with little regard to other aspects, the oil boom of the late 1970s induced a massive development of Pemex's infrastructure – but its information systems lagged behind. From this background, Pemex initiated a new period in its process of changing, as explored in the next chapter.

6 PROCESS OF CHANGE: SECOND PERIOD

This chapter presents the historical development from 1982 to the mid 1990s of the Mexican nation, the process of organizational change within Pemex, and the company's information systems development. It aims is to highlight the relationships between these three elements. After summarizing key events for this second period of the study, the chapter examines how the nation developed through a new age of modernization that was based mainly on tight neo-liberal economic policies. Organizational changes at Pemex are then viewed in terms of what happened during the administrations of different General Directors of the company, followed by a detailed description the path followed by the information systems developed at Pemex to meet the changing organizational requirements. During this period Pemex tried to introduce economic rationale to its operations.

6.1 HISTORICAL CHART FOR SECOND PERIOD, 1982- MID 1990S

Table 6.1 uses the same format as table 5.1 in Chapter 5 to provide a historical chart which covers: Mexican national history; Pemex and the Mexican oil industry; information systems developed within Pemex; and what was happening in the wider world in this second period.

Table 6.1: Historical Events Relevant to Case Study, 1982-mid 1990s

Year	Mexico[38]	Mexican Oil Sector/Pemex	Information Systems	World
1982	President Miguel de la Madrid elected. Tight economic policy.	General Director (GD): Mario Ramón Beteta. Planning and auditing were the central activities of the administration. Economic rationale was introduced to control the company's activities. 'Smurfs' administration.	International consultancy MacKenzie undertook organizational restructuring project.	International oil price: $34 per barrel. Falklands War between Britain and Argentina.
1983		Jailing of Jorge Díaz Serrano, GD from 1976 to 1981.	Introduction of Arthur Andersen information systems development methodology. *Gerencia de Informática* restructured as *Gerencia Institucional de Informática.*	January International oil price: $34/b; October: $29/b. Raúl Alfonsín became President of Argentina.

---

[38] The change of public administration in Mexico is on the first day of December of the previous year identified in the table.

1984		Huge gas explosion in Pemex's Ixhuatepec gas installations. Pemex contracts assigned by public tender.		International oil price: 29/b.
1985	Strong earthquake in Mexico City and volcanic eruption in the south of Mexico.	GD: Francisco Rojas	Open Systems Strategy. In-house development of financial corporate systems.	International oil price: 28/b.
1986	Mexico hosted Soccer World Cup Championship.		Standardization of accounting procedures.	International oil price: 12.65/b.
1987	Economic Solidarity Pact			
1988	President: Carlos Salinas de Gortari. Neo-liberal economic policy; privatization of all stated-owned companies except oil and electricity industries.	GD: Francisco Rojas reappointed. Strong management focus on decentralization as well as industrial security and environmental protection. Top Union leader' was put into jail.	Basic Information Unit relocated under Planning and Co-ordination Under-directorate. Institutional database migrated to end-user computer platforms.	
1990		Organizational restructuring into Divisions by products. Creation of the Petrochemical Division.		Re-unification of Germany. Iraq invaded Kuwait.
1991				Gulf War. End of Apartheid in South Africa.
1992		Massive oil-related explosion in Guadalajara. Company was split into a corporate group and four subsidiaries.		
1993	NAFTA signed. EZLN Indian political movement in the southeast of Mexico.	Four subsidiaries started their operations officially. Business Strategic Plan by business line.		
1994	Official Presidential candidate Luis Donaldo Colosio assassinated. Ernesto Zedillo elected president.	GD: Carlos Ruíz Sacristán who after a month in this post was named Minister of Telecommunications due to a cabinet reshuffle. GD: Adrián Lajous		
1995	"Tequila Crisis" Devaluation of the Mexican Peso	*Pemex Exploración y Producción* undergoes major organizational restructuring. Strategic Business Plan. *Pemex Gas y Petroquímica Básica* faces competition in distribution. Some *Pemex Petroquímica Secundaria* centres put out to tender.	Corporate group selected SAP R/3 for its Enterprise Resource Planning (ERP) system and started its implementation.	

1996			First financial results are generated by SAP R/3 in the corporate group. *Pemex Gas y Petroquímica Básica* and *Pemex Exploración y Producción* started the implementation of SAP R/3.	

6.2 THE NATIONAL CONTEXT

6.2.1 1982-1987: Emergence of a New Age of Modernization

The election in December 1981 of Miguel de la Madrid as President of Mexico marked the end of the old political era of 'the dinosaurs'[39] and the start of the era of 'technocracy', as it was described by the media. Young professionals who had undertaken post-graduate studies abroad were named by de la Madrid as members of his cabinet. University titles became a symbol of status and legitimacy. The public administration abandoned the previous welfare model in favour of neo-liberal policies that followed the requirements of the International Monetary Fund. The government brought in a strict stabilization programme, targeted primarily at reducing its financial deficit (República 1982). It also implemented wage controls, tight constraints on public spending, redundancies among public-service employees, severe credit restrictions, and the devaluation of the peso by 258% in 1982 and 71.5% in 1983. This last year the GDP contracted 4.2% and the inflation rate reached 102% (Mendez 1998).

The administration also had as a main goal the fight against corruption. It created a Ministry of Comptrollership and jailed several public servants. Among those jailed was an ex-General Director of Pemex, Jorge Díaz Serrano, on the grounds of secret dealings over shipping contracts. He took the decision to buy two new ships without fulfilling all the central government requirements for such a process. If this emergency situation had not been resolved, it that would have forced the closure of oil wells that were in production or the wasteful burning away of gas. The charges against him were never proved through the judicial process, but he was kept in prison mainly for political reasons. Another major goal of de la Madrid's administration was to reorganize the pattern of national economic activity

---

[39] The old political figures were called 'dinosaurs' to denote their inability to evolve, which led to their extinction.

to reduce the dependence on oil revenues. It enacted policies to diversify exports, liberalize trade, reorganize the public administration, and privatize state-owned companies.

In 1984, GDP increased by 3.6% and inflation fell to 65.4% – but the balance of payments worsened due to the collapse of oil revenues. There was a renewed capital flight from Mexico that ended in another devaluation of the peso, which itself promoted a further exodus of capital. Economic activity was also hit badly by natural disasters[40] (De León 2000). The government renegotiated several of its foreign debt agreements. In 1986, the GDP contracted 3.8% due to its reliance on oil revenues. Mexican oil prices fell from $25.50 to $13.20 per barrel and the peso was devalued again, this time by 102%. Government finances worsened because of both the reduction of oil revenues and the increased burden of its foreign and internal debt. The Mexican economy was therefore trapped in a vicious cycle of wage and price increases, with a serious threat of falling into a hyper-inflationary spiral (Gurría Treviño 1988).

During this period, a new political opposition group developed from people who had left the PRI, which was the official party. Cuauhtémoc Cárdenas, who had been a federal state governor, and Porfirio Muñoz Ledo, who had headed the Ministry of Education in the previous government, were the leaders of the new party, the FDN (Democratic National Front)[41] (Margáin 1995). This brought together left-wing intellectuals and members of the middle and lower classes who wanted to build a truly democratic country. The new party strongly identified itself with nationalistic ambitions, such as defending public ownership of the oil industry. An opposition party from the right wing, PAN (National Action Party) [42], also increased its level of political activity. The population was demanding a more democratic society that would better suit the economic liberalization of the country (Ortiz Wadgymar 1997).

6.2.2   1987-1992: Strategies Based on National Economic Pacts

In December 1987, the Mexican government announced a new economic strategy, called the Economic Solidarity Pact, which sought to combat inflation by reaching agreements between

---

[40] A strong earthquake caused severe damage in Mexico City and a volcanic eruption had negative ecological impacts in the south of the country.
[41] Later it became the PRD (Revolutionary Democratic Party), *Pártido de la Revolución Democrático* in Spanish.

the different economic and social sectors of the country. These negotiations were possible due to the tight control that the government had over labour organizations. The Pact sought to strengthen government finances through: cuts in subsidies to public services[43] and in levels of investment; adequate taxation to prevent the public deficit from growing; privatization of public companies; increasing interest rates to attract savings; restricting wage increases; adjustments to the prices of basic goods and to the exchange rate; and the rationalization of import restrictions to foster trade liberalization. It achieved a reduction in inflation that allowed the government to negotiate five extensions of the Pact (Mendez 1998). At the end of 1988, the economy showed the need for new adjustments; both the world oil market prices and the level of international interest rates had increased by then.

It was also at this time a man with a strong character and a reputation for powerful leadership and tough decision making became President of Mexico: Carlos Salinas de Gortari. However, the political opposition argued that he had not won the elections because the government had officially announced his victory at a time when the computer-based information systems used to count the votes had broken down without explanation. His main economic goal was to consolidate previous achievements, such as the fight against inflation, fostering recovery through economic growth, and modernizing the country (Ortiz Wadgymar 1997).

Salinas had been the strategist behind the Economic Solidarity Pact, and his stabilization programme had a similar title: the Economic Stability and Growth Pact. Its main measures were: strict control over government finances; optimization in the use of resources for the provision of public services, adjustments in the prices charged for public services to reduce subsidies; peso exchange rate slippage; reduction of some import tariffs; foreign debt restructuring; modernization of public administration; and negotiation with the private sector to control wage increases (Mendez 1998). In the political sphere, he showed his determination by putting into jail Joaquín Hernández Galicia knows as "la Quina" the main oil worker's leader. Salinas used the army to capture him in his home through an ambush. This was a major move by the government to regain control over the oil industry.

---

[42] *Partido de Acción Nacional* in Spanish
[43] The public services provide by the Mexican government include water, gasoline, gas, and electricity.

To encourage the macroeconomic restructuring of the country, Salinas promoted trade liberalization, deregulation of the economic system, and reduction of government participation in the economic life of the nation by the further privatization of state-owned companies. The revenues from these sales of public assets were channelled as social welfare spending through the National Solidarity Programme *(Solidaridad)*, which had a very positive political impact on lower-income sections of the population. Marginalized urban and rural areas were able to develop their social infrastructure with *Solidaridad* resources; the government provided material resources and the population contributed their own work efforts (Mendez 1998). Although the *Solidaridad* programme and its social initiatives were implicitly linked to the PRI's political image, the opposition parties kept winning elected positions.

The Economic Stability and Growth Pact was extended without any major modifications. The foreign debt was renegotiated to reduce its burden and free resources to finance economic growth. Public confidence in Mexico's economic stabilization programme allowed a reduction in interest rates, the evolution of a more realistic exchange rate avoiding its overvaluation, and a decrease in the inflation rate. The main objectives of the National Development Plan for 1989-1994 were to achieve economic growth with low inflation and the modernization of the country in a context of economic realism within market criteria (Mendez 1998).

The government redefined the permitted levels of foreign participation in different economic sectors and in joint ventures for infrastructure development, thus favouring international capital. This policy had a direct impact on Pemex and changed its type of contracting from services to 'turnkey'[44] projects. Mexican small and medium sized engineering companies did not have the capacity to work in this new style, and they also had to face foreign competition too abruptly to be able to adjust in time. In addition, the financial sector was restructured to allow more freedom to banks to determine interest rates and the types of services they would offer.

---

[44] A 'turnkey' project is a way of contracting all services and activities needed for the development of any specific task in the form of one complete project with one contractor, for example to develop an offshore rig. Pemex previously contracted various contractors to carry out different parts of the project, such as using one contractor to build an offshore rig structure , another to do the drilling on the rig, and so on.

In 1989, the Mexican economy grew 3.4%, inflation was 19.7%, and the rest of the main economic indicators also improved thanks to private sector spending. The deterioration of real wages was moderated. The rate of devaluation of the peso was reduced. Some economic indicators improved again in the following year due to adjustments of public-service prices and the exchange rate: the GDP grew to 4.4% in 1990 but inflation was 29.9%. The international community showed confidence in the Mexican economy in the media and the flow of foreign investments increased. The government sold banks and other enterprises owned by the state, such as the Mexican telecommunications company *Teléfonos Mexicanos* (Telmex). The privatization of these assets was criticized, mainly because the way they were carried out fostered a heavy concentration of capital. The resources brought in by these sales were channelled to create a contingency fund to protect the national economy from future external shocks.

The process of trade liberalization continued and Mexico negotiated the North American Free Trade Agreement (NAFTA) with the United States and Canada. The population was suspicious of the consequences for small and medium sized companies and for employment (Ortiz Wadgymar and Nuñez 1998) (Margáin 1995). There were also worries about the loss of local culture and traditional social values, with fears that the Mexican tradition of very strong family bonds would be undermined by the influence of the individualistic culture of the Americans. Mexico also negotiated trade agreements with some Latin American countries.

During 1991, Mexican economic policy remained unaltered; there was a further contraction in the financial deficit and a reduction of the rate of the devaluation of the peso. The economy grew 3.6% and the inflation rate was 18.8%, but there was a deficit in balance of payments. That year, $14.63 billion of capital entered the country, $4.76 billion in direct investment and $9.87 billion in securities. However, the volatility of the capital flows and persistence of inflation caused unease regarding the economic future. The Pact was extended until January 1993, with minor changes: there was a reduction of the devaluation rate of the peso, an increase in Value-Added Tax (VAT), and adjustments of prices for public services and products.

In 1992, Mexican GDP grew by 2.8% and inflation was 11.9 per cent. The reduction in the growth rate was due to the uncertainty caused by a delay in signing NAFTA and the

130

persistence of a deficit in the balance of trade. The Mexican Stock Exchange Index behaved erratically. That year, agriculture was badly hit by adverse climatic conditions and there was a reduction in foreign demand. The exchange rate faced contradictory pressures: the deficit in the balance of trade indicated an overvaluation of the peso, at the same time as pressure towards revaluation was coming from the surplus in foreign currency caused by the inflow of foreign capital (Ortiz Wadgymar 1997). In October 1992, the government signed a new agreement with the economic sectors, called the Stability, Competitiveness, and Employment Pact. The key objectives were the same as the previous pact: to stimulate growth and economic modernization with fiscal discipline; reduce inflation to a single digit; restrain increases in wages; and widen the peso fluctuation range. In 1993, the economic figures were not as positive as were predicted, with GDP rising only 0.4% and inflation at 8.9% – but exports managed to grow (México 1993).

6.2.3   1993-mid 1990s: NAFTA Signed and Political Unrest Grows

NAFTA was enacted in January 1994, after the United States Senate approved it by a small margin at the end of 1993. The energy sector was explicitly included in NAFTA through a statement that guaranteed full respect for the constitution of each country. Nevertheless, the agreement included concessions to the Mexican Government aimed at opening certain areas of the oil sector to private investors and foreign companies (Ortiz Wadgymar 1997) (Margáin 1995).

In this period, the Bank of Mexico was attempting, free of government control, to create more economic certainty through tight monetary policy. Meanwhile, in the southeast of Mexico on the border with Guatemala, a political movement exploded into life in opposition to Salinas' neo-liberal policy. Called EZLN (*Ejército Zapatista de Liberación Nacional*) [45], this movement had an Indian character and a nationalistic perspective. It caused unease, but remained confined to the southeast. Peace talks with it have remained a priority item on the political agenda of the country until 2001, many local and international intellectuals were involved (Ortiz Wadgymar 1997).

Although the government showed a conciliatory attitude most of the time, the political climate still remained uncertain. 1994 was the year for the selection of candidates for the

---

[45] Emiliano Zapata was a revolutionary leader who fought to give the land to the peasants.

elections of President, Senate, and Congress. In March, the official PRI Presidential candidate, Luis Donaldo Colosio, was assassinated in a display of contempt towards the ruling political group. There was general social indignation towards the assassination and the consequent political unrest adversely affected economic expectations. The following year, the head of the PRI party was assassinated, provoking further deterioration of the internal political situation and the international image of the country. When the 1994 general election was held, the result for the presidency was disputed by the opposition parties, but the winner was still the official PRI candidate, Ernesto Zedillo (Margáin 1995). The economy was characterized at the time by structural problems with the foreign sector, which led to its collapse in January 1995 and the devaluation of the peso. The government then implemented restrictive economic policies once again (Mendez 1998).

6.3 ORGANIZATIONAL ASPECTS: PEMEX AS A MARKET-DRIVEN OIL CORPORATION

The second period of this longitudinal study covered the change of Pemex's mission by the introduction of economic rationality to the evaluation of its operations. The process of transforming the company into a participant in the global market started with international productivity standards in 1982 and is still being continued. The collection of field data for the study ended early in 1997, when the corporation was implementing a major integrated information system as part of this globalization process.

6.3.1 1982-1987 Administration

Mario Ramon Beteta, a public administrator with a financial background and a long public career, was appointed General Director of Pemex in December 1982. His management followed central government policies very closely, by focusing on economic adjustment and auditing. From the time he took office, as he expressed during an interview for this study, Beteta was publicly critical of the way in which the expansion of oil production had been undertaken: with no planning; a lack of systems to control operations; a scarcity and unreliability of data to analyse operations; unawareness of the ecological impact of the industry; and the allowance of excessive power to the Union. The President made the definition of the oil export policy the responsibility of a newly created *Comité de Comercio Exterior del Petróleo*, which involved members of the government cabinet. In this way, he broke the monopoly of this area that Pemex managers had held during the previous administration.

Under Beteta, Pemex went through a period of transition that tried to overcome the heavy financial and political cost of the oil boom of the 1970s. The main goals during this transition, as stated by him during an interview were to:

- reduce Pemex's debt and try to finance investment with its own resources;
- foster productivity and profitability;
- decrease the company's fiscal burden;
- eliminate subsidies to consumption that had promoted wasteful habits;
- solve problems in distribution and storage facilities;
- reduce technical dependence on imported equipment and parts; and
- initiate techniques of secondary extraction because many deposits were becoming unproductive due to inadequate decisions being taken about the production levels of oil wells.

As a first step in this second period's pursuit of the introduction of a new economic rationale to the organization, Pemex was restructured in 1982. Figure 6.1 shows how this restructuring led to the establishment of three major branches (called 'under-directions') set up to integrate areas dedicated to planning and administrative activities: Industrial Transformation; Primary Production; and Project and Construction. In addition, a subsidiary company, Pemex International, was established with the responsibility of exporting oil. Pemex remained as one huge company after the reorganization. Decisions and strategic planning was centralized, which made the management and control of overall operations an impossible task.

Figure 6.1: Organizational Structure of Pemex in 1982
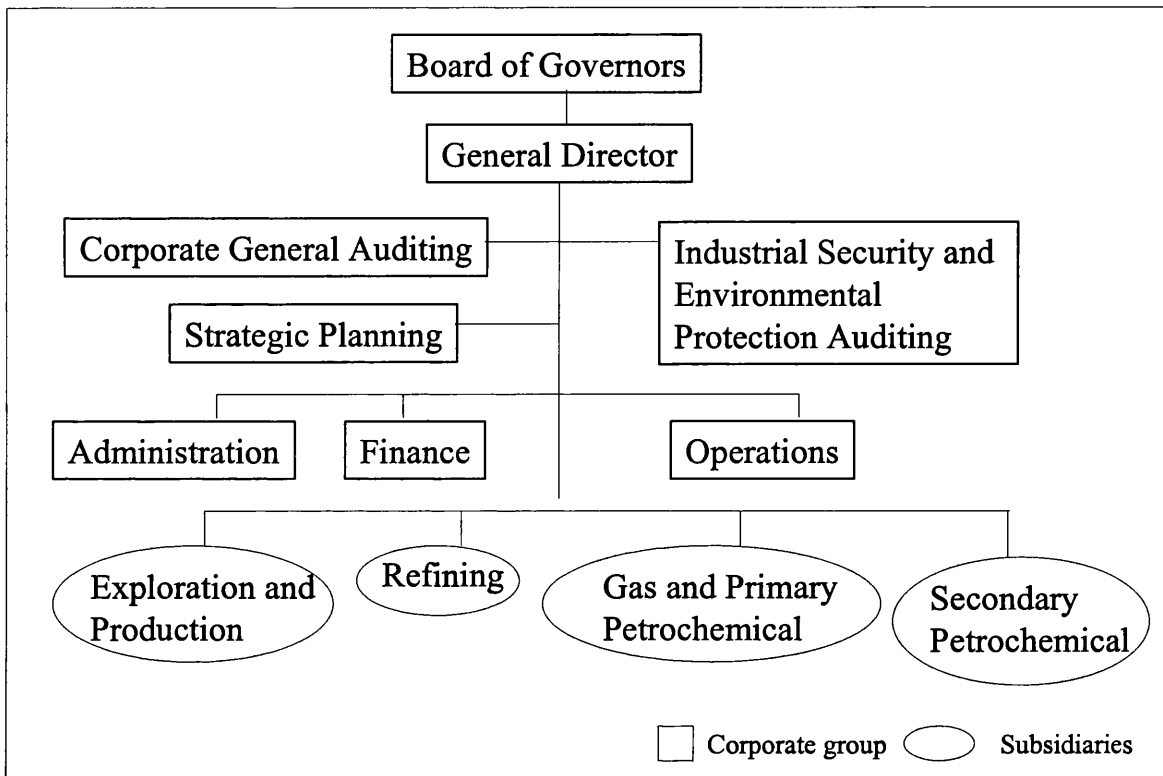
At the same time as this restructuring took place, Pemex changed the logo of the company from *el charrito pemex*[46], a little person in the colours of the Mexican flag (green, white, and red), to a stylized figure of a conch shell that was also a drop of oil. The change of public image had a clear message of wanting to leave the old nationalistic Pemex behind in favour of becoming a modern company. Pemex forced the holders of oil station concessions to employ the new image, which required repainting all oil stations that were in green, white, and red to the new official colours of blue and orange. The holders of the oil stations also had to display the new logo. Many of them did not support the change, but were forced to comply in order to keep their concessions[47].

The reorganization of the company involved several efforts that changed different aspects of the company in trying to achieve the ideal model of a global company. The researcher

---

[46] This figure was a representation of a short man with a big hat and curved legs for horse riding, painted in red, green, and white – the colours of the Mexican flag.
[47] Information provided in an interview with a oil station owner.

identified five main facets of these changes concerning the efforts the company undertook from 1982 in trying to reorganize:

- redefinition of organization charts;
- downsizing of the company;
- cultural change;
- information systems development; and
- process re-engineering.

Beteta's administration hired the services of mostly foreign consultancies and took advice on various aspects of management, such as organizational development, cultural management, and total quality management. The prime goal has been to transform the company into a more efficient and transparent organization in which operational decisions are taken in the light of technical requirements, rather than following only a political *dictum*.

The restructuring efforts were carried out at various levels, sometimes encompassing the whole organization and in some cases just specific areas. An example of these efforts is the restructuring of the Information Systems Administration Unit, which is analysed further in section 6.4. Usually, restructuring initiatives were isolated and each consultancy company worked on its own, within the area of its own expertise. Gradually, the role of the foreign consultancy companies became central to the restructuring drive. Opinions of the consultants carried enormous weight in the company's reorganization during all these processes, especially the opinion of the American firm that was favoured by Adrián Lajous, the General Director's Strategic Advisor, because he firmly believed in its professionalism and expertise. Lajous later became the General Director of Pemex during the final period covered by this research.

The ex-General Director Beteta, explained in an interview that, since 1983, Pemex has been able to use internal funds to pay the costs of its operations, its investments, and the servicing of its debt. This has been achieved even though the government increased the tax burden in 1982 to 58% of its total oil export revenues plus a 5% *ad valour* duty. In 1985, the company kept only 30% of its revenues from oil exports, with 70% transferred to the National Treasury. The Beteta administration insisted on the need to reduce this burden. In 1986,

54% of the government's total fiscal income came from Pemex. The reduction of international oil market prices has continued to affect Mexico dramatically due to the burden of its external debt, which obliged the government to keep oil export volumes high in order to earn the money required to service the debt. The future volume of oil exports has been linked to the conditions of debt re-negotiations (Meyer and Morales 1990).

Beteta had very difficult relations with the Union (see section 4.3.1). He was criticized for having increased, within an austerity programme, the number of *personal de continua* ('trusted personnel') – employees who are hired directly by the authorities of the company and do not become members of the Union. In the opinion of some technical managers, this also represented the destruction of the organization's professional career path. Beteta brought his team into the company to enforce administrative control, and his personnel were known by the very pejorative term Smurfs[48]. These personnel, who mainly had high qualifications from abroad, called the oil workers 'crocodiles'[49], another pejorative term. Most of the personnel that Beteta brought into the company were also quite young, which for many oil workers was another blow to what one interviewee referred to as the "mystique of experience as a source of legitimacy and the end of the golden years". Planning became a key activity of the company's administration.

Oil workers had mixed feelings about the reorganization efforts. On one hand, they recognized that something had to be done, but they did not like the way it was carried out. Many managers said in interviews for the study they believed the consultants were – for most of the time – abusive, charged very high fees, and did not give value for money. An oil worker encapsulated a general view: "Intervention by consultants is the new way foreigners have developed to take the national wealth abroad; the country is again exchanging glass beads for gold as in the time of the Spanish conquest and the colonial period." The expertise of the consultants, endorsed by the legitimization of the authorities, had silenced the experience of oil workers, who had to follow the consultants' advice even if they did not agree with it.

---

[48] Beteta's team were called 'smurfs' because, in the children's cartoons of that name, the characters do not have a mother.

[49] The term 'crocodile' was used to indicate an entity with 'a long tail that could be stepped on', which implied past corrupt practices by oil workers.

The oil workers had a common appreciation that the leaders of the consultancy companies who negotiated the deals were experts, but the staff who actually came into the company to do the work were managed by young professionals who had recently graduated from university and had no work experience. The oil workers considered that it was they who generally finished doing the job the consultants were paid for, as illustrated by this remark: "They just take the material the people of Pemex give them, then they process it into a nice presentation to give back as the deliverables established in the services contract." They saw the consultants' intervention as being positive in terms of diagnosis, but felt that their role had not been enough.

The oil workers also objected that the diagnosis by the consultants told them what to do, but not how to carry out the proposals[50]. The dilemma the authorities faced was that they knew something had to be done, but not who could make it happen. Insiders who knew and understood the complexity of the organization belonged to groups with vested interests; outsiders were identified with the goal of providing efficiency but could not grasp the complexities and peculiarities of the organization. The policies and methods recommended by consultants therefore had little effect in promoting change; the *status quo* prevailed when they left the organization or, worse, their proposals were just not appropriate to Pemex's peculiarities. Managers had taken the opportunity for hiring the services of consultants in the hope of improving the organization's efficiency. However, the oil workers knew for certain that sooner or later the consultants would leave, because it was the current administration that hired them and so they were expected to stay in Pemex for this Presidential period at the most.

A top manager with a long career in the company said that during this period the senior managerial co-ordination units increased from 69 to 121. There was open confrontation between the oil workers and the new management team, arising from a clash of values between the groups; this was explored in section 4.3 about organizational culture. The Union publicly criticized the privileges and high salaries of the new staff and the lack of

---

[50] Across the organization the oil workers share a joke about an ill man who, being desperate about feeling miserable for a long period of time, decides to pay the expensive fees of the most respected medical doctor. After a long interview and a detailed inspection, the expert tells him. "Good, I know what your problem is and what you need to do to solve it. Your problem is being human, all you have to do is to become a dog." The patient asks back, "Well doctor that is fine, but how do I become a dog?". In reply, the practitioner says that his job is diagnosis and prescribing the treatment, but it is up to the patient to find the way to carry it out.

maintenance of the technical facilities of the company. In November 1984, a massive gas explosion in Pemex installations in San Juan Ixhuatepec, a suburban area of Mexico City, had a high human toll. The Union insisted that the authorities were responsible for neglecting the maintenance of industrial sites.

Relations between the Union and the authorities kept deteriorating. The company had various minor industrial accidents, for which the company's authorities and the Union blamed each other. These events were widely publicized by the media. In 1985, in order to smooth relations, the President changed the General Director by appointing Francisco Rojas, previously the Minister of Comptrollership. The political signal of the change was clear; it was aimed at enforcing stronger auditing and control while avoiding open confrontation. The new General Director was able to solve problems by granting important concessions.

6.3.2 1988-1993 Administration

In 1988, when Carlos Salinas became President of Mexico, Francisco Rojas was retained as General Director of Pemex. Although Rojas had brought his own team, most of Beteta's team stayed in the company. Among them was the strategist Adrian Lajous, who was named Under-Director for Operations. The authorities continued to undertake efforts to improve efficiency and to transform the organization into a competitive and modern oil company. The Union was kept under control; in the words of Rojas: "The government recovered the control of the company from the hands of the Union." This was a prerequisite to carrying out further changes in the organization to promote efficiency. The size of the company workforce was a major problem. It was overstaffed by international standards, and the company announced a big redundancy programme that cut the number of workers by almost 40 per cent.

The organizational structure was still centralized and organized by functions. In 1990, the company undertook a restructuring that created Divisions specializing in specific business lines, as shown in figure 6.2. The goal was to decentralize functions and decision making (Sánchez and Bardacke 1992). The key idea of the project, led by consultants, to achieve this was to create cost centres; these would allow the economic evaluation of the operations and enable work to be done by projects within a flatter organizational structure. The reduction of hierarchical levels was achieved mainly in the operational areas.

Figure 6.2: Organizational Structure of Pemex in 1990
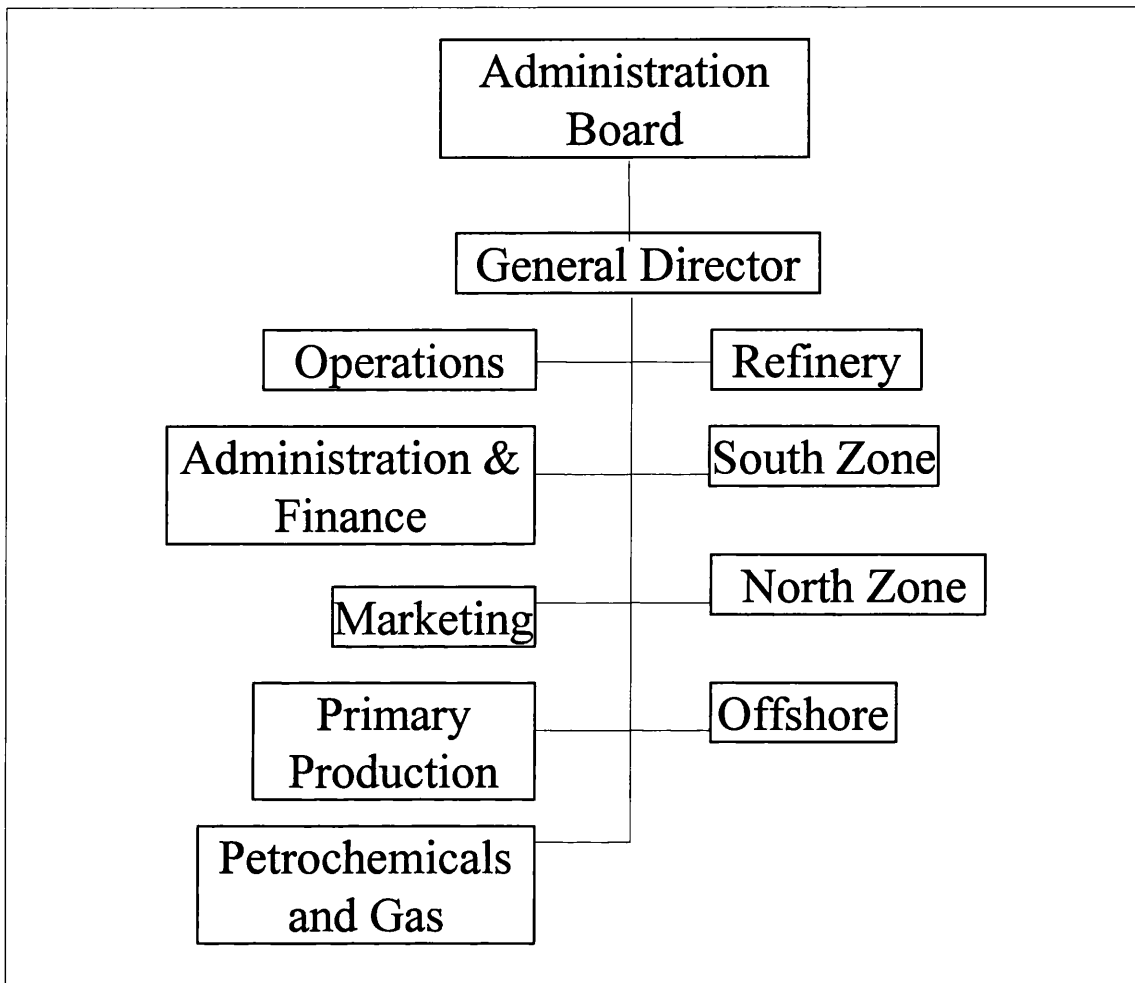
Source: Pemex

The main change of this reorganization of Pemex was the creation of the Under-direction of Petrochemicals and Gas. This business line was an important definition from a political viewpoint, as it created an economic space in the oil industry within which private capital could participate in accordance with the regulations of the National Constitution. To avoid public confrontation, Pemex managers explicitly advised officially that the reorganization did not threaten national sovereignty and that "nationalism was not incompatible with efficiency but, on the contrary, it demanded it" stated Francisco Rojas ex-General Director of Pemex during an interview The duty of the government was to do the best for the company for the sake of the nation; he recalled that the official slogan was: "Do more with less and do it better." The company's price policy became more flexible to reflect the market conditions. Although its operational costs decreased, Pemex's financial difficulties persisted because of

the heavy fiscal burden. The reorganization was later accompanied by further redundancy of its workforce.

The authorities kept insisting that the company was to remain state-owned but its operation would be carried out efficiently. The official mission read: "Pemex has to achieve excellence in entrepreneurial abilities in line with international standards." The company also tried to improve its public image regarding environment protection and industrial security. In labour affairs, the authorities had a peaceful, but not easy, relation with the new Union leaders, as was expressed by the General Director of that time in an interview. The company maintained that the fringe benefits of the oil workers were to be respected, but favouritism or blackmail by Union leaders should not bias the decisions in granting these privileges to particular workers.

6.3.3 Pemex's Split

All the reorganization efforts undertaken between 1982 and 1992 had tried to transform the company from its original functional structure to a business-line orientation, with the intention of introduce the market rationale in its operations. The clash of cultures between the oil workers and the market-oriented white collar staff diluted the efforts of change. A top manager said that it was felt that something more dramatic had to be done, but the political viability of doing that was questioned. Then, in April 1992, there was a terrible explosion of the sewage system in an area near some Pemex installations in Guadalajara, the second biggest city of Mexico. Thousands of people died in the accident and more than 9 km of streets were destroyed.

The origins of the accident were extremely complex, arising from the confluence of many factors, including a petroleum spill, the presence of industrial waste products, human errors, and negligence. Pemex was identified by the media as being the major responsible agent, because of its publicly known inefficiency, lack of proper maintenance of the installations, slackness in complying with industrial safety regulations, and red tape. The government realized that a major response was needed to pacify the public indignation. The organic[51]

---

[51] *Ley Orgánica de Petróleos Mexicanos y Organzmos Subsidiarios* was published July 15, 1992, officially creating a new corporate group and four subsidiaries.

Law of Pemex was published in July 1992 and the newly restructured operations[52] started functioning in January 1993.

Figure 6.3 illustrates how this reorganization split Pemex into a corporate group and four main subsidiaries (Secretaría de Energía 1992) (Mexicanos 1993a):

- *Pemex Exploración y Producción* for exploration and production;
- *Pemex Refinación* for oil refining;
- *Pemex Gas y Petroquímica Básica* for gas and primary[53] petrochemicals; and
- *Pemex Petroquímica Secundaria* for secondary petrochemicals.

Figure 6.3: Organizational Structure of Pemex in 1992
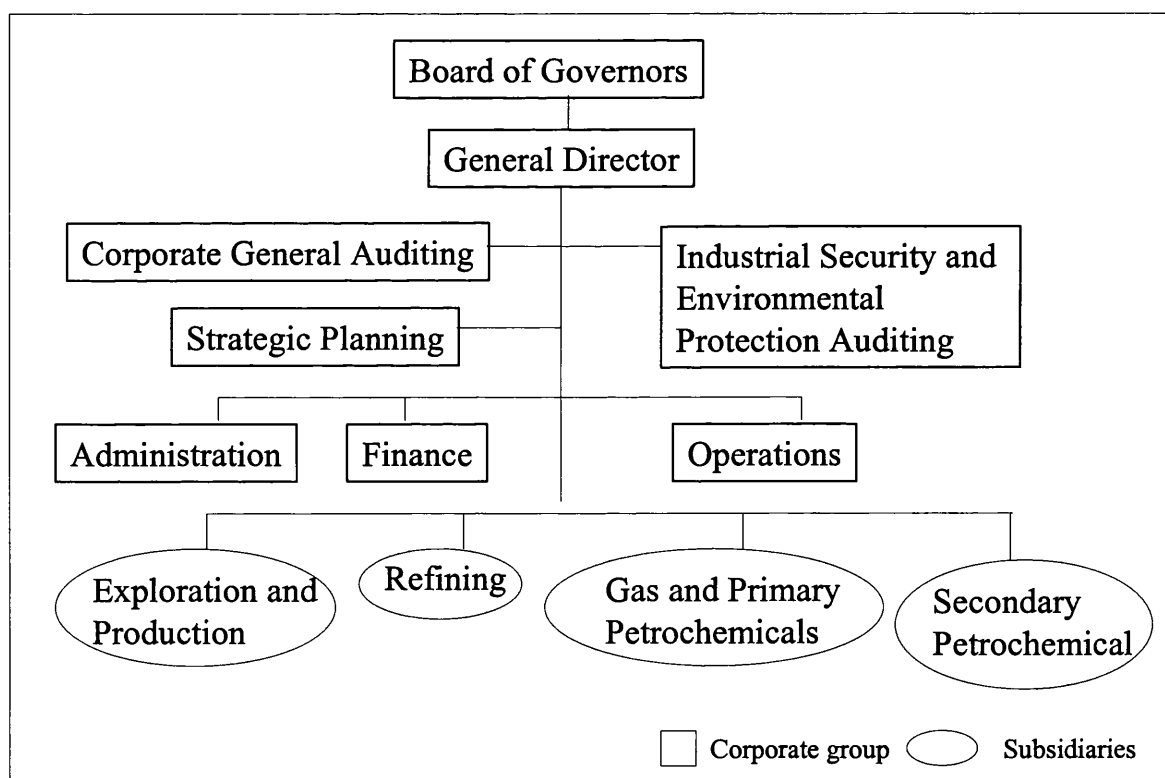
Source: Pemex

---

[52] In Pemex, the new companies were called 'organisms'.

[53] As explained in Chapter 5, the Mexican Constitution established a legal framework in which all oil sectors involving 'primary' petrochemical products had to stay state owned due to their strategic nature. In terms of the activities of Pemex's subsidiaries, primary petrochemicals include gas, gasoline, ethane, and sulphur; while by-products of methane, ethane, aromathics, and propylene are examples of secondary petrochemicals.

141

The political character of the manner in which Pemex was split can be seen both at national and organizational levels. Nationally, the neo-liberal governments that headed the public administration during that period had the privatization of state-owned companies as their major economic policy goal. Most public enterprises had been sold, except for the electricity and oil industries. Article No. 27 of the Constitution of Mexico stated that activities related to oil production were exclusively activities of the state. In 1992, the government amended this article to restrict this condition to basic oil activities. The new definition of the law allowed the participation of private investment in oil and gas distribution activities and in certain areas of the petrochemical industry. The split of Pemex created enterprises that could be legally privatized.

In the organizational dimension, the political character of change was reflected in the opinion expressed by a top financial manager in an interview: the aim of introducing evaluation based primarily on economic rationality to all activities of the company could be achieved only by reducing of the number of employees the enterprise. Control and supervision became officially the key aspects of the public management of the organization. This major restructuring process had the goal of changing Pemex into an organic type of company, with a flexible structure and the capacity to respond and adapt to changes in the environment.

A top manager involved with planning activities stated that this attempt at change had tried to develop a flatter organizational structures and give the power of decision making to the point nearest the relevant operations. The dramatic splitting of Pemex into subsidiaries sought to be a once-and-for-all change in the way the company operated. In its transformation into a global company, Pemex was meant to leave behind its bureaucratic form (Albrow 1979), characterized by having a large hierarchical structure with very specialized units and lots of red tape.

The goals of the restructuring as stated in an official document (Mexicanos. 1992a) (Mexicanos. 1992b) were to:

- redefine the functional aims of the company, away from focusing on volume goals, self-sufficiency, and vertical integration to targeting the long-term maximization of economic value;

- give authority and responsibility to senior managerial levels for the economic results of the company, with true management autonomy for the exploitation of oil deposits;

- fulfil responsibly the commitment that the company has towards the government, its workers, and the society within the legal framework (keeping state ownership of strategic oil resources); and

- develop flexible management structures that could drive organizational change and take advantage of it, by modernizing Pemex in accordance to the international model of an integrated global oil company.

The split was announced officially to the media before most of the oil workers were directly informed. A 'transition committee' led by Adrián Lajous[54] was formed by the experts of Pemex and a consultancy company, Mackenzie also without any consultation with the oil workers. This committee, which was called COLIBRI[55], defined a master plan for the split which was carried out through nine functionally defined technical committees. These technical committees worked together to manage the logistics of dividing up the company, with their work being integrated by managers of each area of expertise and members of COLIBRI.

As described in interviews for this study, on the day of the official announcement of the split, some of the top managers of Pemex received an early-morning telephone call at their homes to inform them that they had been designated members of special groups to allocate the resources of the old Pemex. This was the first news they had about the split and their role in the committees charged with the allocation of Pemex's assets among the newly created enterprises. The committees defined how to distribute the resources, commitments, and responsibilities. They dealt with a vast number of issues, such as: assets; human resources; financial commitments with contractors; projects under development; financial accounts; invoices; budget allocations; debts; fiscal duties; information technology equipment; corporate data; industrial production facilities; distribution infrastructure; pipelines; legal affairs; office space; and procedures to deal with the transfer of products and services between subsidiaries. This was a difficult task to perform, particularly given the huge size of the company and way its facilities were spread throughout the country, as illustrated in figure

---

[54] In many of the interviews, oil workers identify Adrián Lajous as the key strategist of the process of organizational change at Pemex.

6.4. To meet this widely dispersed need, medical services, telecommunications, schools, aircrafts, and natural gas distribution facilities were also organized as subsidiaries. These services were previous part of the vertically integrated enterprise.

Figure 6.4: Pemex Production and Distribution Centres

Source: Pemex

The transition was carried out in two steps, according to a manager who participated in the transition process:

1. De-concentration: This preparatory step before the actual physical allocation of the resources to the subsidiary was meant to assure continuity of operations and fulfilment of all legal requirements.

2. Decentralization: This involved the actual work of transferring the responsibility and delivery of assets and resources to the new legal entities and their managements.

---

[55] The word *colibri* means hummingbird.

In all interviews with the personnel that participated in these committees, work meetings were described as open battles in which everybody tried to obtain as much as possible of the available physical space, human resources, and responsibilities for the areas to which they had been assigned in the new organizational structure. Implementing the split was recognized as a difficult task, but the hierarchical culture of the company encouraged the carrying out of orders; as one top technical manager noted: "it had to be done and so it was done". It was taken for granted within the culture of the organization that any order was feasible as long as it was not openly rejected; as one interviewee explained, the authorities' mental framework was that, "the people who do the job and know what needs to be done would reject only an order that they truly considered to be an absolutely impossible task". Others who were interviewed for the study said that when they received difficult orders they did their best, concentrating on areas in which they considered they could actually obtain results and allowing social inertia to take care of the rest.

As the company had to become manageable quickly, no time could be wasted by hesitating to consider the costs involved in fulfilling this goal – the political moment could not be repeated. The various attempts at reorganization that had been undertaken throughout the history of Pemex had demonstrated the capacity of its employees to execute orders. They believed chaos would be prevented as long as middle managers were not removed.

The ongoing process of the split was implemented through careful negotiations inside and outside the company. Some top-level managers considered that if the authorities had formally planned the change, it would have never been achieved due to the complexity of the process of allocating resources among the different groups. A senior technical manager considered that the specific circumstances of this historic moment helped to overcome the political difficulties that otherwise would have halted the process. As the restructuring had a paramount political dimension, the need to achieve its goals allowed no room for doubt. Problems were therefore solved as they appeared, through a pragmatic approach; the ultimate goal was to keep the operations running. Within this context, the impact and the cost of the split on the information systems of the company were outside the main agenda, at least in the short-term.

According to an official document, (Administración. 1994) the corporate office was responsible for the definition of general policies, regulations, operations, and technical

standards[56] for the whole group. Both financial resources and treasury management were kept as activities centrally controlled by the Finance Division of the corporate group, which was the only legal entity that could borrow and allocate financial resources. The corporate group remained responsible for defining human resources and information systems policies. It had the formal power to define regulations, but no real way to enforce them. The view within the subsidiaries, as expressed by several managers, was that the corporate group has no real function. The subsidiaries considered that if their performance was going to be evaluated, then they should define the policies themselves. Their position was supported by the principle of the restructuring process that promoted autonomy of decision making at the point of operations.

All the revenues generated by the subsidiaries were sent directly to the government Treasury, and the resources needed by the subsidiaries for their operations were allocated to them through the Federal Budget.[57] Defining the budget is a very arduous process of negotiations with various periods of definitions during the year. The level of income of the government, which was highly dependent on oil export revenues, determined the resources available for Pemex's budget. The most important variables in determining the oil revenues were the international oil price and the company's oil production. The value of oil production depended on the budget that the *Pemex Exploración y Producción* company allocated to its investment programme to develop and maintain its production facilities and to undertake exploration activities.

By the beginning of each fiscal year on January 1, the subsidiaries did not have precise definitions of the financial resources they would be receiving; planning their expenditure was a difficult task that had to be defined and redefined in parallel with the definition and redefinition of the national budget[58]. Sometimes, the subsidiaries received final budget allocations towards the end of the fiscal year. They then had to spend those budget allocations before New Year's Eve – or else unspent funds had to be returned to the National Treasury Internally, the subsidiaries had to be able to accommodate these budget changes in their spending and investment programmes. At the same time, every project had to go

---

[56] In Pemex, these responsibilities are described as *normatividad*, a noun derived from the word 'norm' that implies a high-level definition of these activities (regulations).
[57] Pemex's general budget still has to be approved by the National Congress.
[58] This is the situation that all government agencies face in Mexico.

through a very difficult process of internal approval. When the project was eventually approved, the contract had to be put out to public tender, which could be offered to national or international bidding. The bids from private companies were evaluated using technical and economic criteria.

A middle manager stated that the process of putting a project out to tender could, in the best conditions, take at least two months. In this process, scrutiny was the main concern; a mistake, ambiguity, or bad practice could cost the employee his job. There was a feeling of surveillance that arose from the actions of the Ministry of Comptrollership and the local auditors. When revising the rules of a public tender, the employees tried to ensure that the tender fulfilled legal requirements and did not represent any personal risk of liability to those originating it. The technical responsibility for procurement resided within the area requiring the goods or services. In the case of information technology, the technical requirements were usually defined solely in terms of equipment benchmarking[59].

The procurement procedures made the decision-making process very inflexible. Once the resources were allocated to a project, they could not be removed – even if changes in the environment made such a project inappropriate. The financial resources allocated to the subsidiaries and not spent within the fiscal year were returned to the National Treasury. In interviews for the study, managers stated that the authorities considered this meant "losing the financial resources". To defend the adequacy of the procedure for launching a public tender for procurement or acquisition of services, the central government authorities argued that transparency was the first concern in public spending policy as corruption had to be avoided. Pemex management had striven, but failed, to gain more flexibility in decision making in financial matters and project development procedures, in order to leave space to accommodate contingencies.

After the split, each subsidiary company defined its organizational structure and management strategy following a predefined model, using the advice of consultants. The organizational structures of the new company were modelled on the ideal of rational functionality. The activities of planning, professional development, industrial security, and environmental protection were central to the new management rationale. Nevertheless, some interviewees

---

[59] The researcher had the opportunity to witness one of these processes.

indicated that in reality the new organizational structures were developed to accommodate the number of staff at senior levels – 'the generals' – that were to stay in the subsidiaries. The structure was also adapted to accommodate: the political commitments of the country's President and Pemex's General Director; the structure of power of the old company's employees (mainly those who endorsed technical legitimacy); and the interests of the group leading the process of change.

The President appointed the first directors of the four subsidiaries. For *Pemex Gas y Petroquímica Básica*, an academic with a PhD in Economics who had no managerial experience was chosen. The General Director of *Petroquímica Secundaria* was a member of Adrián Lajous' group who had participated in the whole process of modernization of Pemex. For *Pemex Refinación*, an engineer identified with the reorganization was appointed. And at *Pemex Exploración y Producción*, the oil professionals who kept political power through their technical expertise were able to negotiate the General Directorship for a member of their group.

The organizational structure of each subsidiary included an auditor post at a very senior level to supervise the operations; they were appointed by the General Director of the corporate Pemex group. The documents prepared for the process of transition included organizational charts of the subsidiaries that specified both the title of the post and the name of the person appointed to it. The function and responsibilities of each post were predefined. However, as several interviewees stated, in reality every manager fought to keep as many responsibilities within his function as he could, and ultimately every area tried to defend its space of power.

The new subsidiaries inherited features of the original company, even though they also started to develop their own specific features. The character of the original Pemex that arose from being a state-owned company prevailed, as did the cultural values of the oil workers. These new organizations did not follow the rationale of the market economy; their goals were different: profit could not be their *raison d'être* despite their striving for efficiency and following of the model of what a global company should be like. Each subsidiary defined its strategic business plan with the help of the same consultancy company (Mackenzie), that participated in the restructuring process and which had been employed by Pemex since 1982. These documents were considered highly confidential, and only top managers received personalized numbered copies of them.

Each subsidiary undertook further restructuring. The common goal in all these efforts was to provide accountability for their operations through the development of cost centres. Collecting data for this goal came to be a major challenge in an organization with no tradition of this type of accountability, as it meant not only the collection of a new type of data but also a radical cultural transformation. The consideration of costs had always been outside the organization's traditional way of operating, which had aimed only at producing the levels of output determined by the central government. The challenge also implied trying to train employees in the methods of analysis, evaluation, and use of the information.

When the legal split was completed, each subsidiary faced the enormous further challenge of keeping the continuity of the operations and the flow of data in the fragmented structure. The committee of transition made arrangements for foreseeable major discontinuities. But it was only when the split was officially formalized that the managers faced the need to keep operations and flows of information acceptable in situations where all definitions of the links required in the new conditions were not yet established. In the opinion of a member of the transition committee, invoicing was the major difficulty to overcome. This function in the old centralized organization had created major problems that meant it was consistently unable to control these operations effectively. The split made things worse at first; it was difficult to to agree definitions of the precise volume of products exchanged among subsidiaries.

The splitting up of Pemex resulted in the subsidiaries becoming legal owners of certain parts of the original company's infrastructure; but some parts of the installations and equipment owned by only one subsidiary were still needed by others. The authorities had to negotiate the levels of the fees charged for the services provided between them and for the use of infrastructure. For example, the distribution facilities at the sea terminal of Pajaritos, Veracruz that was allocated to the infrastructure of *Pemex Exploración y Producción* was also needed by *Pemex Refinación* for its operations; and a gas plant located within the installations of *Pemex Petroquímica Secundaria* was operated by *Pemex Gas y Petroquímica Básica*. The distribution of the infrastructure among the subsidiaries was a major operational challenge in the new organizational structure. These economic and political negotiations among the subsidiaries were very sensitive in terms of determining their financial results.

Within the new organizational structure, each subsidiary faced different conditions. In each, the internal power groups were accommodated differently. The challenges they faced were also different, depending on how the changes in the definitions of the energy policy of the central government affected the environment in which they had to operate.

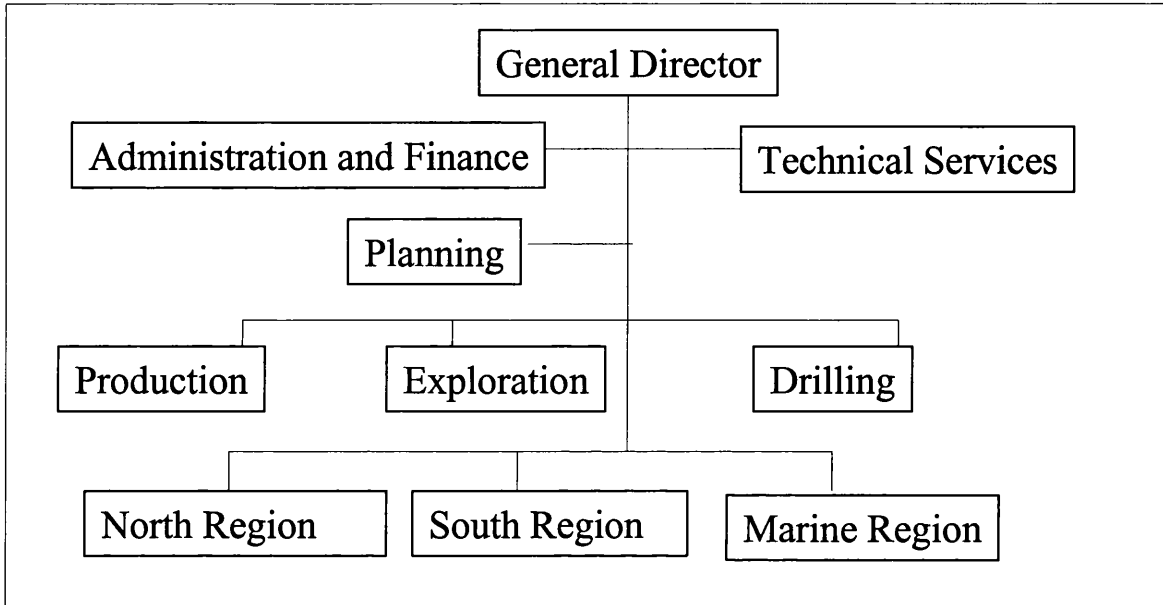### 6.3.4 The Administration since 1994

In December 1994, Ernesto Zedillo became president of Mexico. He appointed Ruíz Sacristán as General Director of Pemex, but shortly after the president's first month in power an economic crisis undermined Mexico's financial stability. There was a cabinet reshuffle and a new General Director of the corporate group of Pemex was appointed: Adrián Lajous, who had been the strategist since 1982 behind the organizational change efforts to modernize the company. The new General Directors of the subsidiaries were members of Adrián Lajous' group and were totally committed to the aim of organizational change.

6.3.4.1 Pemex Exploración y Producción

Lajous appointed an oil engineer totally identified with the new administration's goals as the General Director of *Pemex Exploración y Producción*. Although this showed that the oil professionals still had technical legitimacy in this subsidiary, these professionals did not consider him as 'one of them'. *Pemex Exploración y Producción* received special attention due to the strategic character of its business and because the government Treasury was heavily dependant on the revenues from its oil exports. This subsidiary is examined in detail here because of its importance and the way it typified the overall approach during Lajous' administration and subsequent developments at Pemex.

The structure of this subsidiary (see figure 6.5) was initially organized by business lines that mirrored the structure of the previous company, but was aligned to the concept of creating cost centres and leaving just the core activities within the company. The subsidiary was organized into three levels: Mexico City headquarters, Regional Offices, and Districts. Three districts were aligned with the production areas: North, South, and Marine. The latter comprised more than 70% of the whole oil production of the company. The functional structure of the headquarters was replicated at the regional and district levels, with the administrative functions kept mainly at the regional level.

Figure 6.5: Organizational Structure of _Pemex Exploración y Producción_ in 1994

General Director

Administration and Finance — Technical Services

Planning

Production — Exploration — Drilling

North Region — South Region — Marine Region

Source: Pemex

This type of organizational structure implied that the operational areas had two dependencies, as shown in figure 6.6: _lineal_ by hierarchical level corresponding to the organizational chart; and _functional_ by technical area. Such a situation created problems in terms of flows of information and the duplication of chains of command, which were not necessarily synchronized and consistent. Planning was done by concentrating on the operation of the functional area, not on specific goals of the projects. The senior levels of the organization at headquarters and regional levels interfered in the decision making of the operations performed in the districts.

Figure 6.6: Functional Structure of *Pemex Exploración y Producción* in 1996
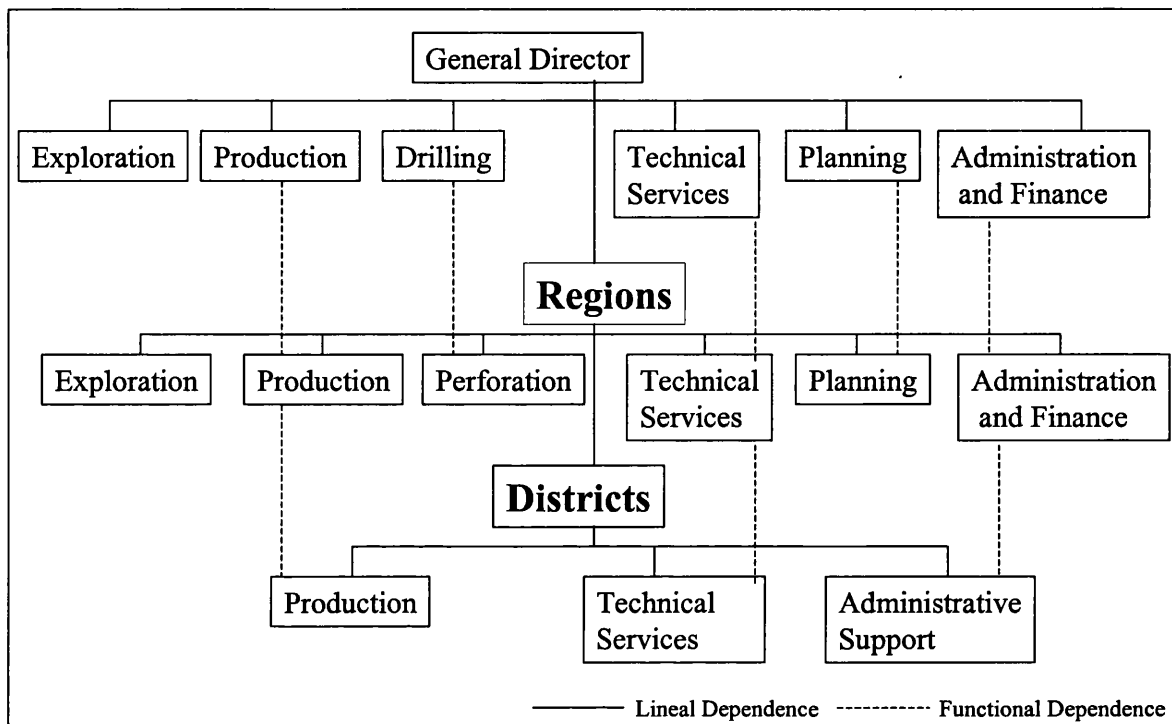
Pemex Exploración y Producción undertook a major effort to decentralize its headquarters to the city of Villahermosa, Tabasco in the area of production in the southeast of Mexico. The project was initiated and the personnel were appointed for transfer without consultation, several interviewees noted. The President stopped the process some months later and the company was left with two headquarters, one in Mexico City and the other in Villahermosa. Top managers had to make frequent two-hour flights between them, as often as twice a week, to deal with their business in both headquarters.

Some interviewees suggested that the efforts to decentralize were difficult to carry out because being away from Mexico City was seen as losing political presence in the organization. There was a saying in the local political culture: "In order to be in the photograph, you should not move, and should be with the right group at the right moment." Most of the senior managerial levels of Pemex spent their lunch and dinner times socializing with other members of the organization or of the public services, in a 'restauranting' activity similar to lobbying. Through such restauranting, they could sense trends and movements among the political groups, and make their personal alignments accordingly.

Pemex Exploración y Producción undertook other organizational restructuring and cultural management projects in the guise of Total Quality Management. Some of the interviewees said they had been in the middle of many projects that had never been completed, and expressed their lack of confidence in the merit of all these efforts to change the organization. They also mentioned a feeling of not having been considered in all the processes and that the authorities did not value their technical expertise or their working experience in the organization.

In 1995, this subsidiary defined a new Business Plan with the advice of Mackenzie an American consultancy company. This restructuring project had been monitored personally by the General Director of the corporate group. It implied a major reorganization that left in the core structure only the areas directly linked with its two business lines of production and exploration. The rest of the technical areas were organized as cost centres in separate units which, as indicated earlier, could allow the eventual creation of service companies that could be privatized. Such organizational changes also complied with the modified content of Article 27 of the Constitution that stated all oil resources are national assets.

The company was reorganized into three geographical levels: headquarters; region; and assets[60], which were new organizational entities that worked through projects with multidisciplinary work teams. The official headquarters' functions were: regulation; strategic planning; professional development and technological assimilation; corporate systems development; and data consolidation at national level.

The regions were split in four: north, south, marine southwest, and marine northeast (see figure 6.7). Marine northeast still covered around 50% of the whole production because it comprised the most productive offshore oil deposits. The regions' functions were to consolidate data for their area and co-ordinate their own operations and resources. The regions were integrated by assets, as indicated in figure 6.7. and its activities were organized as strategic units or as service centres.

---

[60] The rigs are considered as another asset of the company; that is why the basic unit of organizational structure changed from district to asset.

Figure 6.7: Organizational Structure of *Pemex Exploración y Producción* in 1996
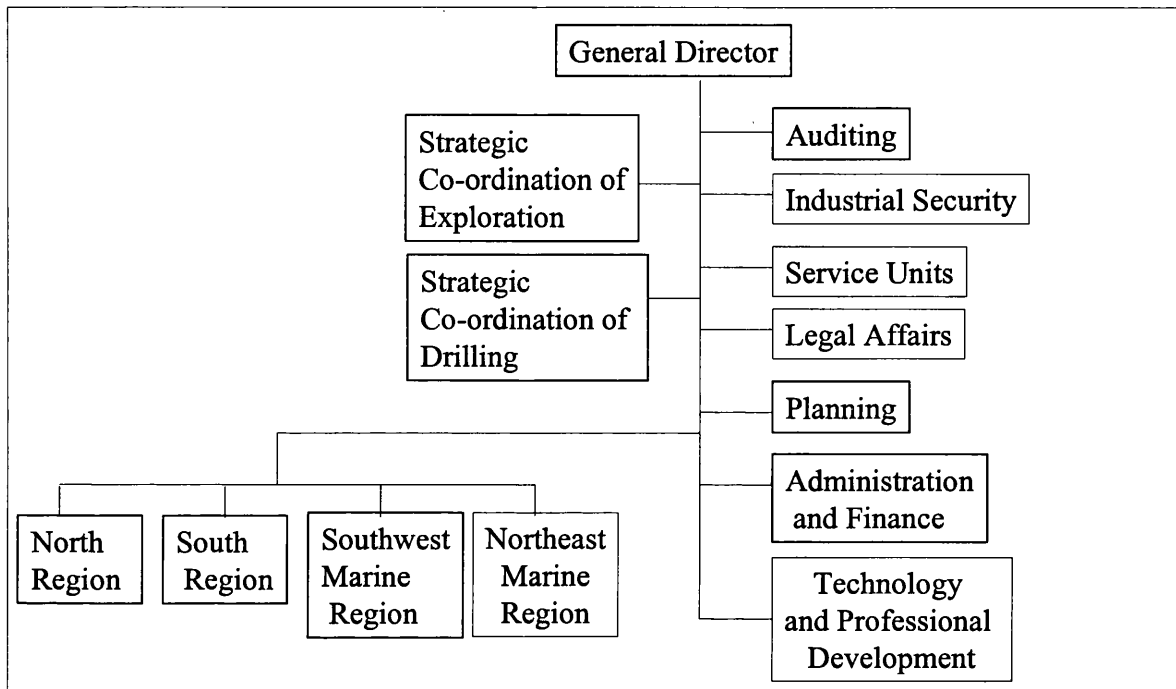
Source: Pemex

The assets were of two types: exploration and production. Their functions were the planning and operation of technical activity and the control and operation of administrative work. Figure 6.8 shows the conceptual structure that the leader of an asset had of the organization of the activities within it.

Figure 6.8: Functional Diagram of an Asset in *Pemex Exploración y Producción*
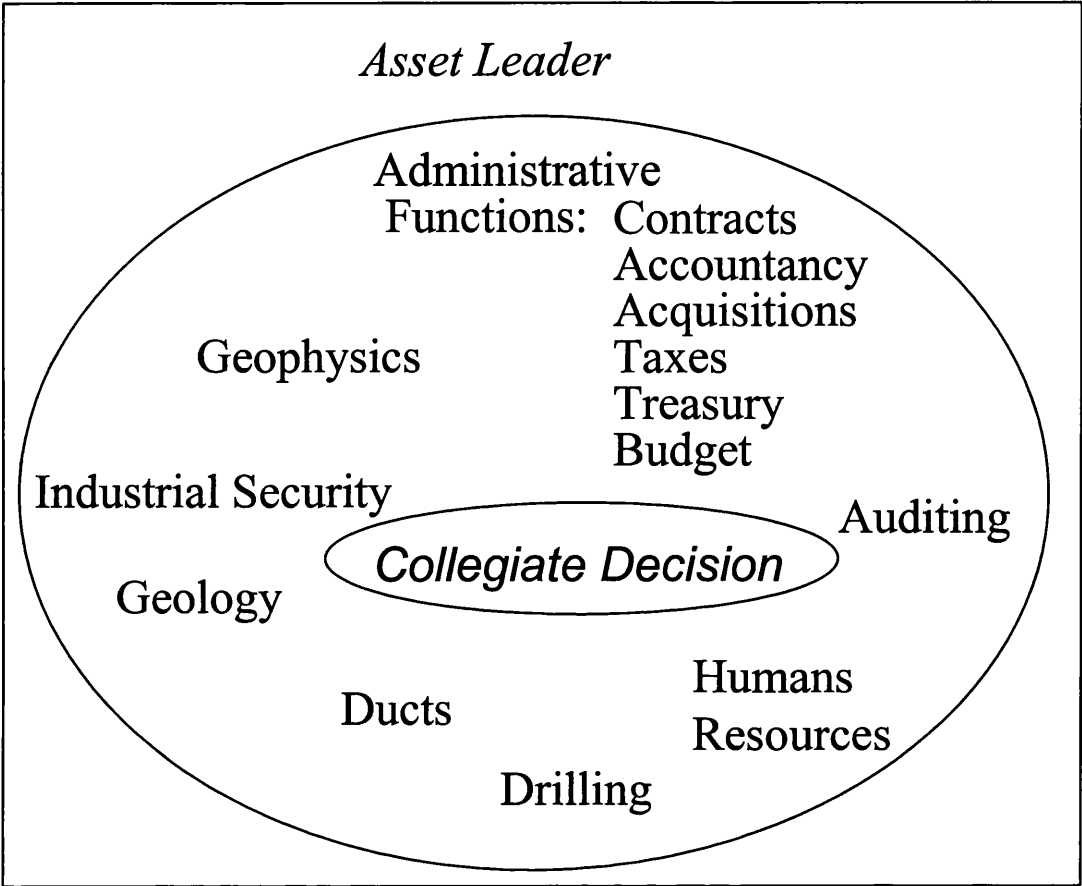
Source: Pemex

As described by a top manager, the project of reorganizing *Pemex Exploración y Producción* had been done on a pilot basis in marine northeast, as it is the most productive offshore production region. The importance of this region gives it a privileged position in the company in terms of availability of resources and information technology infrastructure. Some interviewees suggested that it had facilities similar to that of the standard model of a global company. The change process was carried out through work teams, with participation of both oil workers and experts from Mackenzie. The oil worker who was the leader for the process of change in that region was highly respected and charismatic; he was an oil professional with many years of experience in the company and truly believed that the process was feasible and worth the effort. The process was undertaken through negotiations.

The consultants who worked in this area commented that they had "learned over time that, in order to be effective in promoting organizational change, we had to work shoulder to shoulder with the oil workers". The reorganization included moving the office location of the

regional staff to a new part of the building. This had an open-plan layout, which aimed to promote co-operation at work, the free flow of information, and shared decision making. During meetings about the change, many of the definitions of the organizational change had to be 'grounded' because the distribution of functions as defined in the strategic plan was highly ambiguous when considering the actual allocation of authority and responsibility to the managers who were doing the job.

The oil workers interviewed said they had raised doubts about the feasibility of changing their hierarchical culture in a variety of ways, such as at meetings, by the new open layout style of the offices, and through posters with slogans. They also stated that they did not know if their bosses would ultimately accept the loss of power that the new arrangements implied, or how people trained to obey orders without challenging them would dare to give opinions to their bosses if that could imply contradicting them, a behaviour unacceptable to the oil workers' code of conduct. The workers doubted that just taking some training courses could alter the authoritarian personality of some bosses, who had strong technical legitimacy and were accustomed to the old hierarchical managerial style. Some oil workers interviewed were also suspicious about the permanence of both the group that was promoting the organizational change and of the change itself once the consultants left the organization.

The groups of oil workers and consultants involved in the change process at *Pemex Exploración y Producción* had long meetings to redefine the responsibilities of the different levels of the organization: Mexico City headquarters; regional offices; and the assets, the actual cost centres of production. The problem between the managements of the corporate group and the subsidiaries was replicated at this level, as personnel in the regional areas of operation considered that the Mexico City headquarters were not needed. For them, the headquarters were for managers who gave orders without understanding their effects on operations, and the regional staff were suspicious that this situation would prevail even in the new organizational structure. The only people who knew what was happening were those involved in the pilot project. In the rest of the organization, a considerable flow of informal information about the process of change was transmitted on the *radio pasillo*, but no official announcements were made – a situation that some found quite unsettling.

The organizational change at the operational level required a very dramatic redefinition of the way operations were carried out. Top managers recognized, even at meetings, that a change

of culture was needed. The whole organizational transformation was aimed at subordinating decision making at operational levels to a technical rationale. The idea was that all activities carried around the operations of an oil deposit would be organized by projects, each with a leader heading a multidisciplinary team. The changes all implied that workers' remuneration would relate in future to their responsibilities and operational results. Some of the interviewees felt this change would culminate in challenging the salary and professional rewards policy of the company as it would not be in line with government revenue policy. The new organizational entity was sketched with no defined layers of hierarchy, but as a cluster of multidisciplinary experts.

The strategy of change for the whole subsidiary implied that once the pilot project of change was implemented in the first region, the process and arrangements would be replicated in the other three production regions of the company. The process implied a redefinition of responsibilities and a reallocation of resources similar to the initial split of the company, but on a smaller scale. The second region to start the process was marine southwest, but it did not wait for the completion of the pilot project. The consultants involved said that during the negotiations undertaken to carry out the change in this region, sometimes the most radical positions came from oil workers. This process was under way at the time the research fieldwork for this thesis was coming to an end in 1997.

6.3.4.2 Other subsidiaries

The subsidiary *Pemex Gas y Petroquímica Básica* had to face external competition. This meant a dramatic change in the conditions of this sector, which had always been a public monopoly. Its first General Director made a dramatic change in the communication policy of the company. He organized a campaign to promote open discussion of the content of the strategic business plan so as to gain the commitment of all employees to the implementation of the strategy. The subsidiary would face competition in distribution, and gas prices were to be determined in accordance with international markets, mainly that of the American East Coast.

Pemex Refinación is the subsidiary with the lowest profit rates. It also inherited the strong organizational culture of the oil workers and faced problems caused by a lack of proper maintenance of its installations. The fourth subsidiary, *Pemex Petroquímica Secundaria*, had

put many of its petrochemical plants out to tender, but this process provoked a political reaction; the privatization of these assets has not been achieved and has faced conflict from the opposition parties who regarded it as a loss of sovereignty.

6.3.4.3   Reactions to the Splitting Up of Pemex

There were mixed feelings from oil workers regarding all these organizational changes. Some considered that they had gone too far and that the benefits did not match the costs, including suggestions that the efforts were just irrelevant. For them, everything had changed to remain the same ("it is just a matter of new titles for the old practices") and the privileges of one group have simply been transferred to another. There was also a sense that the authorities did not recognize the titanic effort they had undertaken in coping with all the changes. Others with a cynical attitude believe that it is just a matter of survival by tolerating the current regime with its fashions and fads for a time, until a new administration comes to power with its own programme.

In the interviews, it was suggested that the company had given too much authority and information to consultants, who were outsiders that could not fully understand the organization. Some regarded this as a loss of sovereignty. Senior management was concerned that the changes had affected national industries negatively, because Mexican companies were not prepared to respond to changes in the way contracts were now tendered. Some oil workers had the feeling that the changes brought in by outsiders were alien, and had a lack of sense of the local conditions.

Some interviewees expressed the view that managers followed orders to carry out the various change projects even when they were not necessarily convinced of their adequacy; but they had no choice if they wanted to keep their jobs. An interviewee suggested that even when the personnel of the organization fulfilled instructions related to the process of change in a passionate way, their compliance did not necessarily mean agreement with the order they were executing; instead, they were 'showing off' as followers of the process of change while actually allowing organizational inertia to continue. For them, the change process was just another 'text book exercise' of the group temporarily in power.

Many employees found the process of downsizing very traumatic. They were demoralized by a real feeling of uncertainty about the near future: "they feel they can be fired at any moment," according to an interviewee. There was also concern that the company had lost its store of knowledge with the massive redundancies of staff, especially in the information technology areas where specialists with a lot of experience in the development and implementation of the corporate systems were laid off. It was said that this would cause an enormous dependency on consultants in the future.

There were problems common to all subsidiaries, such as the lack of structured flows of information from the operational area. All the companies had a shortage of automatic measuring instruments and their installation represented, in all cases, major new investments. None of the subsidiaries had a reliable inventory with consolidated values for its assets. This represented a major political problem due to its impact on assessing the level of profit, which was the basis for taxing revenues. A top financial manager recognized that the subsidiaries did not have adequate accounting standards; they had inherited a problem of the accounting records, and the fact that standards used in the past were not suitable for the new conditions of operation in the subsidiaries. In addition, the subsidiaries inherited the problems of risk management and insurance claims relating to the inadequacy of the records of this type of data. The 'old Pemex', as it came to be called in the subsidiaries, had negotiated global insurance for its equipment and infrastructure; but accidents were always related to specific premises, for which records were often difficult to identify accurately.

6.4 INFORMATION SYSTEMS

6.4.1 Background to Information System Changes in the Second Period

An important factor in the process of reorganization was providing the company with integrated information systems based on the use of much information technology. Traditionally, the operations of Pemex were carried out mostly through disconnected flows of information that followed local arrangements in each work centre, as shown in Figure 6.9. The situation of having various styles of data collection went back to the time of the oil expropriation in 1938, when 17 private companies with different administrative styles were integrated into the state-owned enterprise that became Pemex (García Hernández 1971). As described by some interviewees, the first formal information systems that were developed

were mainly for administrative purposes. The payroll started to be automated in the late 1960s, but each production centre developed its own proprietary system using the mainframe technology available at that time. The rest of the information systems were primarily manual. These had a strong reputation for tortuous bureaucratic procedures and much red tape; they were managed with a high degree of discretion by local management in defining procedures and the meanings associated with the data collected.

Figure 6.9: Model of Information Flows at Pemex until 1992
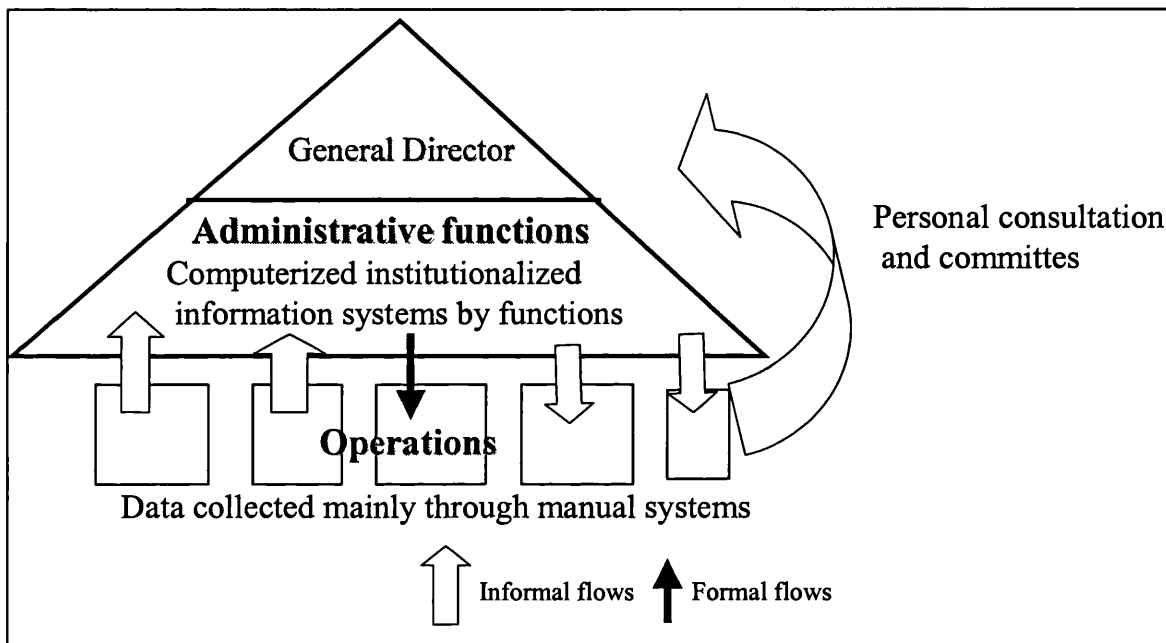
A top financial manager said that the flows of information in Pemex until 1992 had a particular feature: financial data did not reflect the conditions of the operations as there was no structured link between information flows of the operations and the administrative functions. The different financial functions, like accounting and treasury, were created as separate units in the organization as they were needed, along with the general development of the company; they were not linked to the technical functions.   Each geographic area developed its particular way of collecting and processing data, which was changed whenever the local authorities demanded – without prior notice to other areas.   Control over the information became the main source of personal power, creating the feudal structure that was the main characteristic of the organization until recently. Those fiefdoms proved extremely difficult to break down with the development of computer-based information systems.

To structure the description of the development of information systems in Pemex, the researcher identified four types of systems: administrative, technical, expert, and strategic. The administrative, strategic, and expert systems were heavily automated, while the technical systems that dealt with recording large volumes of operational data were basically manual *ad hoc* arrangements defined at the plant level. The expert systems were linked to sophisticated mathematical formulae required for calculations of the plants' projects. The organization also had a unit that specialized in geographic information systems using state-of-the-art technology. The systems were for internal use with very a restrictive access policy, because they were considered highly confidential by the area managers. The development of these expert systems is not part of this research.

By the early 1980s, Pemex's management began to view information technology as an enabler of modernization closely linked to the idea of strategic planning and control, as well as being seen as an end in itself. At this stage, certain projects looked like 'solutions looking for a problem', and information technology was being technically driven from an engineering perspective. The organization did not want to get left behind the 'technological band wagon'.

The following sections examine how information technology was actually deployed in the information systems developed at Pemex in the second period studied, from 1982.

6.4.2   1982-1991: Introducing Open Systems and Corporate Financial Systems

Information systems development at Pemex at the start of the second period saw the emergence of two main policies: the definition of an 'open systems' technical standard designed to facilitate a move from mainframes to mini and microcomputers; and the creation of plans for corporate systems, known as *sistemas institucionales*, to standardize the company's financial systems. These policies were developed and co-ordinated by the *Gerencia de Informática*, which had been formed in the late 1970s to be responsible for computer-based systems and which went through a number of reorganizations after 1982

Another characteristic that originated in the second period was the growing participation of consultants in organizational and information systems developments in Pemex. According to a top information technology manager at Pemex, the company tried to bring in new ideas and styles to the organization based on the state of the art in information technology and

management practice; but, as one oil worker remarked, these related to "the ideal world, but things here in Pemex do not work that way".

In 1982, the *Gerencia de Informática* was relocated from reporting to the Under-Director of Finance to come under the General Comptroller. It was also restructured again in 1985 because, according to an official document (Coordinación Ejecutiva de Recursos Humanos 1985) "there is a need to re-organize the *Gerencia de Informática* in order to make it capable of responding to the present and future informatics requirements of the organization. The area needs to be able to plan and to regulate the informatics resources and to control this activity, and its functions have to be distributed in an adequate way." Two new departments were created. One was dedicated to planning the informatics activities of the whole company; the other had the responsibility for establishing the general regulations for the 'informatics function' of the whole organization. During this process of organizational restructuring, some posts were upgraded and some functions were relocated within the existing departments. According to the official document, the changes were to be implemented that year, but they actually happened much later. This same year 1985 the *Gerencia de Informática* was again relocated under the Finance Under-directorate, which later merged with the General Comptroller's office. The *Gerencia de Informática* kept the same number of people, but they were upgraded in terms of salary and status.

By 1982, information systems management was strictly centralized although, as mentioned in chapter 5, some local areas operated some of their own systems units covertly. The *Gerencia de Informática* provided procurement, maintenance, and information technology services from its head office in Mexico City. Its systems development activities were related to operations organized in three zones: north, central and south. There was no transmission of data between machines due to the incompatibility of proprietary technologies and the failure of the IBM data transmission project in 1975 (see section 5.1 in Chapter 5) It could have been technically possible to transfer data between machines of the same type, but only if they had used similar operating systems. However, Pemex had computers from various vendors, and even machines of the same type on different sites that used different operating systems. Data transfer was done through magnetic tapes, on which data was recorded in the ASCII coding standard.

The mainframes ran batch-processing systems and information was jealously controlled by the different areas. In practice, the only system that had some real central supervision and control was the payroll; all the others had been developed independently in an *ad hoc* way. A top information technology manager described how, by the early 1980s, the efforts to plan the informatics activities still usually ended in meetings where Pemex managers received information about the latest IBM deliveries and explanations of how the equipment could be used in their work. The *Gerencia de Informática* programming was undertaken in FORTRAN for technical systems and COBOL for administrative applications.

Even with the existence of computer-based systems, managers usually did not receive timely and reliable information for making decisions. The lack of information could not be explained solely by technical deficiencies. The source of power in the organizational culture had come from controlling the flow of information. Several interviewees agreed that each area of the company's operation autonomously defined all aspects of its information systems, regardless of their relationships with others.

In 1982, an accountant who had worked in the National Telephone Company was appointed as Under-Director of Finance. He had a high reputation as an expert in telecommunications. The researcher interviewed people who worked with him during that period but were no longer part of the company. They noted that when this Under-Director of Finance assumed the responsibility for the informatics area he realized that the *Gerencia de Informática* had severe problems, including information systems management and the quality of the information available. Accountancy data did not match budget data; they each had very different information structures, making the task of data matching almost impossible. Pemex had to provide information to the central government for the national accounts, which also had a totally different structure.

The financial data of the organization that came from work centres scattered throughout the country was centralized in three mainframes. Most of the financial areas of the work centres had local computer-based systems, but these did not have an accountancy perspective. There was also a problem with the reliability of the data from the areas of operations, particularly in relation to information about what was produced and then sold or channelled to other areas of the company. As a result, it was almost impossible to make figures match when trying to consolidate data among the different areas of the organization.

The new Under-Director of Finance hired consultants to develop two main projects: the international Booz Allen & Hamilton company to carry out the evaluation of the informatics function; and *Secofin* a national consultancy company for the development of the linkage between financial (accountancy and budget) and operations data.

The project to link financial and operations data also required the definition of responsibilities for the different data flows and organizational entities responsible for providing specific data; this proved very difficult, as it required changing the oil workers' mentality so they would accept the need to record data for accountability purposes. The oil workers considered that this data was unnecessary, and that it was a waste of time having to collect it. They considered such a requirement ultimately to be just red tape.

The interviewees recognized that this project also had to change local practices in regard to procedures to record data to achieve general corporate standards in accordance with 'good management practice'. These changes faced political opposition because they broke the fortresses of power. Local managers now had to comply with the new rules and standards dictated by the central authorities; before, they had been the ones who could define the local practices for data collection as well as changing them when they so decided, without notifying other areas. The project team faced resistance during the implementation, but managed to get the support of the area managers by working hard to convince them that gathering high-quality data would help them to take better decisions.

The executive leader of the project had a very clear notion of the complexity of the challenge they were facing. His slogan was: "the best is the enemy of the good"; this indicated that any progress towards the project's objective was positive, even if they were unable to reach the ideal outcome. The main unresolved problem by the time he left Pemex in 1987 was the matching of accountancy and budget data on time. Booz Allen's analysis of the informatics function acknowledged that this could not be fulfilled centrally. It recommended giving official recognition to the existence of the other informatics areas that existed throughout the organization, as a way of co-ordinating the informatics function of the whole organization. As a result, the *Gerencia de Informática* was restructured and given the name of *Gerencia Institucional de Informática*; it kept responsibility for information systems management, but only for regulation and not for the operation of systems. The key word of the campaign to

decentralize the informatics function was 'regulation'. A middle manager stated that, "within the defined standards, every area was given the freedom to develop its own systems, in accordance with its needs and preferences".

Some people involved in software development felt that the diagnosis made by the consultants was the same as that done previously by company staff. However, in the organizational culture of Pemex, insights from insiders were not taken into account unless somebody from outside supported it. For some oil workers, this was a manifestation of the national cultural feature of *malinchismo* that favours aliens over fellow countrymen. Also, outsiders' opinions were taken into account in order to avoid responsibility if there was a failure of decision making.

A group of people opposing the head of the central informatics team joined forces with the consultants and achieved his removal in 1985. The manager who took over was an engineer who had worked for many years in the company, with a strong reputation for having a strong and autocratic personal style. This kind of personality suited the circumstances of that time because a strong leader with a "hard hand" was needed to put things under control and in order, commented a top information technology manager in an interview.

In 1983, Pemex bought a systems development methodology from Arthur Andersen. The procedures were described in great detail in seven large volumes of documentation, but people involved with software development said in interviews that it did not bring the expected benefits. The analysts and programmers did not follow the methodology because, as one said, "it was too tortuous and its philosophy did not suit Pemex's organizational culture". A typical comment from the technical staff interviewed was: "Those methodologies usually describe how things should be, but Pemex's reality is something else".

Booz Allen's proposal suggested the creation of two entities: an Informatics Committee as a forum to discuss information technology issues; and an organizational unit responsible for ordering and regulating the informatics function of the whole organization. The proposal specified that the values of this unit should be based on a culture of service. The new responsibilities of this unit were planning and standardization. The consultants provided a methodology to develop the informatics corporate plan, although some of its aspects did not suit Pemex's working practices. The *Gerencia Institucional de Informática* developed the

corporate informatics plan; it had very detailed technical specifications to regulate the procurement of information technology. A technical manager noted that the final report of Booz Allen pointed to Andersen's methodology as a useful tool.

The Informatics Committee was created with representatives of each of the six under-directorates of the company, together with the manager of the *Gerencia Institucional de Informática* and a technical secretary, who was an engineer from this same area. The goal of the committee, according to an official document, was to "create synergy among the different groups, by sharing experiences and knowledge". The committee ended up being perceived as an instrument of manipulation by the autocratic manager of the *Gerencia Institucional de Informática*. It seemed that this manager defined 90% of the subjects discussed in the committee; it existed for three years, until it disappeared because none of its members were interested in attending.

The *Gerencia Institucional de Informática* was responsible for information systems management systems activities, such as the definition of technological standards and the maintenance of information consistency. The technological standardization was enforced through strict procedures for information technology procurement defined by the central government through INEGI[61], the National Institute of Statistics, Geography, and Informatics. The national informatics policy also defined the delivery of an informatics plan as a requirement for all government organizations[62]. As described in Chapter 5, the first effort to define a Pemex Informatics Plan was carried out by the central authorities using an IBM methodology that consisted mainly of standards for the technology and for acquisitions procedures; later, Booz Allen brought in its own methodology for the Plan's development. This Plan came to be seen solely as something necessary for the fulfilment of a central government bureaucratic requirement, as the content was not actually related to the development of the systems in the company. It was during this period that the *Gerencia Institucional de Informática* created the concept of *sistemas institucionales* (Institucional 1992): projects aimed at developing corporate information systems that would standardize the main financial functions throughout the company. These institutional systems were

---

[61] The *Instituto Nacional de Estadística, Geografía e Informática* had the responsibility for defining and supervising the government's information technology procurement policy.
[62] Reglamento de la Secretaría de Hacienda y Crédito Público (Artículo 100, Fracción 3, Inciso B), published September 11, 1996.

internal to Pemex. Although they were corporate systems, they were not integrated and their flows of data were not linked electronically.

6.4.2.1 New informatics strategy

In the definition of technical standards for equipment, the Booz Allen proposal stated that Pemex should move towards IBM's standards. Before this, a section within *Gerencia Institucional de Informática* dedicated to monitoring the information technology market had recommended that Pemex should define UNIX as its technical standard, which challenged Booz Allen's proposal relating to an IBM standard. According to a top information technology manager, this proposal was based on market trends rather than technical considerations. There was an intense period of discussion among the consultants and senior managers of the *Gerencia Institucional de Informática,* at the end of which the top manager followed his colleagues' suggestion and Pemex moved to a UNIX environment.

Booz Allen was re-hired to implement its overall recommendations regarding the informatics strategy, but using UNIX rather than its IBM proposal. However, the experts interviewed said this contract was not performed properly. The consultancy's senior managers were highly trained, but the analysts who came to develop the recommendations did not have the skills required. Moreover, they were unable to understand Pemex's culture sufficiently to consider the specific nature of the organization and perceive what was feasible in this context, rather than trying to implement an unrealistic ideal system. As a Pemex manager said in an interview: "The change from A to Z cannot happen abruptly; it has to be implemented in a systematic and incremental way through a strategy with a long perspective."

The consultants' proposal considered some other aspects of changing the organizational structure of the informatics area, the values of the group, and also the type of administration. The *Gerencia Institucional de Informática* used to deal with the requirements of three environments: technical, linked with operations; administrative, related to payroll and other financial functions; and computing engineering, dedicated to research and development of software for areas of specialized expertise, like calculations for exploration and refining. The new organizational structure of the *Gerencia Institucional de Informática* highlighted the importance that was given to the planning activities, as shown in figure 6.10.

Figure 6.10: Organizational Structure of *Gerencia Institucional de Informática*
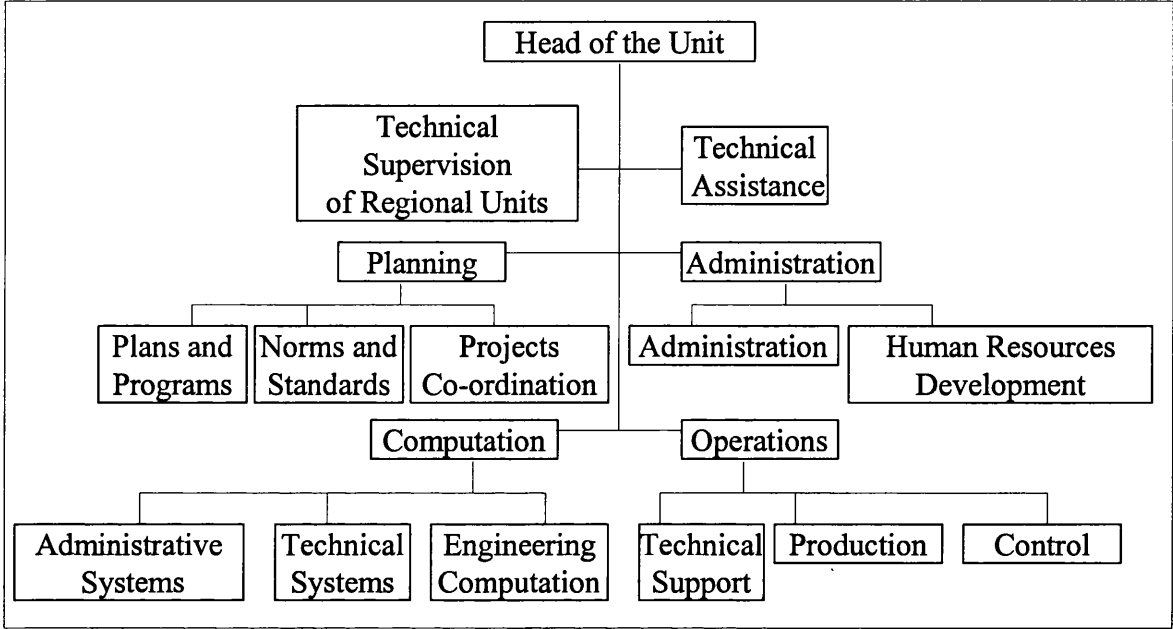
Source: Pemex

Several times during the interviews, senior managers tried to emphasize the effort that the managers of the informatics function made to incorporate state-of-the-art information systems management into the company. In trying to make sense of their own activity they used a variety of concepts and ideas. For instance, they used Nolan's (1979) 'stages of growth' model, into which they tried to locate Pemex's situation and incorporate the activities needed to move forward in accordance with the linear progression outlined by the model. They also made visits to other organizations to compare the state of their information technology development with that of Pemex.

The technical staff showed a sense of deep pride in the information technology development of Pemex, mainly in the sophistication of the equipment and the 'informatics solutions' they were operating in the company. Some of the technical staff interviewed were very suspicious of the academic background of the researcher, and kept a vigilant attitude during the interviews to avoid failing to live up to expectations they thought "an outsider with certain expertise" would have of Pemex's informatics activities. At higher levels of the hierarchy, the section with technical expertise in hardware had a critical view of information systems research activities, as if they felt such academic work saw the technology as having only

limited benefits because this kind of research was "unable to understand things and facts from real life", in the words of a technical expert.

The process of restructuring the *Gerencia Institucional de Informática* led to half the staff leaving because they did not suit the new conditions, where new type of expertise were required. Those that stayed had proficiency in COBOL and FORTRAN programming, and new people with appropriate skills were hired. In 1985, the *Gerencia Institucional de Informática* defined a new informatics strategy for the whole organization. This officially conceptualized the institutional systems that were to become the corporate systems, as shown in figure 6.11. The institutional financial systems, aimed at linking the flows of information about the financial functions throughout the whole organization (Institucional. 1990). They wanted to prevent the duplication of data input and reduce the likelihood of mistakes.

Figure 6.11: Conceptual diagram of Pemex's Corporate Systems
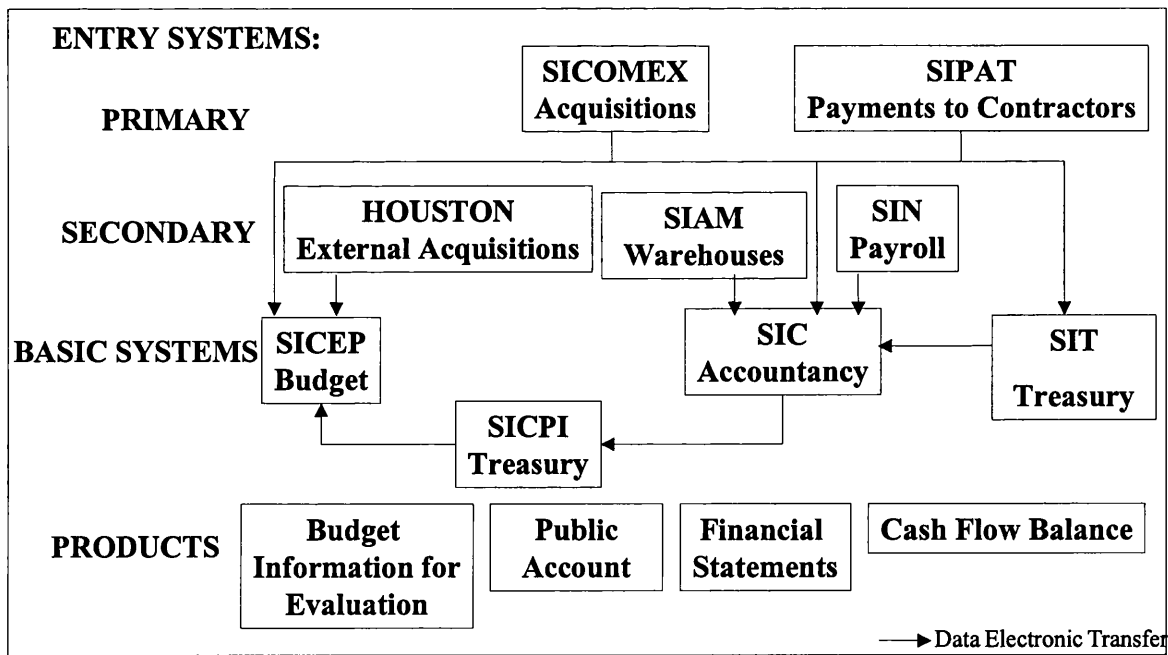
Source: Pemex

This strategy considered information technology as an enabler to allow the synchronization and integration of the financial activities. Before these systems were developed, treasury statements and other financial reports were prepared manually every day. This led to delays of up to a month in the registration of accounts. The ultimate goal of the institutional systems

strategy was to implement an integrated network of systems. This brought about organizational changes because it broke the local control over accounting activities. Budgeting that had depended on accounting data was defined in 1988 as a separate function with its own organizational unit.

The implementation of the proposal for new computer-based financial systems also implied a process of downsizing the equipment from the previous mainly mainframe computing platforms, as it was based on an open-systems technical standard designed for mini and microcomputers using the UNIX and DOS operating systems. Relational database management systems that implemented SQL in an Oracle environment were also introduced. Until then, the programmers had experience only of batch file processing, whereas the new system had online terminals. In order to achieve prompt results with the new systems, all programmers therefore received special training, which involved five to six weeks of learning about UNIX and in basic and advanced Oracle. However, senior managerial levels came to realise that it was difficult to undertake so much training effectively in such a short time. The technical staff interviewed suggested they would have preferred to have taken the advanced Oracle courses at least six months after working with the new environment, in order to make sense of the more complex features.

6.4.2.2 Development of Corporate Institutional Systems

A senior technical manager stated that there were problems in the top-down approach to implementing the new systems and that the vendors were unable to provide adequate technical support for the development of UNIX-based systems. The programmers also had difficulties in understanding and implementing database theory and relational models, but they found changing their group values towards a culture of service proved to be the most difficult task. For the user, the implementation of the strategy represented a positive change, as they were now able to carry out their information processing tasks through terminals in their offices. This meant they could stop having to take the data to the computer centre to be processed in batches by the technical staff, who were themselves liberated from the burden of these operations and thus had more time to dedicate to other activities. The benefits of the strategy generated a demand for new services. The negotiation and definition of requirements for the systems were done at an operational level, without concerted managerial action.

The development of corporate institutional systems was carried out with a lot of political negotiation. The teams that developed the projects were integrated by specialists who came from the informatics offices of all the company's work centres, and there was a committee that co-ordinated the work of the various project teams. The heads of the projects were top managers and the leaders of the teams were technical informatics specialists and users; interviews were conducted with a representative sample from both projects and teams.

Existing systems were maintained in parallel as new ones were developed. The strategy included corporate systems encompassing the following applications:

- Contracts
- Budget
- Human Resources
- Treasury
- Costs
- Accounting
- Acquisitions & Procurements
- Warehouses

The change was very dramatic. As the company had no previous experience in database practices, internal experts recommended that these systems should be developed gradually. A middle manager noted: "The company did not actually have a real methodology, nor tools to support software development, nor a technical culture". But the 'Informatics Tsar', as the head of the *Gerencia Institucional de Informática* was known, decided to start with four systems at the same time. The Andersen methodology was used for these, but an analyst complained in an interview for this study that it comprised filling at least a thousand different forms, which meant it was not used for practical reasons. The technological platform for the open systems did not arrive on time, so the project team started developing the systems in COBOL with the methods they had used in the past. Technical staff from all the regional areas of the company were brought in to help. All the people working for these systems were concentrated in Pemex's Mexico City headquarters, according to a middle manager involved in this process.

The Costs system was the first to be developed, because of political pressures. Pemex had no tradition of recording cost data; the technical staff therefore defined the system's requirement specifications with no participation from the users. When the system was presented to the users, they rejected it, noted the middle manager interviewed. When the open systems arrived, an attempt was made migrate the development to this new environment. In the middle manager's opinion, the system never worked because of all these factors.

Human Resources Management was the second corporate system to be developed. After the first experience with the Costs system, the group in charge of the new development bought the Information Engineering Methodology[63] and a computer-based tool to help draw the diagrams for the requirements analysis. The developers made changes to the old Human Resources Management system that worked on a Burroughs machine to enable it to operate in an open systems environment. The new system was tried out first at the company's operations in Coatzacoalcos, Veracruz, as the developers understood that they needed to "make the system softer" to meet local needs. They realized that each area interpreted the regulations in its own way, even when standards of procedures were defined through the properly documented corporate regulations (known as the *normatividad*[64]). The middle manager noted that the developers used to joke about the interpretations of the regulations with the question: "How do I know that what you understood is what I understand?"

The implementation of the Human Resources Management system was difficult because of the complexity of the payroll due to the variability of payment definitions [65]. Staff involved in this process said the implementation of the system in the whole organization was like trench warfare, with a battle fought in every work centre. The developers adjusted the systems to the users' requirements, having negotiated with them and evaluated the practicality of the changes. Additions and upgrades of the system were documented and distributed to all the other areas that were already operating the system, in order to keep a

---

[63] Developed by James Martin Consultants.

[64] Pemex used the Spanish noun *normatividad* to refer to the technical and information standardization and regulation of administrative procedures; it includes the connotation of control and regulation. The phrase strictly means: relating to, or dealing with, norms, discipline, or regulation; creating, prescribing, or imposing a norm governing rules.

[65] Each of the more than thirty sections of the Union had its own labour terms of employment. In addition, there is variability in labour conditions due to the specificity of certain types of work; for example, divers working on

unique version operating throughout the company. The rule was that the local informatics teams at the work centres could not modify the programs' source code.

The activity for which the next system was developed represented one third of the total budget of the company: purchasing aspects of Acquisitions & Procurements, without materials management. The vested interests in this area were also very strong. The users kept asking for changes, which eventually succeeded in making the project fail. The next system was Warehouse Management; for that, each procedure was analysed and documented. Taking into account the previous experiences, the project team implemented it gradually, including initiatives such as: presentations to users; identification of local sponsors; clear definitions of responsibilities negotiated among the different parts involved; and cascade training[66]. This was also not an easy experience, noted a middle technical manager. The system had bad precedents, as other information technology groups in Pemex had tried to implement similar ones before and had failed. This created an attitude of the users summarized as: "The informatics people are trying once more."

Later, the project leader tried to redo the development of the system for Acquisitions & Procurements using a strategy of incremental implementation through the different work centres. The project tried to link the acquisitions and warehouse systems, but their product catalogues were different. It worked eventually at the fifth attempt. Next, the Budget system was developed. This faced enormous problems because the analysis of requirements was done on the basis of corporate regulations which described a system that worked on the principle of allowing the areas to spend only if they had proved that they had enough resources available for a transaction. In real life, things worked differently; the areas were not used to this restrictive measure on their spending procedures.

For the Accounting system, all users from various levels of the hierarchy were involved. It took almost two years to develop, and the implementation was done gradually. It turned out to be a very expensive system, but it was the first one that really worked, in the opinion of some of the technical staff interviewed. The project team learned through trial and error, trying several times until they were successful in implementing the system.

---

underwater drilling forom offshore rigs are paid at an hourly rate in pesos and workers on the offshore platforms are paid a salary every two weeks in dollars.

[66] Training future trainers.

A senior financial manager noted that the institutional systems did not necessarily work in an identical way throughout the organization; different information technology infrastructure and technical skills were available in each area. In the areas outside Mexico City, the implementation of the systems was initially carried out with the authority of the head of the financial and administrative activities who was responsible for the accountancy function. With the evolution of the systems, the organizational structure of the regions changed to mirror that of the Mexico City headquarters, and in some cases new sections were created to split the different financial activities.

During the development of the corporate systems, a group of specialists in the *Gerencia Institucional de Informática* started to work on a self-training programme for software development and project management, and studied thoroughly the Information Engineering Methodology. They held meetings among themselves to share ideas and experiences, calling their group *Centro de Evolución Normativa en Tecnología de la Información* (Information Technology Evolutionary Regulations Centre). The technical experts that were interviewed saw Pemex as a laboratory where they could try any product, tool, or methodology they wanted. This group of experts clashed with the Booz Allen consultants, who were interested in the exclusive use of its own methods.

Pemex bought a new methodology from Booz Allen and hired their services to help with its implementation. The consultants were good technically but lacked communication skills. They tended to impose their choices, points of views, and decisions, and did not compromise in order to build a consensus with the Pemex technical staff. In the end, Booz Allen dissolved the *Centro de Evolución Normativa en Tecnología de la Información* because, according to this centre's members who were interviewed, the consultants felt threatened by them.

During the interviews, the technical staff stated that Pemex had no overall systems architecture; as a result, the corporate systems were developed as separate systems, isolated from one another. Later, interfaces were developed to allow the transmission of data between them, like the first one between the accountancy and budget systems. The financial operations at each work centre were undertaken according to standards defined centrally by

the head office, but the problem of the interpretation of regulations and product catalogues remained even with the new systems.

The technical staff interviewed suggested that, with hindsight, the authorities were unable to predict the size and complexity of the project to develop the new corporate systems. This development encountered problems due to both the relationship of the technical analysts with the users and the aggressive attitude of vendors and consultants who wanted to take advantage of the situation. The change from batch processing to online relational databases was also difficult to implement for both users and the technical personnel. The managers of the *Gerencia Institucional de Informática* were not able to foresee that the corporate systems strategy involved the risk of becoming too restrictive about the operations of the organization.

The technical staff advised, in the words of one, that: "the strategy of open systems came to be anything but open" because hardware was not homogenous and every machine had its own standard. However, the technical staff considered that Pemex was able to evolve very rapidly to an open systems environment compared to what had happened in other organizations across the world. They regarded strong project leadership as a decisive factor in this achievement. Due to the culture of the organization, changes had to be defined top down and needed strong political support to push them forward. Nevertheless, they felt the benefits brought by the corporate systems were never recognized. For these technical experts, the corporate systems were the glue that integrated Pemex as an organization for the first time in its history, at least in terms of the flows of financial data.

The accountancy area kept control over all the legal documentation of the financial transactions involved in the corporate systems. Before the systems were linked electronically, data was input at least three times into different systems, noted the technical staff interviewed. With the development of the new interfaces, the data was entered only once: in the acquisitions section at the start of the financial process. The implementation of the systems did not bring about the expected reduction in paperwork, although the systems did cause staff redundancies – mainly because of the elimination of the duplication of data entry. The corporate systems faced opposition from the Union because of these redundancies and the redefinition of posts. In particular, the new data input jobs were not easily accepted. Technical staff saw this as a resistance to change, because these users "came every day with new complaints about the system". Even though Pemex started to develop the systems by the

mid 1980s, their impact on the organization was felt later. By 1986, the structure of the accountancy function was redefined, as were most of the financial procedures subsequently in most working areas as part of their standardization process.

Technological innovation made new technologies continuously available, but an analyst pointed out: "The possibility of evolving these systems to incorporate the potential offered by the new technologies, such as a client-server environment, never crossed the minds of the authorities." The corporate information systems applications mostly remained as they were initially built, although there was an ongoing demand to make changes to meet new requirements and some interfaces were developed to avoid duplication of data input. However, the maintenance practices degenerated because the changes made were not documented, as the urgency to have the changes on time and to keep operations running prevailed over "good software development practices"; and the needs for changes "just kept on coming". The *Gerencia Institucional de Informática* retained the centralized operation of the corporate systems.

The opinion of technical experts was that the company lost its software knowledge because of top managers' lack of understanding of systems development activities. Most of the people who were involved in the development of the systems left the central offices and returned to their local areas. The typical systems analyst's career evolved to be more of a programmer than an 'information analyst' specialist in software development who can understand both the business and technical aspects of the system. When the technical experts expressed these views to the researcher, there was an evident sense of frustration about what they considered was a historical loss of their personal and professional efforts, at the cost of the lost opportunities that this loss of knowledge represented for the organization.

In the informatics area, there was a division in attitudes towards information systems between those dedicated to hardware procurement and those specializing in software development. The hardware-oriented group, who had politically dominated the central informatics area of Pemex, had the engineering perspective that prevailed throughout the organization. The software developers were 'softer' in their orientation: they were conscious of the need to take into account social and human aspects when developing information systems.

Despite the concentration of power of the informatics activity in the *Gerencia Institucional de Informática,* other informatics areas from the under-directorates of exploration, primary production, and industrial transformation also became very powerful. The latter area was headed by a chemical engineer who was a strong leader with a 'hard' engineering-oriented systems perspective. He engaged in a perpetual struggle for power with the informatics central authority, mainly on the grounds that his local technical standards were better than those defined at the centre. He even developed his own version of the corporate financial systems to demonstrate the superiority of his developments and technical choices. He built a budget systems using Informix, his technical platform, that was later ported to Oracle and implemented throughout the organization. In this case, the development was done through prototyping in order to develop it faster than the accountancy system, which had taken several years.

This local information technology manager had a personal rivalry with the head of *Gerencia Institucional de Informática.* He believed the corporate systems "were too big and heavy, with complicated flows of information and too many computing problems". For him, "politics are a part of life and things just have to be done, as they are required"; but he did not clarify who is to determine what is required. He tested his systems against those of the *Gerencia Institucional de Informática* in terms what he called "benchmarking performance". In his view, the results favoured his systems, both in terms of the quality of the data and the technical performance of the systems. He considered that corporate standards should not be defined "top down, they only have to be interpreted as they emerge from the daily use and the market". At the same time, he accepted that it was up to the *Gerencia Institucional de Informática,* as an authoritative body, to define the rules because they had the power. He was later named head of the information technology area of one of the subsidiaries.

The implementation of the corporate systems strategy was not homogeneous throughout the whole organization. Each area had its own particular level of achievement, depending on its access to financial and human resources. Later, the responsibility for the operation of the corporate systems was given to the users. The result of this change was very different in different areas of the company. Some users became very sophisticated in their information technology expertise, but in other cases they did not even verify the data.

Technical staff considered that one of the problems of the corporate systems affecting the whole organization has been that the input of data is done by personnel who do not care about the quality of the data and had no understanding of the repercussions of their mistakes. The data recorded by the systems was therefore of poor quality and the information in the different systems did not match. The impact of this poor-quality input had become more significant with the development of the interfaces between the systems. In certain cases, the correction of a mistake could take many hours of work by technical experts in tracing the origin of the error.

The strategy of open systems also included the development of telecommunications infrastructure, based on a nationwide X.25 data communications network, called Pemex PAQ. The LAN standard was Ethernet and Novell, with integrated services facilities such as the network file system.

In 1991, the company undertook an organizational restructuring program that changed the traditional way of operating, from one in which directorates were responsible for activities defined by functions to a structure of divisions whose responsibilities were defined by business lines. The *Gerencia Institucional de Informática* kept the same name, but it was decentralized: its equipment and human resources were split among the informatics areas of the different work centres across the country. The head of the *Gerencia Institucional de Informática* was unable to cope with this change, which represented a loss of power in the opinion of some of the interviewees. Its new head was an accountant from outside Pemex with experience in the financial sector.

The technical staff interviewed suggested that this new manager invested a lot of effort in projects to promote his personal image, and neglected the real needs of the informatics function. For example, he twice organized the oil industry's information technology national seminar. The technical staff interviewed generally felt that the style of the new manager caused a lot of problems with the users of information systems. He had difficulties coping with the attitude of the oil workers, and the negative consequences of his disagreements had long-lasting effects. His most positive contribution was that he carried on the project to install an optical fibre wide area network. During his period in office (1991-92), he transferred 80% of all the resources of the *Gerencia Institucional de Informática* to the informatics centres of the divisions and to those of the production centres.

The people who had worked in the *Gerencia Institucional de Informática* readily understood the reasons for the organizational change from under-directorates and functions to divisions and products. They also welcomed the new structure because they knew that Pemex had an excess of human resources, even if its accounting balance didn't show red numbers. In 1991, the *Petroleum Intelligence Weekly* (1991) ranked Pemex among the 50 largest oil companies in the world, based on a number of indicators that clearly showed the organization's over-staffing (see table 6.2).

Table 6.2: Pemex's Ranking Against the World's 50 Largest Oil Companies, 1991

Indicator	Rank
Liquid reserves	7
Liquid output	3
Revenues	14
Employees	1

Source: *Petroleum Intelligence Weekly* (1991)

The staff who had been responsible for the corporate systems knew that the organization had been unable to determine the costs of its technical and administrative processes. Whenever there was an audit, it was impossible to identify the lines of responsibility. Every manager was responsible for many things and, at the same time, for none. "No organization can be efficient if the responsibilities are not properly defined," was the view expressed by one of the senior managers interviewed.

The *Gerencia Institucional de Informática* officially kept responsibility for the corporate information systems; it also controlled information technology procurements and information consolidation. However, the results actually achieved by these systems were nobody's responsibility, neither the *Gerencia Institucional de Informática's* nor the users'. The personnel of the different departments who co-ordinated activities within the *Gerencia Institucional de Informática* considered that their work was based upon the *dictum* that they were providing service to the users. In reality, however, it was the informatics specialists who defined everything.

In 1992, the head of the *Gerencia Institucional de Informática* hired Arthur D. Little to define the internal *normatividad* regulations for the "informatics function". The consultancy's proposal outlined the need for a broader "internal regulation framework", which had to be defined by the participation of, and negotiation with, all parties involved. It developed a 'Model of Internal Regulations' whose key principle was that all the informatics activities should be co-ordinated by an informatics plan. Arthur D. Little also developed such a plan and intended it to become a master strategic document, but it seemed to some of the staff interviewed that it ended up being yet another a bureaucratic document needed just to fulfil central government requirements, as had the previous plan.

6.4.3 1992-1997: Pemex's Split and the Emergence of *Unidad Corporativa de Sistemas Financieros*

When Pemex was split into a corporate group and four subsidiaries in 1992, the organizational restructuring process did not involve a study of either the impact of this change on the information systems of the corporation or of the feasibility of the split in terms of information systems functionality. It was a political decision that had to be carried out, stated a senior information technology manager. However, consideration was given to how the integrity of the data could be assured during the period of transition. The personnel of the *Gerencia Institucional de Informática* were not called on to participate in the process of planning the restructuring; they were told only to implement the plan, which they did by working with personnel from other areas of the organization in "transition groups".

The split of the information systems resources was carried out by an information technology transition group. One information technology senior manager who participated in this group was interviewed. He noted that the group was responsible for the informatics function in terms of defining the outcome, not for how it was going to be achieved. The group had to divide up the assets and human resources through a process that was meant to be negotiated. In reality, however, all the decisions about those allocations had already been broadly defined by the staff of the Planning Under-directorate who were leading the whole process of restructuring, through the group called COLIBRI. Managers of the *Gerencia Institucional de Informática* received orders about what to do, as was the case for the other areas. One of the outcomes of this process was that the *Gerencia de Telecomunicaciones* became an

independent company with the task of providing telecommunications services for the Pemex group (Mexicanos. 1992b).

The process of transition was difficult in terms of negotiating the detailed distribution of resources between the subsidiaries and the corporate group. The technical staff did not have clear guidance as to the objectives of the restructuring processes. There was no marketing of the change project, the information technology staff did not display any confidence in the organizational split, and there was no consensus about it. Nobody wanted to give up resources. When the decision was finally taken, the resources were given to the new informatics centres of the subsidiaries, and 90 staff of the *Gerencia Institucional de Informática* were made redundant. Many of them were rehired by the new subsidiaries after having received their statutory compensation from the 'old Pemex'. The transition group included staff from the *Gerencia Institucional de Informática*, the Ministry of Comptrollership, and the subsidiaries; all the processes were carried out with strict compliance to legal and formal requirements.

As explained by technical staff, the transition group gave a copy of the corporate systems to each subsidiary. The six corporate systems did not hamper the process of change because their structure allowed portability. They were designed to operate at various organizational levels, from headquarters to regional offices and local work centres. The new subsidiaries were autonomous and each informatics unit went its own way, which led to the corporate standards being lost. In practice, the systems continued to operate as usual, but the informatics units of each subsidiary became responsible for their management, and the levels of consolidation of the accounts were modified. The personnel who had previously worked for the *Gerencia Institucional de Informática* and later became part of the informatics units of the subsidiaries adopted a very aggressive attitude towards the corporate systems and the authority of the centre.

After the transition, an old enemy of the corporate systems – the chemical engineer who had headed the industrial transformation informatics centre – became a defender of these systems. His opinion was that the adoption of standardized systems by the subsidiaries was the only way to prevent chaos and that "not having the possibility of developing new solutions, it is better to use the one at hand". Nevertheless, his personal differences with the central authorities remained when he was appointed head of the informatics unit of the subsidiary

Pemex Refinación. During the period of transition, he recalled during an interview that, "I used the corporate systems with discipline but later worked to improve them."

With the split of Pemex, the *Gerencia Institucional de Informática* became the *Unidad Corporativa de Sistemas Financieros* (Financial Systems Corporate Unit), located in the Corporate Finance Division. This change represented a loss of status for the informatics unit; its new name meant to indicate that its function had become exclusively related to the financial information systems operations of the corporate group, implying a loss of hierarchical power within the organizational structure.

An engineer with a long professional career in the company was appointed as head of the *Unidad Corporativa de Sistemas Financieros.* Officially, (Mexicanos 1993b) its main responsibilities came to be the planning and definition of regulations and technical standards. The corporate information technology policy was aligned with the national information technology policy and required the development of an information technology plan from each of the subsidiaries. Pre-eminence was given to the definition of equipment procurement rather than to systems development. The subsidiaries were given the freedom to choose the methodology or tools with which they want to develop their own systems. In summary, the key responsibilities of *Unidad Corporativa de Sistemas Financieros* were to:

- maintain the institutional financial systems (this was meant to be a transitional responsibility);
- consolidate the accounts of the subsidiaries;
- process the financial information of the corporate group;
- provide company information to the central government; and
- regulate the informatics function of the whole organization, a responsibility split between the Finance Corporate Division and the Administration Corporate Division.

The corporate systems were kept in operation by each subsidiary and would continue to be in use until both the subsidiaries and the corporate group implemented new corporate systems, which they started to develop some years later. On paper, the computer equipment was allocated officially to the new companies. Physically, the mainframes stayed in the same premises as before, but each belonged to the owner of the corporate system operated on that

computer. For example, the corporate payroll system was under the jurisdiction of the Administration Corporate Division but ran on Burroughs equipment located in the information technology centre belonging to the Finance Corporate Division.

Some of the technical staff interviewed suggested that the reduction of information technology personnel was done without a proper evaluation of the needs of each subsidiary and the resources available. The informatics groups of the subsidiaries were unable to cope with their users' demands. Technical staff from the corporate group noted during the interviews that the technical staff of the subsidiaries initially refused to ask for help from their colleagues in the *Unidad Corporativa de Sistemas Financieros*, but they frequently ended up taking their advice because these colleagues had experience in operating the systems and fulfilling the central authorities' requirements.

Later, the *Unidad Corporativa de Sistemas Financieros* defined a corporate strategy for the development of the corporate financial systems that they called *Sistema Institucional Integral de Finanzas* (Integrated Institutional Financial System). This strategy aimed at developing a holistic information system for all the financial functions of the whole organization, with integrated connections between the different corporate systems. The strategy was redefined several times in trying to prevent it becoming too restrictive. The two basic principles of this strategy, as stated by a manager from the *Unidad Corporativa de Sistemas Financieros* during an interview, were: firstly, that information should be input directly at the place where it was generated; and, secondly, that every system should work as an island connected by flows of information. The quality of the data would be assured by validation procedures at the interfaces. The aim was also to provide access to data that was, synchronized to be simultaneously available (almost online). In addition, a long-term goal was to create a new standardized and regulated corporate database using data coming directly from the operations. This strategy represented an evolution of the old corporate systems, but it was not carried out because, as explained later in this section, Pemex chose to buy a commercial software package instead of developing its new corporate systems in-house.

The technical people of the *Unidad Corporativa de Sistemas Financieros* who were interviewed said they did not want to throw away all their past work, so would have preferred to have built the new systems in-house as this would have represented a process of developing expertise in the organization. They accepted that the corporate systems needed to

be redefined to respond to the new conditions and to take advantage of the potential offered by state-of-the-art technology. The corporate systems were designed to match requirements analyses undertaken many years before, in very different circumstances to those faced at that time. "In some cases, the corporate systems became white elephants with many parts that were never used," was one comment. These technical staff pointed out that even if the strategy of the *Sistema Institucional Integral de Finanzas* prevailed, the new systems would be very difficult to manage and maintain because of the interconnections between them – although it might become possible to develop new systems very rapidly.

After the split of the company, the *Unidad Corporativa de Sistemas Financieros* continued to develop systems as they had in the past, using the state-of-the-art technology and trying to make the operations of the organization more efficient. Among these systems was a 'one-stop front desk' project for third-party suppliers and contractors, which aimed to use touch-screen interfaces to provide information to the companies that supplied products or services to Pemex, and thus to facilitate the relations with these third parties. From the first contact with this system, a supplier would be able to find out the necessary legal and administrative requirements and the financial feasibility of a transaction. The system would provide a reference number for the transaction to allow the company to track the state of the deal. The system was intended to put an end to the chaotic situation that third-party companies had to face when selling services to Pemex. Managers from companies dealing with Pemex explained in interviews that the contractors usually had to follow as best they could the complex progress of their business through all the departments of Pemex. This tortuous procedure sometimes delayed payments for months and was linked to vested interests. When the 'one-stop' system was made operational, some third-party companies were impressed but many still complained of problems with their payments. The representative of a contractor said, in a corridor chat, that their relations with Pemex were too complex to be solved by such a system.

One of the main political statements made by the central authorities during the process of organizational restructuring was that it was a corporate group priority to develop reliable information systems. Each subsidiary started to develop its own, mostly autonomous, computer-based information systems, although certain corporate systems were kept in operation with centralized version control. Most of subsidiaries contracted the services of

consultants for the development of systems. For instance, *Pemex Petroquímica Secundaria* bought an Oracle financial package that was implemented with the help of consultants.

With the transition, many functions and responsibilities were moved out of the hands of the organizational entities that used to have them. The Administration Corporate Division fought to keep control over the definition of corporate informatics policy, against the Finance Corporate Division that had previously had responsibility for it. According to the goals of the restructuring process stated in an official document (Mexicanos. 1992b) (Mexicanos. 1992a), the informatics policy of the new organization had to be decentralized. Each corporate division and subsidiary company therefore had its own information technology unit. The new role of a corporate informatics policy was not clear. In the end, the Finance Corporate Division kept this responsibility because of its traditional reputation for tight control and its engineering perspective. Changing this image had not been an easy task, because the same people held the leading posts. The introduction of new practices and ways of thinking towards systems was not something that could be done just by a change of the official rhetoric.

The Corporate Group had aimed at regulating the activities of the four independent subsidiaries, but one of the official aims of the restructuring was to provide autonomy of decision making at the level of operations, as stated in the official document that describes the organizational restructuring strategy (Mexicanos. 1992a). The *Unidad Corporativa de Sistemas Financieros* tried to define corporate informatics policy using a participative approach, according to the head of this unit. It tried several times to organize meetings with people from the subsidiaries to define a common informatics policy, but staff of the subsidiaries did not attend the meetings. They did not trust the *Unidad Corporativa de Sistemas Financieros*, according to technical staff interviewed, because of its tradition of control and centralization.

The subsidiaries acquired freedom and, in the new operating conditions, nothing forced them to compromise with the corporate authority. Nevertheless, as already mentioned, when the subsidiaries faced problems they contacted staff of the *Unidad Corporativa de Sistemas Financieros* for help. The technical staff noted during interviews that even with the fruitless meetings to promote the participation of the subsidiaries, the *Unidad Corporativa de Sistemas Financieros* continued to lobby to keep its role of defining the central policy

because this was considered to be important in ensuring harmonious development of the information systems of the corporate group. The *Unidad Corporativa de Sistemas Financieros* had three departments, as shown in figure 6.12.

Figure 6.12: Organizational Structure of *Unidad Corporativa de Sistemas Financieros*
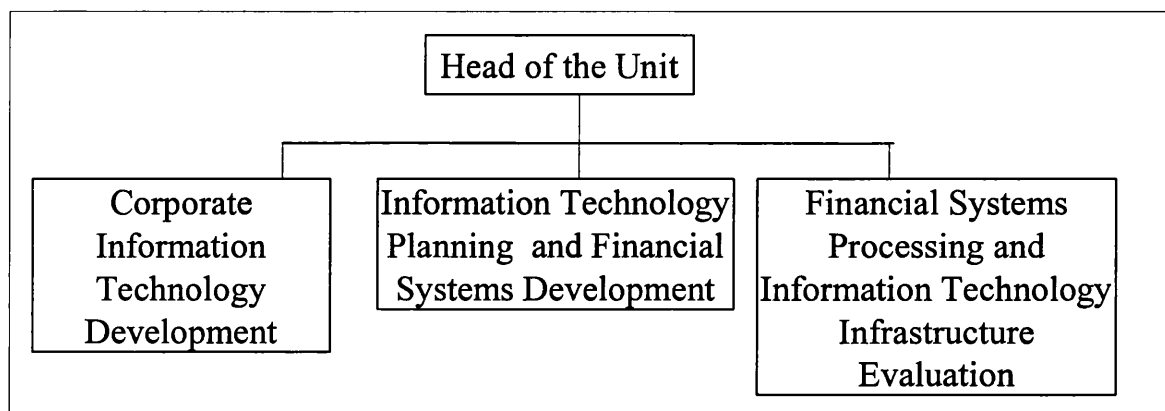
Source: Pemex

Until 1994, the *Unidad Corporativa de Sistemas Financieros* officially held the responsibility for defining the organizational informatics policy, endorsed by a letter signed by the General Director of the corporate group. The unit's name was changed in 1993 to *Unidad Corporativa de Informática y Sistemas Financieros* (Informatics and Financial Systems Corporate Unit) to indicate that it had kept the responsibility of the informatics policy and to reflect its organizational status.

In 1993, the *Unidad Corporativa de Informática y Sistemas Financieros* readopted the strategy of developing an integrated corporate financial information system, but with the new name *Sistema Integral de Información Financiera* (Integrated Financial Information System). Its conceptual plan as defined by the head of the Unit is shown in figure 6.13. By this time, the unit's leader recognized that the effort of such a project should be centred in the negotiation of flows of information and not in information systems development regulations. Such a system still worked on the basis of interconnecting the various independent financial systems. The *Unidad Corporativa de Informática y Sistemas Financieros* faced opposition from other informatics areas, both those of the subsidiaries and those of the other Corporate Divisions; it was not clear to them what strategy was demanded from them.

Figure 6.13: Conceptual Diagram of the Financial Integrated Information System

Electronic Flow of Data

Corporate Systems
by Function
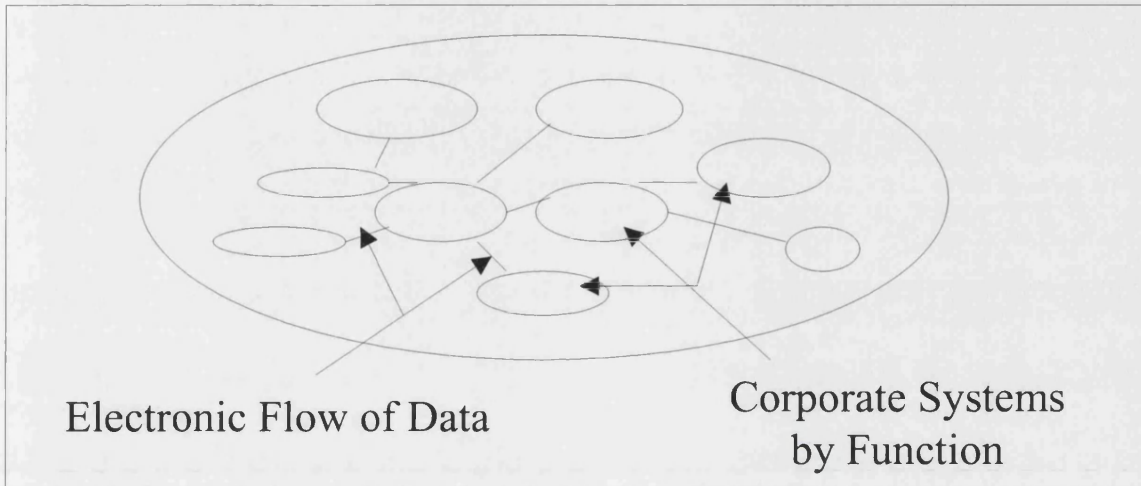
6.4.4 Information Systems at Pemex Subsidiaries

When the subsidiary companies were created out of the splitting up of Pemex, the organizational structure of each included an informatics unit. This created a problem of 'reinventing the wheel' because each subsidiary had to learn about the needs of information systems developments in its own way, and paid the cost of this learning process. They also went through an experience similar to that of the informatics unit of the old Pemex: the struggle between centralization and decentralization of information systems management and the need to understand a culture of service towards the users. A technical expert expressed this by saying that, with the split, "it was as if Pemex had lost its memory of all the organizational informatics knowledge accumulated in the past". These aspects can be seen as a cost that had to be paid for the organizational restructuring of the company.

From the point of view of the corporate group, the informatics areas of the subsidiaries lacked leadership and knowledge of methodologies. The corporate systems were kept operating, but each subsidiary had to solve its specific needs as best it could. Some kept the versions developed by the *Unidad Corporativa de Informática y Sistemas Financieros*; some did their own maintenance; and, in some cases, the whole system was redeveloped following the

structure of the original corporate system. In addition, there were instances where subsidiaries solved their needs with a totally different system.

From the point of view of the technical staff of the subsidiaries, the corporate group was trying to defend its *raison d'être* and its area of power, because the new style of management introduced with the split entitled the subsidiaries to define their own internal information technology practices and policies. Some of the heads of the informatics units of the subsidiaries gained considerable power. In others, such as *Pemex Gas y Petroquímica Básica,* the informatics unit underwent a period of continuous changes of top manager.

Pemex Refinación adopted the corporate systems for the transition period, then developed new systems with an engineering perspective using a top down approach. The leader, as described in section 6.4.2, was a key player in the informatics world of the old Pemex who wanted to exhibit the supremacy of the technical quality of his systems. One of the methods he employed to implement his systems was to threaten users with an audit of their areas if they did not use them. He maintained his personal rivalry with the *Unidad Corporativa de Informática y Sistemas Financieros* as he believed that the corporate function of co-ordination was the "corporate bottleneck". His rhetoric kept emphasizing that his areas had no other goal but that of satisfying users needs, through the slogan: "We provide services to those who we serve." In an interview, he said he had a marketing perspective in promoting the use of computer-based information systems and also mentioned his bad experiences with consultants. He saw consultants as being needed, but they had to be managed properly. He tried to establish quality control over consultancy companies by requiring specific professional qualifications for the personnel of the consultancy who participate in particular projects.

The last stage in the process of organizational change was the plan to modernize the information systems. The General Director of the corporate group, with the advice of internal technical experts and international consultants, looked for solutions for the development of integrated corporate systems and visited various international companies. This group decided to buy a package and evaluated the major integrated system products available in the market; that basically meant either SAP R/3 or Oracle Financial, which was already being implemented in *Pemex Petroquímica Secundaria.*

The process of implementation of the selected package was headed by consultants and faced many problems. Personnel who had been involved in this process said in interviews that the system had not been able to operate, although most of the deliverables specified in the work programme had been completed. One noted that the top managers of the corporate group "did not want to get hooked up with this package, just because one of the subsidiaries had it". It is important to note that this subsidiary, *Pemex Petroquímica Secundaria,* would eventually be privatized.

The top leader of the corporate group discarded the alternative of developing the institutional systems in-house on the grounds that this "would be too time consuming". It made more sense to the group to modify the mechanics of the organization to make it work according to the logic of proven efficient 'best business processes', rather than trying to modify the old inefficient corporate systems. They did not consider whether these 'best business practices' might not necessarily fulfil government regulations, or the cost of adapting the systems to comply with them.

The process of evaluating the two possible software packages was carried out with the participation of technical experts and users from the whole corporate group. There was a presentation of the packages in a conference room with three computers for hands-on demonstrations. Some technical experts and users said they had very little opportunity to appreciate the functional capabilities of the software. The experts and users had to complete a questionnaire to record, in a structured way, their personal evaluations of the packages. The survey results "massively favoured" recalled the head of the *Unidad Corporativa de Sistemas Financieros* SAP R/3[67], an Enterprise Resource Planning (ERP) software package with an integrated perspective of business processes and a good reputation for being used successfully by many of the largest organizations in the world, among them the major world oil companies.

---

[67] The R/3 package was developed by the German company SAP AG. It is an integrated system that automates within one database the flows of information of a company, using processes that cross functional divisions. The package comprises different modules to manage the various functions of the organization. The implementation of such a package generally requires organizational changes to accommodate the flow structures defined in the software. The package has been widely used by major organizations throughout the world, and much has been written about both its successes and the difficulties involved in its implementation (Davenport 1998).

A technical expert with long professional experience in Pemex suggested that the SAP R/3 project came as a "solution looking for a problem". The organization did not undertake an analysis of the condition of its information systems; in his opinion, such an analysis would have allowed Pemex to organize its investment in information systems to give priority to the areas that lacked computer-based information systems and where there was a desperate needed for them.

The corporate group gave the formal right of choice to the subsidiaries, but emphasized the convenience of SAP R/3 because the exchange of information among them could be facilitated by having standard packages. *Pemex Refinación, Pemex Exploración y Producción,* and *Pemex Gas y Petroquímica Básica* agreed to adopt SAP R/3. The licence negotiations carried out by the corporate group became a very tortuous process that almost failed because the local SAP representatives did not want to accept Pemex's conditions. In the end, they were able to strike a deal thanks to the intervention of SAP's international head office. The corporate group and each subsidiary followed 'their own way' of implementing the package. SAP Mexico advised Pemex that the implementation of the package should preferably be carried out by international consultancies certified by them. The corporate group and the subsidiaries of Pemex followed this advice and chose companies through public tender: IBM for the corporate level; Arthur Andersen for *Pemex Exploración y Producció;* Ernst & Young for *Pemex Gas y Petroquímica Básica;* and KPMG for *Pemex Refinación..*

The financial module of SAP R/3 was eventually implemented by all subsidiaries; according to a technical expert this was paradoxical because the financial area was where "good, bad or with problems, at least there was a corporate systems in operation". He noted that the choice of this module for implementation throughout the company could be explained because the sponsors of the systems came from the financial area of each of the subsidiaries.

The head of the *Unidad Corporativa de Informática y Sistemas* was the project leader who started the implementation in the corporate group of SAP R/3 with only the financial module. He carried out this project with an internal group of senior technical experts. The project had many difficulties with the consultancy company that was chosen through public tender, as there was a high turnover of consultants – including even the leader of the project. The Pemex team started the implementation with an almost exclusively engineering perspective

based on process analysis. This technical perspective soon proved inadequate because it did not manage the social aspects of the project. The corporate group hired another international consultancy to carry out the management of change in the corporate group associated with the implementation of SAP R/3. This new project worked with almost no co-ordination with the consultants implementing the package. It was a separate project addressing communication, cultural management, and training. During the SAP implementation project, the participating Pemex experts complained that the consultancy company sent very young analysts with no work experience to do the actual work. Thus, it was the Pemex experts who finished the job, including having to check the spelling of the documentation.

The implementation of the financial module very soon showed signs of falling behind schedule. The module was officially put into operation in January 1997, more than six months late. The first financial closing results generated by the systems were issued on February 12, 1997. Some of the personnel interviewed suggested, in a critical tone, that SAP R/3 had been reshaped to become the *Sistema Integral de Información Financiera*. The remark meant that the organization failed to take the opportunity to restructure its operations in line with the 'best international business practices'; instead, it modified the software to adapt it to the Pemex style of operations. After the implementation of SAP R/3, the corporate group launched a new project to match budget and accountancy data, a task that the SAP R/3 project was not able to fulfil. Further research, utilizing the benefits of hindsight, will need to be carried out to be able to identify the features of the new organizational system created by the implementation of SAP R/3.

In relation to the organizational impact of SAP R/3, the leader of the Pemex corporate group insisted that the personnel made redundant by the implementation of the package would be redirected to analysis activities. There was neither a clear definition of this new responsibility and the skills required, nor whether those made redundant were qualified for these new tasks.

A senior corporate manager suggested that, with the passage of time, it could now be seen that it would have been better if they had first carried out a reorganization, and only then undertook the implementation of SAP R/3. But it was not done that way, so they had to adjust the organization to the architectural logic of the package. In his view, the most difficult aspect of the implementation was human resources. The workers had no belief in the

project because of their previous bad experiences of information system implementations. There was also the fear that SAP R/3 would cause massive redundancy. The oil workers shared with the researcher in informal chats the new definition that they had created for the acronym 'SAP': *Salida Automática de Petroleros*, which means the automatic sacking of oil workers. This reflected their belief that the use of the package in the organization would bring immediate redundancies. The authorities tried to send the message that SAP R/3 was a corporate project "with no way back and which, in the end, will prove to be useful to everybody", according to one executive. He also noted that some managers from the operations areas had already started to use the information provided by the system for their decision making. During the interview, he stated: "We have won many battles although we cannot say that we have won the war."

The *Pemex Exploración y Producción, Pemex Gas y Petroquímica Básica*, and *Pemex Refinación* subsidiaries each implemented different SAP R/3 modules, but all included at least the finance module. The sponsors of the projects in these three companies also all came from financial areas. They started the process of implementation in the early months of 1997 and were to be finished by the middle of 1998.. Every subsidiary made its own choice of how to implement SAP R/3 and decided which modules to adopt, which geographical areas to include, and the strategy for carrying out the project.

In the three subsidiaries, the selection of the consultancy companies was undertaken through public tenders, but taking into account the experience of the corporate group. The tender specifications were very detailed as to what was expected from the consultants selected. These specifications included profiles of the required previous experience, work programmes, commitment to avoid changing project managers and technical experts, and methodologies of process analysis. The first months of implementation proved that, while most of the consultancy companies were professional at presenting all the requirements asked for in the tender documents, when the work was actually carried out they used their own methods and style of implementation. They were carried out almost exclusively from an engineering perspective, even though the tender specified the need to address the social and political aspects of the systems. The definition of the parametrization requirements was done through the use of standard templates, not by an analysis of Pemex's processes.

The corporate authorities established a committee that met monthly to bring together the leaders of all the projects implementing SAP R/3, to share their experiences. The technical staff considered that the leaders could not disclose problems freely in these meetings because of the political impact it would have on their careers. Senior staff from the corporate group had the view that the best implementation process had been that of *Pemex Gas y Petroquímica* because of the relatively small size of the company [68]. The leader of this project also had a good reputation among the technical experts as somebody with systems implementation experience in the old organization.

A corporate executive considered that if the Pemex group were to have reliable information systems, the company would be in a better position to strike a credible deal with the central government authorities. The control of operations would then be made possible by the capacity to measure and evaluate activities through reliable data. It would break the vicious cycle of the budget negotiation in which authorities always gave less than Pemex demanded, while the company always asked for more resources that it needed – because Pemex knew that the government would give it less as the central authorities realized these needs were based on unreliable information.

The availability of more reliable data would also allow Pemex to define an investment plan through a robust financial analysis of profitability and well-documented feasibility studies and comprehensive engineering studies. Achievements were made in this process of change; for example, a corporate executive considered that Pemex was able by 1996 to negotiate the budget with the central government within an "acceptable economic logic".

The above description followed the development of the financial administrative information systems in Pemex. Chapter 7, which deals with the content of change, also includes a description of the use of information systems in other areas of the organization because this is relevant to the overall analysis of the outcome of the process of change of the organization.

---

[68]By 1993, according to data provided during an interview by an engineer who worked in the informatics unit of one of the subsidiaries *Pemex Exploración y Producción* had around 120,000 employees and *Pemex Gas y Petroquímica Básica* only 13,000.

7 NON-MAINSTREAM INFORMATION SYSTEMS DEVELOPMENT EFFORTS IN PEMEX

This chapter describes the company's development of information systems other than the mainstream ones discussed in earlier chapters. Three streams of information systems development at Pemex other than its mainstream ones were identified by the research for this thesis as being relevant to the analysis of the case study because they provide important information for understanding the content of change that has taken place in Pemex:

> - technical systems related to data collection from the operational areas;
> - strategic information systems; and
> - various efforts to develop strategic executive information systems for the General Directors.

7.1 TECHNICAL INFORMATION SYSTEMS

Pemex's technical information systems are related to the operations in its various plants. Previously, these tasks were mostly carried out manually by oil workers who used *ad hoc* procedures to check the data required, such as the levels of substances in tanks. During interviews for this study, workers described how they could employ simple methods for measurements, for instance using a stick or even hitting the tanks to calculate the level by sound and then enter the data onto paper forms. Later, such data was given by telephone to the offices where it was processed, in order to calculate the quantities of the different substances.

Until early 1990s, tanks and pipelines did not include proper measuring devices. Calculating these volumes was complex because the tanks held varying substances and the pipes could be used for different types of liquids. The large number of possible variables meant that these calculations involved mathematical functions with indefinite solutions. The balance of volumes for the different substances were figured out by expert analysts, called *balanceros*, who provided a type of human 'intelligent interface'; when they identified inconsistencies in the data, they would call back the work centre to ask the operators to check the data they had sent. A technical middle manager explained that they usually ended up *"cuchareando"*[69] ('adding and subtracting as needed') to make the data match.

---

[69] The literal translation is putting and taking spoons.

The data processed by the *balanceros* was given by telephone to the administrative office, where it was usually validated by other analysts. These analysts were typically engineers with many years of working experience in the company. They performed the role of a second human 'intelligent interface'. The data that was processed was then input into the financial systems. The practice of adding and subtracting as needed to achieve the desired figures was also related to the fulfilment of the goals defined by the central government. It was the responsibility of the managers to achieve these production goals, which they did to safeguard their political image – even when that required modifying figures when necessary.

The posts of the *balanceros* began to disappear with the introduction of proper instruments to measure tanks and pipe flows, which made their expertise unnecessary. The introduction of these instruments had not been an easy process. It had needed strong political support from managers because, as explained by a technical middle manager, it required: major investments; the definition of organizational responsibilities at the different points of the operations; and a specification of the unique catalogue of substances and product equivalents. The instruments were introduced gradually, as the installation of any new measuring devices[70] reduced the degree of discretion of, and the scope for, any intervention by the *balanceros*. However, in this middle manager's opinion, there is still more work to be done to achieve proper control of the operations.

7.2 STRATEGIC INFORMATION SYSTEM

One major computer-based information system not related to the mainstream informatics function was the institutional database created in 1980, during Jorge Diaz Serrano's administration. This is of particular relevance because it came to be a key strategic system for the organizational change of the company. It was first developed to solve Pemex's public image problem caused, in part, from the inconsistency of the data provided to the central government and the media by the different areas of Pemex. The incompatibility of the figures was exacerbated by the chaotic situation brought about by the oil boom, and by the lack of appropriate definitions and standards of the information in the organization at that time.

---

[70] The first measurement devices were pneumatic the automatic distributed control systems were introduced after the split of the company in the 1990s.

In 1980, the General Director created the Basic Information Unit with the responsibility for compiling and presenting a single credible version of Pemex's operations (see table 5.1 to locate this event in the context of other developments at the time). This Unit started to develop a database and to publish a monthly Basic Information Report which contained information from the different work centres and organizational functional entities. A middle manager involved in the operation of the database said these reports were produced from the daily flows of information delivered by phone. The figures were processed to provide monthly statements of operations for the General Director. However, a number of problems arose with this system, such as: data was inconsistent; figures related mainly to levels of production, with no financial evaluation of the processes and operations; the database resided on a mainframe, but due to technical restrictions it was difficult to access the data; the system had a very tortuous interface; and the users depended on technical staff to access data.

Years later, under the administration of Francisco Rojas who was appointed in 1987, the Basic Information Unit was located within the Under-directorate of Planning and Co-ordination, where it was given broader functions and renamed the Evaluation and Information Office. Rojas' administration had a strong commitment to financial control of the operations of the company, which generated new information demands in terms of both the quantity and quality of data. The General Director gave the Evaluation and Information Office the power and responsibility for the institutional database, which stored and processed information from:

- technical operations;
- budgets[71];
- sales; and
- production.

The mission of the Evaluation and Information Office continued to be the integration of a single overview of the operations of the company and the provision of data for evaluation and analysis. This Office kept the responsibility of publishing the monthly Institutional Report, which contained detailed indicators of the levels of production. It also dealt with the

---

[71] It includes information from the *Programa Operativo Annual*.

information that had to be delivered to five ministries of the central government: Energy, Treasury, Budget, Commerce, and Comptrollership.

By 1988, the database had to provide reliable data that would enable an in-depth economic analysis of operations. The new activities of financial evaluation provoked the need to improve the accessibility, quality, and quantity of information in the database. However, this new analysis was impeded by the inconsistency and inadequacy of the data. A middle manager interviewed stated that more detailed data was needed for the preparation of the company's profit-and-loss statements and to analyse the performance of the different organizational units. Figure 7.1, based on an explanation by the former head of the Evaluation and Information Office, shows a functional diagram of the strategic information system at Pemex which highlights the nature of the problem about a lack of accurate and timely data that prevented a proper analysis and evaluation of Pemex's operations.

Figure 7.1: Functional Diagram of Strategic Information System at Pemex in 1993
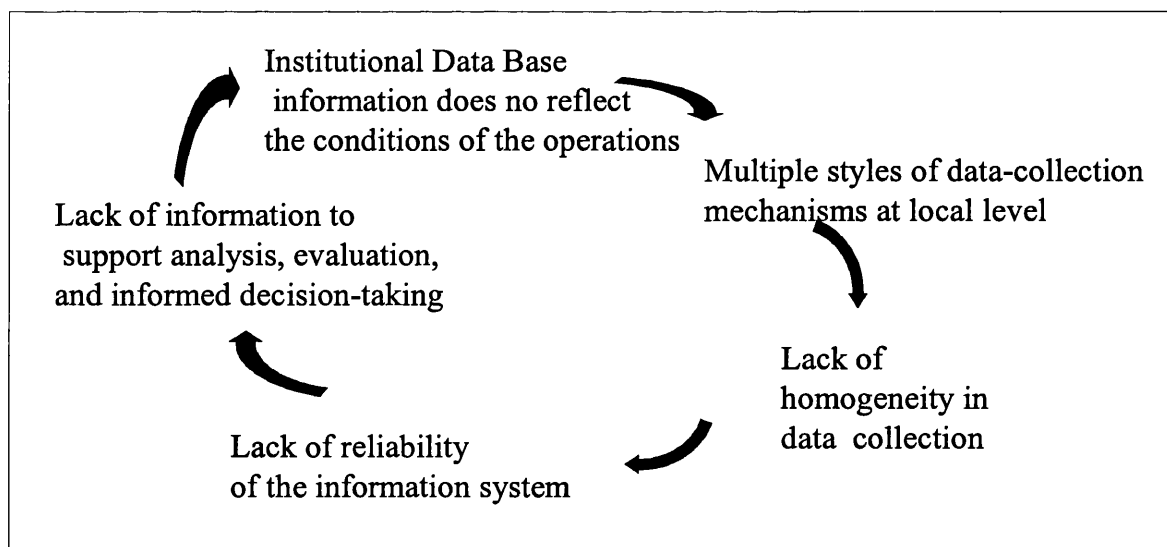
Source: Interview for this study with a former head of Pemex's Evaluation and Information Office

To meet the new financial evaluation needs, the database had to meet new information requirements related to: levels of production; expenditure; distribution of production; asset depreciation; and the introduction of costing in line with international oil market pricing. To facilitate access, the database was migrated to a networked microcomputer. Validation of the data became a priority because the fundamental goal of the database managers was data quality assurance. In the organizational context of Pemex, this was a very difficult task to

achieve in the short-term (see table 5.1 to locate this event in the context of other developments at the time).

A new manager appointed as head of the Evaluation and Information Office had qualifications in engineering and operational research, as well as a long professional career in Pemex. He had a clear understanding of information technology as a tool and appreciated the importance of the quality of information in supporting planning, evaluation, and reporting activities. He solved the problem of data validation by defining another human 'intelligent interface' between the provider of the data and the recipient who input it into the database. Each flow of information was politically negotiated with each area at an individual level, so the rules of the flow of data and the responsibilities of the parties were clearly defined. The new manager used to his advantage the organizational feature of tight control of local areas over information. Figure 7.2 shows the way the data flows and validation were structured, based on description provided to the researcher by the manager who once headed this unit.

Figure 7.2: Institutional Database: Data Flows and Validation Processes
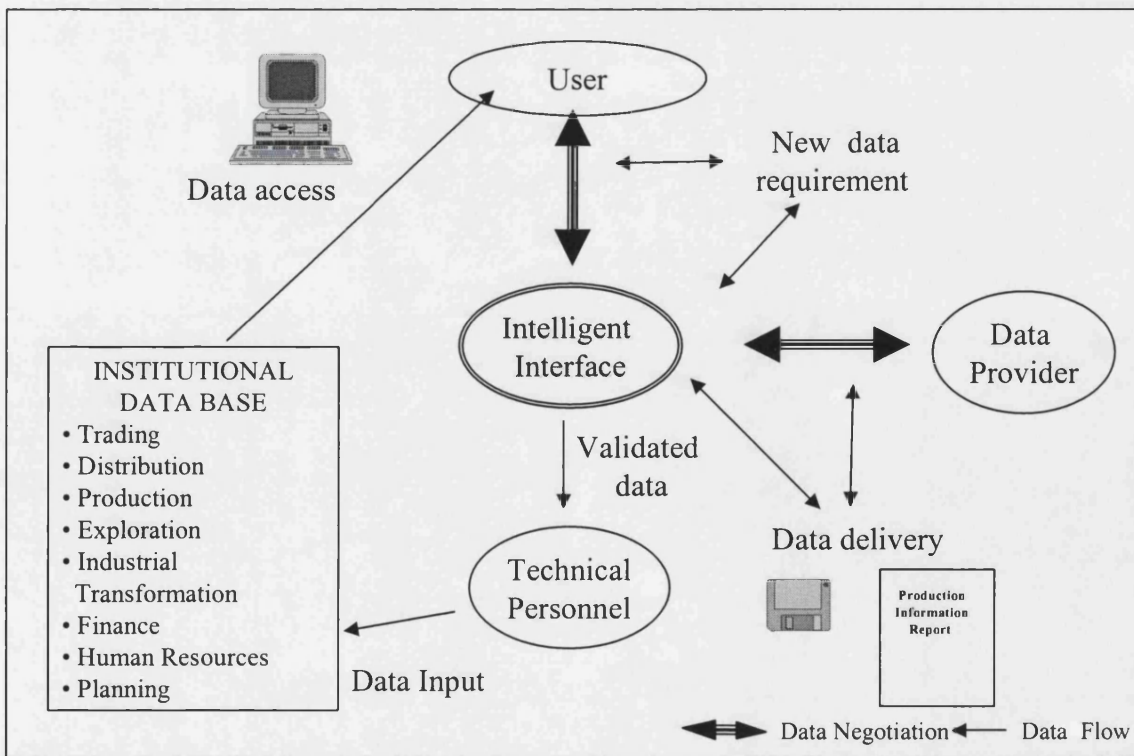

Source: Interview for this study with a former head of Pemex's Evaluation and Information Office

198

The Evaluation and Information Office regarded the structure of the existing corporate systems as too restrictive and inflexible. The new manager emphasized that, as in any organization, goals have to be fulfilled at Pemex; but trying to build a reliable database through the development of an integrated system would have been an impossible task within the organizational context that prevailed in the company at the time. The manager was an oil worker with long experience in the company. This gave him a good knowledge of Pemex's organizational culture and power structures, which were based on the local control of the flows of information. This explains why his strategy focused on the negotiation of flows of information, not on developing a new system. He also migrated the database to an end-user computer platform to facilitate both data access and the ability to manipulate its information for analysis and evaluation purposes. (Subdirección de Planeación y Coordinación 1992).

The information provided by the database was a key element in the organizational restructuring. It was the main source of data for evaluation and analysis which could support and justify the changes proposed. From this perspective, the institutional database could be seen as a strategic system. The analysis of reliable data clearly highlighted the actual inefficiencies in the company that confirmed previous speculations. This information provided a source of power for the authorities in the negotiations to move forward with the process of restructuring the company.

7.3 EXECUTIVE INFORMATION SYSTEMS: THE GENERAL DIRECTORS' PERSPECTIVE

As highlighted in section 4.3, the post of General Director in Pemex has had a political character. Presidents of Mexico have made the appointments, and General Directors have usually been replaced every six years following the change of public administration. The General Director has to fulfil the mandate given to him by the President; to do so, he needs specific information to take decisions to reach this goal. During the field work for this thesis, the researcher had the opportunity to interview four ex-General Directors to understand how they met their information needs and their view of the changes the organization underwent during their periods in office.

Earlier chapters described the company's lack of formal information systems providing timely and reliable data on its operations. As each General Director came into the company, he had to find his own way to obtain the information he needed. The review of how each of

them made the necessary arrangements to build their executive information systems is done in this section by reconstructing information each of the General Directors provided in the interviews. This description of the events therefore reflect their points of view and the direct quotations in each section are from the General director for that period.

7.3.1 Jorge Díaz Serrano, 1976-1981

Jorge Díaz Serrano came into office as General Director without being a political figure; he had a reputation as a very successful oil sector entrepreneur and close friend of the President. He was given the mission to expand the company's oil production capabilities in order to take advantage of the extremely favourable conditions of the international oil market at the time. When he joined the organization, he felt he was an alien although he did have some friends in senior managerial posts in Pemex. He soon realized that, "the workers were conscious that they were the owners of the business". He discovered serious deficiencies in the flows of information about the operations of the company and its administrative functions, for example with delays of months and even years in closing financial statements. Pemex's administrative procedures were a mixture of the managerial styles of the two biggest foreign companies that had been nationalized in forming Pemex: El Aguila (Shell, Anglo-Dutch with a diplomatic style) and La Huasteca (Standard Oil, American with a direct style).

In order to understand the lack of information, it is necessary to consider the role of workers' resistance and the Union's power. Any attempt at trying to improve the recording of data, such as in the accountancy system, faced severe problems because of the extent of the power of the Union. Promotion was based on seniority and, naturally, the employees were getting older as the company developed and time passed. In the 1960s, the average age of the employees was over 40. Díaz Serrano believes this could explain the degree of opposition to the introduction of the IBM machines in those years. Even though the people responsible for computers took enormous efforts to modernize the information systems of the company, the problem of lack of reliable information persisted.

He had came into an organization where communications and the flows of information were between fiefdoms, and the General Director was not provided with adequate information. Clear clashes of power existed between: geologists and oil engineers; geophysicists and geologists; and the refinery engineers and petrochemical engineers. "Their fight, ultimately,

was to grasp as much as they could of the budget allocations." They all told the General Director that their area was the most important for the future of the company and that it had to be considered as a priority. "Not being an expert in all the areas, it was difficult for me to make the right decisions for the company," Díaz Serrano noted.

He was able to appoint people he wanted to the top managerial levels of his administration, and he picked older oil workers with a lot of experience as well as some friends with management experience. Even though they were all part of this team, they kept their information jealously within their individual domains. The informal flows of information were very powerful: they moved the organization. He considered that any person appointed as General Director of Pemex without the understanding of the oil business that he had would have faced a more difficult situation than he did, because the oil workers could easily play tricks and distort the facts of how the organization was operating. In order to produce and sell oil, he needed information. He said that he did not care how he obtained it, as long as he had it to do his job.

Díaz Serrano solved his needs for information by organizing daily early-morning meetings with his work team. During his period of administration, he never had breakfast at his home. The early-morning meetings he had with his senior managers discussed problems, settled arguments, identified information discrepancies between the operational areas, and co-ordinated activities and communication between the different units. They did not use memos, but made telephone calls to sort out any differences, there and then, by contacting work centres as necessary. After the meetings, they sent notes confirming the settlements.

He considered he had a privileged position as somebody who knew the business without being an expert in any particular area. He said this allowed him "to face, without emotion, the needs of all the areas of the business and motivate the organization towards a common goal: to achieve a massive development of the production facilities in a very short time". The formal information systems were not performing well at the time he was appointed General Director, but they fell even further behind in efficiency during his period in charge. Despite the availability of enormous resources and company investment in computers, the use of the technology encountered many problems and severe resistance.

Díaz Serrano needed very detailed information, without delay, to take advantage of the oil boom. He needed to have reliable information every day to answer questions like: "How much drilling equipment does the company have?", "What progress is being made by the exploration projects?", and "What was the level of oil production?". Every day at 7a.m., he phoned each of the main areas of operation to receive the information directly from the local managers, except for two areas: *refining* was controlled by programmed schedules of work; and activities in *petrochemicals* moved relatively slowly due to their complexity.

He evaluated the degree of progress by comparing the data he received by telephone with the milestones defined in the investment programmes. In the area of trading, clients had three months contracts, so he needed to know what the competitors were doing and the prices of the deals. He was also in frequent telephone communication with the governors of the estates where the oil activity was being developed, in order to settle problems. He received information about the political and economic events at national and international levels related to the oil industry. This was the "world of information" that he said he needed as General Director of Pemex at that time, and without which he could not negotiate. He commented that he obtained information from wherever he could, and if he could not get it then he invented it, "but the primary aim was to carry on the oil boom".

To assure the reliability of information, every Monday he travelled to the different regions in which construction or drilling projects were being developed. He chatted with the people doing the job and observed how things were going. His knowledge of the business meant the chats were meaningful and his observations pertinent. It was the way he checked that things were actually progressing. He said it was difficult to manage Pemex without going out of the office because that would have represented taking too high a risk. This implicitly accepted that he did not trust the information that was given to him.

As an oil expert, he realized that the known oil reserves of the country were low – so he focused on exploration projects. The rest of the cabinet wanted to receive detailed information about the investment programmes although "it was impossible that they could know everything". He could not divert the effort of experts towards fulfilling the central government information requirements. He therefore organized a group of technical and financial experts whose responsibility was to provide information to the central government; this information later came to form the Institutional Database. These experts did everything

manually; they had no computers, not even a fax machine. They used their expertise to evaluate the data they received from all areas of the company. It was a difficult task because they had to understand the business and how it was changing.

For example, previously a land-based well had cost $50,000 to drill, but drilling an offshore well could cost up to $500,000. Only an expert could understand and evaluate this information; the people from the central government found it extremely difficult to cope with such discrepancies. When Pemex asked for money for its investment programmes, the central authorities used to grant them half of the amount requested because they assumed that Pemex always asked for far more than what was needed. Knowing this, Pemex always asked for more than was needed so as to receive as much as possible; this became an embedded practice. It was a time of abundant resources and so, for him, there was a way out: if the central authorities did not give him the requested finances, he asked the President directly.

In Díaz Serrano's view, the company's results were impacted negatively when investment programmes were held back. This effect was dramatic in the case of the oil industry, where drilling a well with 24-hour-a-day operation involves enormous resources. The sooner the oil is extracted the better; delaying the start of operation of a well usually results in extremely high opportunity costs. Taking too much time in making decisions to allocate financial resources for operation, development, and maintenance in this context therefore had a serious negative impact on the capacity of the company to generate income.

The pressure on the General Director to push forward exploration and drilling projects was even greater because the market conditions then favoured the seller, and it was also known that such conditions would not last long. Pemex needed results in less than five years to profit from such a situation, so decisions couldn't wait and had to be taken in time to achieve the desired outcomes. For example, the shipping problem for which years later, the government prosecuted him and he was put in jail for several years (see section 6.2.1).

During the oil boom, Díaz Serrano was able to increase prices without consulting the President. When the market conditions changed, he still acted as he had done previously and adjusted the price of oil, decreasing it by $4 per barrel. By so doing, he ensured that Pemex's customers renewed their contracts. The cabinet criticized this change to the oil price on the grounds that he had taken an autocratic decision. He resigned and immediately the Ministry

of Energy increased the price by $2. Overnight, Pemex lost contracts for 1 million barrels per day. The company had to close the production of some oil wells and lost $10 billion in eight months. The members of the cabinet could not understand the change in the balance of supply and demand in the international oil market. It was the privileged position he had in handling all the relevant information about the national oil industry and the international energy sector that made him understand the need to reduce the oil price. He stated, to end the interview, that modern information systems are good and necessary as a tool, but only if people know how to use them and have the ability to understand information.

7.3.2   Julio Rodolfo Moctezuma Cid, 1981-1982

Julio Rodolfo Moctezuma Cid came into the top post at Pemex as a political figure, a close and loyal friend of the President, a man of "all his trust". He was given the mission to maximize oil sales because Pemex had started to lose its main clients rapidly. Other aspects of the business took lower priority. To fulfil his mission, he had to travel abroad endlessly throughout his administration. Mexican oil was difficult to sell in a glutted market because Pemex's main product was 'heavy' crude oil produced offshore and not suitable for the production of gasoline in standard refineries.

When he took office, Moctezuma Cid came to realize that the previous administration had developed an enormous oil production capacity, but not the necessary infrastructure of distribution, pipelines, and storage. The programme of investment to capitalize on the oil boom had been so ambitious that many drilling projects were developed simultaneously and all had to be finished. The central authorities believed that oil wells could be operated simply by closing and opening valves, which was not the case for Pemex. The physical pressure of the oil in the Mexican wells made it very difficult to shut them down or control them flexibly.

Under the previous administration Pemex, had changed in a few years from being a local oil company to one of the most important oil corporations in the world. The traditional information systems at Pemex, most of which were in-house developments, had not been able to cope with the new operating conditions. The main goal of the previous administration was producing oil, so the development of trading facilities and other administrative structures was left behind. The company did have computer-based information systems, but not the devices for inputting data, and the centres of operation did not have enough measuring instruments.

The data, opinions, and recommendations given to him by the oil experts were contradictory, including both pessimistic and optimistic views. There was an over-abundance of external information about the oil market, "information that was good and bad".

To handle this situation, he acted on two fronts. The first one had both a medium- and a long-term perspective. He created a project called 'control board' that aimed to present in one room all the relevant information, both internal and external, that the General Director needed to carry out his work. For that project, Pemex started to develop computer-based information systems. As he stayed in post only for about a year, this project was never finished.

In the short term, he needed to obtain the prompt and accurate information required for decision making. To get this, he created a committee of operations in which all the main managers of the company met weekly to harmonize the information they each provided. Before this mechanism was put into practice, some managers did not even bother to check the information they provided. By sitting together at the meeting, they were able to compare data from the different areas of the organization. For example, the volume of products claimed to have been delivered by one area was compared with the data on the volume the recipient area had recorded as being received. The area mangers were therefore forced to reconcile their information. This was a very difficult task because the senior managerial levels of the operational areas had enormous power, and usually acted as "families of power[72]" to protect their own interests.

The oil engineers with long experience in the company and with strong personalities were accustomed to controlling their areas like field marshals. Gaining access to information was very difficult and the only way out of this situation was to make the managers responsible for the data from their own area. The General Director made the managers work together, acting as a facilitator in the negotiations between them. A key aspect at that moment was assuring the accuracy of the American Petroleum Institute (API) index[73] for its oil. The API was

---

[72] Groups of power with fraternal bounds.
[73] The API is an index used to measure the density of the composition of different types of hydrocarbons in a specific mixture of oil. A high number means that it is classified a 'light crude' oil, i.e. one with a predominance of short chains of hydrocarbons. This type of oil is in high demand for the production of gasoline because of its high productivity. 'Heavy' oils have a low API, like most of the Mexican production, and are used in the generation of electricity or for producing asphalt for motorway construction.

needed to settle contracts with the clients who were demanding the maintenance of the quality of the oil they were buying. The only way to ensure the quality of the oil exported was by making the each manager responsible for his information. Moctezuma Cid observed: "The information system I developed could respond, even if it had shortcomings."

The company had an enormous amount of data. Each department kept its own registers, lists, and reports, but that type of data was not of much value for decision making. The company also had a large hardware infrastructure; however, "having the computers did not mean the authorities had the information they needed". Although the General Director tried to develop new information systems in various administrative areas during his administration, he faced severe resistance and even open sabotage. In some cases, the oil workers filled the computers with paperclips. The areas that had good results in the use of computers were those with substantial technical expertise in the calculations that need to be made for the company's operations. A project with the Mexican Institute of Petroleum for the seismic detection of oil deposits gained particularly large benefits from computer use.

7.3.3 Mario Ramón Beteta, 1982-1985

When Mario Ramón Beteta became General Director in 1982, he had a reputation as a political figure and financial expert and industrial manager. Before then, his contact with Pemex in his public career had been from the outside: he was previously General Director of a state-owned industrial and financial holding group, after being the Minister of Finance. At the time he became General Director of Pemex, the post was of extraordinary importance to the country. Of Mexico's total exports of $24 billion, $16 billion came from oil exports; 50% of the government's tax revenues came from Pemex, which also provided 95% of the energy used by the national economy.

His main mission was to sell oil. He was not an oil expert; so, he realised he would not be telling the technical experts how to do things in the operational areas. His background was in finance and management, and those were the areas where he concentrated his efforts to reorganize Pemex in accordance with economic rationality. When he took office, he soon found out that the organization had inflexible and inadequate information systems that had to contend with impenetrable power structures which controlled the information flows. From his perspective, "legitimate and illegitimate interests had put these systems in place".

The legitimate interests arose from those employees who felt that their personal assets lay in the routine official procedures they performed daily. This type of employee did not welcome changes that would affect their work procedures because they had always done things in the traditional way, and had a vested interest in continuing to do that. It is difficult to be innovative in transforming or remodelling the administrative machinery of any organization characterized by this type of environment.

The illegitimate interests[74] who resisted the introduction of changes also saw the introduction of new information systems or procedures leading to the collapse of the *status quo* that brought their personal benefits, but in ways that were not part of legitimate formal organizational processes. For example, it was very difficult to introduce a system that allowed Pemex to pay its contractors within thirty days; under the existing arrangements, Pemex took up to six months to pay for goods or services. In the operational areas, the workers created problems so they could later charge for their solution. These inefficiencies caused further costs to Pemex because the contractors, knowing that their payments would be delayed, added extra to their invoices. It proved a difficult task fighting both types of interests, which were both very powerful. In addition, it was impossible to deny that questionable deals were being carried out between different sections of the organization.

Pemex needed financial resources to pay for the efforts of reorganization and investments in state-of-the-art technology because the government took almost all its income. As General Director, Beteta tried to negotiate a reduction of this financial burden with the central government. His aim was to transform Pemex into an efficient company with an appropriate relation between the costs of operations and the income generated. To support his arguments in these negotiations, he used as a reference the standard of operations of other international oil producers, such as those of OPEC.

Pemex had 260,000 workers at that time. When he tried to reduce the cost of labour, the powerful Union leader known as La Quina[75] opposed all the plans. The Union leaders exploited the *transitorios*, the group of senior administrators who came into office

---

[74] They are illegitimate because the foundations of these benefits were not ethical.
[75] See section 4.3 for a discussion on La Quina, the role of the Union, and the position of the *transitorios*.

temporarily with each change of public administration, by employing their unconditional political commitment to the Union to get them to fight against the company. The Union issued death threats to the top managers involved in the reorganization of the company. It was also very difficult to promote productivity among the middle managers who had a reputation for technical expertise and were not willing to listen to newcomers telling them how to do things. The General Director was therefore in a very difficult political position when he undertook these changes. He had to try to foster productivity by challenging the *status quo* at the same time as guaranteeing the country's energy supply, which was effectively in the hands of those oil workers identified with the *status quo*.

Limited options were available for developing for the top management level the type of information systems that could be of direct value to the General Director. When the areas provided information, it was not possible to know if it was reliable or how to verify it. The only way out of this trap was to work in co-operation with the managers responsible for each area, so Beteta created teams of senior managers to conduct the operations of Pemex jointly. They met together on what came to be called the 'oil Friday', when the area managers negotiated in front of him any necessary reconciliations of differences in the information they provided. They established a strict system for following up agreements. In some cases, it was difficult to clear up problematic arrangements, mostly relating to technical aspects. During his administration, he travelled to all the work centres of Pemex to be near the operations, so he could see for himself how things were carried out and cross-check information with the personnel in the different areas.

After the experience of the way Díaz Serrano determined oil prices without consultation, the central government fixed the company's oil prices through a newly created committee in which Pemex's top management and members of the cabinet participated. The pressure on the balance of payments was so strong that the company had to guarantee oil revenues; any change could have threatened the stability of the national economy. The government therefore tried to make the company continue to perform its operations while also introducing measures to foster productivity. It created a "committee of efficiency" in which they asked for suggestions from the company's computer experts to improve the information systems. The committee was aware that information technology by itself would not provide solutions to the problems faced by the company because of the lack of reliable information. Beteta

pointed out that if the input to the computer is rubbish, the output would be rubbish – but delivered at a higher speed.

In his view, the real conditions in which Pemex operated had enormous problems to overcome to achieve an ideal situation. In particular, the human resources available to the company limited the possibility of achieving the desired efficiency goals. So he brought into Pemex people whom he trusted, and who had work experience in the public sector or in private companies. Most of them had completed postgraduate studies abroad. He said that his team did their best given the historical circumstances in which they were working. No management techniques or technologies were then available that could have solved the type of problems they faced, but they established the foundations for further progress.

The Union was very upset with this team, who were nicknamed 'Smurfs' (see section 6.3.1). In order to have peaceful relations with the oil workers, Beteta decided to leave the technical aspects of the company to the oil industry professionals and had his team heading up the administrative and financial functions. The Union opposed all his changes, especially the redundancy plans; they carried out acts of sabotage in many cases. They also opposed the development of information systems, because reliable information could expose the inefficiencies and the consequent opportunities to reduce expenses and costs. "The Union had real power and used it."

The ability of Pemex managers to make decisions on key aspects of the company's operations was limited by the participation of the central government's representatives on the board of governors of the company. The Union could also interfere in the operations of the company. In addition, the management's room to manoeuvre was restricted because of the importance of the company to the national economy. The information Pemex had to provide to the national accounting office, and the many public policies that regulated its operations, further restricted the company's capacity to define new managerial practices. Beteta faced difficult negotiations with some members of the cabinet who wanted to impose a heavier fiscal burden on Pemex. The accountancy and financial procedures were very complex because the Pemex budget had to comply with national budgetary arrangements.

Nevertheless, he was able to carry out some changes. He established the use of public tendering for contracting goods and services; even if this was not always the cheapest option,

he believed it would helped to open up the process. By opening the tenders to international contractors they were able to reduce costs and delivery times. With the development of internal systems, Pemex was able to pay its contractors in less than six months, and eventually within one month.

7.3.4 Francisco Rojas, 1985-1994

Francisco Rojas was appointed General Director of Pemex in 1985, before the end of one presidential period and he stayed in the post for the period of the next public administration. When he was appointed, the company had more than 200,000 workers and a very powerful Union with entrenched areas of power. The managers of the operational centres had to heed the will of the local Union leader. All the actions undertaken to improve Pemex's performance had to be analysed with regard to the historical conditions in which they took place. Trying to control the human resources of the company through the use of information technology would not have worked, because the proper procedures and industrial relations were not in place.

On taking office, Rojas realized that the Under-directorates worked independently, as if they were different businesses each safeguarding their own interests. It was very difficult to get reliable information. He created an executive committee including all the under-directors and his personal advisors. This meant the ten most important managers in the organization were among those who attended the weekly meeting of this committee, which exchanged information and shared responsibility for the management decisions taken by the committee. "This shared responsibility was for good and bad; in the best conditions, it achieved the co-operation of the parties in carrying out the decisions taken in the group, and even in the worst situations the parties at least did not hamper the implementation of decisions." The meetings always involved negotiations to settle differences between the participants. "These under-directors knew they had real power. They had the operations of the company in their hands, and so did the Union leaders who controlled most of the projects to develop the infrastructure of Pemex."

A main goal of Rojas's administration was to implement an industrial relations policy, specifically trying to reclaim the company from the Union. He also focused on: the technology of the operations; drilling and oil production; and the definition of responsibilities

of each organizational entity. In Pemex "nobody was responsible for anything", a feature inherited historically from the time of the expropriation when the workers controlled the operations and anything was acceptable as long as the oil kept flowing. He tried to develop information systems in parallel to those that were in place to support his management. He had a clear understanding that information technology had a fundamental role in management, but in his opinion the organization had to be prepared in terms of culture to receive the technology; if it was not ready for this, then those investments would have ended up being wasted.

During his administration, Rojas introduced an entrepreneurial culture in which people had to be responsible for their decisions and, in consequence, would care for the economic aspects of the business. This represented a change of organizational ideology towards one in which operational decision making was carried out by middle-level managers with a focus on: productivity; costs and benefits; and transfer costs. The process of change of the organization started with the introduction of the economic rationale. This process later brought the restructuring of the organization into divisions, and later still its split into subsidiaries.

Rojas said that the company had about 100,000 too many workers in comparison with international standards. The first restructuring efforts started by redefining the relations between management and the Union and the modification of the collective labour contract, in line with his basic goal of reclaiming control of the company from the Union. The labour contracts were revised every two years; in the meantime, he tried to make progress in other areas such as information systems. The introduction of the concept of evaluation represented a dramatic change for the workers, who had never before been obliged to inform management of their performance. Evaluation came as a cultural shock to those who considered themselves proprietors of the company. Rojas' team had to introduce the idea of maximizing value and economic rationality, which were principles that were not part of the social arrangements within which oil workers had been accustomed to perform their work. The team had to make the middle managers and workers understand what was now needed for the company. "The mental change was fundamental, the rest of the transformation could be done afterwards."

Rojas frequently travelled to the different work centres of Pemex to motivate people as part of his leadership role. Negotiations with the Union were based on the idea that Pemex could

remain as a state-owned company only if it became more efficient. The Union had to compromise in order to reduce costs to make the operations more productive. The management looked to consultants for advice. The proposal for reorganization was to keep Pemex as an integrated oil company within the structure of a corporate group. The transformation project had to deal with the legal aspects of defining a new organic law and an organizational structure that would suit the new definition.

At that particular time, information systems were not a priority even though the company had a multiplicity of incompatible systems. During Rojas' administration, Pemex had developed an executive information system utilizing touch-screen technology. He suggested that although it was a good system, the information he needed as General Director was related to strategic aspects of decision making and negotiations, not detailed data in real time. Corporate information systems were an important development in his period in office, but the problem of data reliability remained. However, the institutional database helped to provide a means to follow up the performance of the group, to co-ordinate the operations, and to get budget spending under control.

The need to settle differences through negotiations during the meetings of the executive committee persisted, but with fewer discrepancies than when the committee was first created. The problem that Pemex would continue to face was that it had to cope with two different accounting systems: the traditional Pemex accountancy system and that of the budget and national accounts. Translating the performance of the operations from one to the other requires an enormous effort due to the complexity of such a transition, because one was based on income and expenditure and the other on cash flows.

8 CONTENT OF CHANGE

It has been recognized that information technology enables organizational change, but the precise nature of that change depends on the type of information system and its impact in the specific context where it is implemented (Hammer and Champy 1993) (Davenport and Short 1990).

8.1 TYPES OF CONTENT OF CHANGE AT PEMEX

So far, this thesis has examined in detail the context and the process of change at Pemex, both at the organizational level and in relation to its use of information systems. Here, the content of change is analysed in terms of the actual outcome of these processes and the desired outcome that the authorities had sought.

The impact that information systems development efforts had on Pemex as an organization resulted in changes that are mostly related to the introduction of a technical and economic rationale into operations. These can be catalogued into three types, depending on the nature of the activity and the benefits that the use of this technology enabled; this research's analysis characterizes these types by the terms 'automate', 'systemize', and 'informate'[76]

> • To 'automate' implies the introduction of electronic processing to manual procedures, and the immediate benefit is efficiency – the same activities being performed faster. The risk of this is that the speeding up might be of an unnecessarily tortuous procedure, which would hide organizational inefficiency. Automation is usually applied to vertical functions within isolated systems that process specific data related to that function. For this, requirement analysis is done separately by function. The implementation of this type of system usually represents a challenge to the *status quo* in terms of layout, job redesign, and the structure of control over the information. It also usually implies that information is controlled by the organizational unit in charge of data processing. This kind of use typically reduces data errors because it decreases the need for human intervention in the input procedures and avoids duplication within this procedure. The quality of data would depend on the process used for validating data and having it verified by users. To be effective, this should take place within a framework of goodwill, where the data entry personnel understand the data and the repercussions of their work.
>
> • To 'systemize' involves the analysis and redefinition of processes utilizing the potential for integrated systems offered by new technology.

---

[76] 'Informate' is a term coined by Zuboff (1988).

This type of use is usually linked to business process re-engineering. The actual procedures of the organization are analysed with the aim of simplifying them, and even defining new ways of operating enabled by the technology, using processes that cut across the different functions of an organization by processes . It introduces an economic rationale by reducing costs through eliminating procedures duplicated between functions. This process implies rationalizing the operations of the company with a holistic perspective, as well as the development of integrated systems using a single corporate database. In most cases, the development of such systems has implied following arrangements common to firms in the same industrial sector. With this type of information system, the organization can achieve the goal of obtaining properly validated data on time: data that accurately reflects the organization's current actual conditions of operations. This arrangement usually implies the homogenization of procedures in accordance with the prescriptions of experts.

• To 'informate' implies the use of the data available for informed decision-making regarding the operations of the company. This type of use requires the availability of good data, together with the ability to use it and make sense of it as information. The validated data is analysed to evaluate operations and provide the basis for decision making. This use also implies understanding the potentialities and limits of the technology as an entity that deals with abstract data, not with reality. It is in this style of use that the true strategic nature of technology is manifested, by its ability to link up the relationship between knowledge and understanding (Tricker 1992) and ground decision making. This use does not necessarily imply standard arrangements of information systems or systematization. The prerequisite is having high-quality data, then learning and understanding how to use it to make more effective decisions through evaluation and analysis of all aspects that affect the organization. Data availability is a requirement, but it does not mean that by just having data the organization actually has this type of use of information systems; informatization cannot be achieved just by undertaking the systematization of an organization through the development of an integrated corporate information system. In many cases, processing more data through a computer-based information system can lead to information overload and the incompetent use of information (Ciborra 1996).

These three types of use of computer-based information systems are context dependent. The specific conditions of every organization give meaning to the use of information systems. The state-of-the-art of technology and the characteristics of the context define the potentialities of, and limits to, the use of information systems. Specifically, the development of corporate integrated online systems requires the development of telecommunications and database technologies.

Applying this typology in Pemex shows that the content of change introduced by its mainstream computer-based information system efforts is closely linked to the development of the technologies and to organizational change. For the first period studied, starting with the introduction of the first computers until the early 1980s (see Chapter 5), the diffusion of information technology into the administrative function implied the automation of manual procedures. The benefits brought by the use of computer-based information systems came not only from the increased speed brought to the procedures, where data was processed promptly, but also from the reduction of personal discretion in manipulating the data.

The problem of data reliability persisted when data input to computer systems was done by unqualified personnel. In this period, the systems were organized according to the geographic location of the different working centres of the organization and the technology was based on mainframes. Even if the official policy for information systems was heavily centralized, each working centre applied its own local rules to the automation; and each information technology centre, even if it was not recognized officially, worked autonomously in the determination of the local computer architecture and software requirements. Systems were developed with *ad hoc* styles to produce prompt benefits from the automation of manual procedures.

The second period that started in the early 1980s (see Chapter 6) comprised a different type of content in the change brought about by computer-based information systems. In 1985, with the formulation of the official policy of open systems and the creation of the core corporate systems, the organization underwent a new process of automation that involved a certain level of systematization. The technical professionals responsible for these information systems analysed processes in order to refine and standardize them across the organization; however, these were functional rather than process oriented. The new systems allowed for the integration of the financial functions of the company through the exchange of information between them, using electronic interfaces developed to avoid the duplication of data input.

The corporate systems did bring horizontal integration of the organization across each financial function. The different working centres of the organization scattered throughout the country mainly used these corporate systems to carry out their major financial operations. For the first time in its history, the organization, was able to standardize to a great extent its

financial procedures and data. In terms of the organizational change, this allowed the integration of a single company rather than having a conglomerate of companies as it had been in the past.

During this second period, the institutional database was restructured. By 1988, the reliable data about the general operations of the organization that this system began providing was used to analyse and evaluate the operation of the organization. This system enabled the computer-based information systems to be used for informatization, but that was limited to the planning area where technical experts knew and understand how to use data. This change implied the institutionalization of the economic rationale, as explained in the analysis in Chapter 9.

Systematization characterized the last project undertaken by the corporate group as part of the mainstream efforts on the development of an integrated corporate information system through the implementation of the SAP/3 enterprise resource planning package. While it is too soon to be able to evaluate the impact of the redesign of processes this involved, what can be said with some certainty is that such a system in itself will not necessarily bring the informatization of the organization. The information that can be made available might still not be used by workers or employees for a variety of reasons, perhaps because they consider that they do not need it or that they do not have the competences to carry out the necessary analysis or evaluations.

This explains why the relocation of people from operational areas to analysis activities is not a simple process and will be difficult to implement Such a change would, out of necessity, require training in: the use of techniques of analysis; a process of learning to understand the data and its use; and the transformation of the organizational environment into one that would allow decision making based on data analysis. This would lead to a change of culture to one that would value: structured information as an important foundation for decision making processes; making sense of information; and having a clear purpose for its use, including economic and financial evaluation. What seems clear is that the aim of Pemex's authorities was to informatize the organization, but they held the belief that systematization would be sufficient on its own to bring that about. The redefinition of processes and the fulfilment of regulations implied an enormous risk for the project, but greater complexity is needed to achieve the informatization of the organization.

As for the other non-mainstream information systems efforts, it appears that the use of computer-based information systems has resulted in informatization in the specialized technical areas. Since the 1970s, these areas have been using computers to facilitate the calculation of sophisticated mathematical functions to guide project decision making in the construction of installations and drilling of wells.

The description of Pemex's information systems allows a longitudinal analysis of the process of changing the organization and, as Pettigrew (1983) points out, a longer time perspective allows an analysis to understand the permanence of organizations. Even with the enormous amount of resources allocated at Pemex to develop computer-based information systems since the 1960s, the four General Directors interviewed faced a similar problem: lack of reliable information. This does not imply that the company's information systems efforts did not have benefits, but it does highlight the complex challenge that is inherent to the process of changing an organization. The aim of the change was to introduce a technical and economic rationale, but this was seen as alien and even a threat to the *status quo* and the very *raison d'être* of the organization because it was in conflict with the ethos of a state-owned company whose goal was service, not profits.

9 ANALYSIS

The description of the case study given in earlier chapters highlighted both the complexity and specificity of the social setting being examined. It showed how social circumstances form a web that interconnects the daily acts of people as they try to make sense of their circumstances, while also fulfilling their work commitments according to their own understanding and to the interests of the group (Orlikowski 1992). These aspects are, in turn, shown to relate to the actors' mental frameworks as structured by their institutionalized values. In this way, the people involved enact the process of changing the organization within its cultural environment, where the institutionalized values shape their acts and decisions – and these acts enforce the institutionalization of those values (Zucker 1987). The clash of political groups arose from two main sources: the people who came from within the organization with specific institutionalized values; and the 'others', the group who came from the 'aliens' outside the organization and had different institutionalized values. Each strove to assert their own order as being the best one for the needs of the organization and the well being of the country.

The analysis in this chapter of the Pemex case study is carried out at the macro level in terms of the explanation of the social order. It focuses specifically on the character of the prevalent institutionalized environments that were identified in the organization, with the recognition this is just one possible interpretation, constructed upon the theoretical basis of the research and its objectives (Pettigrew 1983). Account is taken of how the process of change is in a continuous flux, so that an interpretation at one point in time and from a certain perspective does not mean to represent the ultimate outcome of the change process as a definite result, but as an insight into the prevailing trends of the process of dialectic forces that interact in a social setting.

This analysis interprets the case using the theoretical bases of institutional theory and the specific framework of the prevailing institutional orders of modernity identified by Berger, Berger, and Kellner (1973). The explanation of the case emphasizes the dichotomy between the economic/technical rationale and the political rationale as the contrasting central principles of the two key institutionalized environments that were identified in the social setting in which Pemex operates, both at national and organizational levels.

This dichotomy is also manifested in the interpretation of the case study in terms of two divergent forces that shape information systems. One force drives organizational change and the use of information technology towards so-called 'best international practices', which have a homogenizing character founded in a economic/technical rationale. The other force recognizes the imperative of the political rationale of local conditions and sees the development of information systems in the context of arrangements that are appropriate for contingent conditions. These include influences that tend to move events and relationships towards a diversity of outcomes, each with its own specificity reflecting the characteristics of local conditions.

As the data from the case study illustrates, the so-called 'soft' aspects of information systems – related not solely to human aspects but also to the social, cultural, and political factors – are predominant factors in the development of both Pemex as an organization and its information systems. The changes in these that have been described in this thesis arose strongly as a result of the particular character of Pemex as a state-owned organization. Its social and cultural setting is distinct from that of private companies in industrialized countries, which operate in accordance with a market rationale and have been the object of most studies in information systems research.

As a state-owned oil company in Mexico, Pemex has been linked since its origins to very strong nationalistic feelings in a country that has striven to develop through the path of modernization. Until recently, it held a public monopoly in almost all activities of the oil sector. Its agenda as a monopolistic state-owned company has not followed a market rationale and a profit orientation; instead, its mission has been determined by the social and political role it has had in the life of the country. The social, cultural, and political features of its environment have deeply permeated the social arrangements of operations, which do not necessary follow a economic/technical rationale. The company's administrations in recent years have tried to adjust its operations to the economic/technical rationale with the aim of making its operations efficient, but without modifying its character as a state-owned company. The analysis in this chapter seeks to understand the major influences that have made the fulfilment of this objective very complex. These forces operate at the level of institutional values of the social setting that shapes people's behaviour and decisions. The analysis is structured around the prevailing characteristics of the two historical periods

identified in chapters 5 and 6, at national and organizational levels as well as in relation to efforts to develop Pemex's information systems.

9.1 LINKS BETWEEN PEMEX AND THE NATIONAL CONTEXT

The close interconnection between the economic policy of the central government and the style of Pemex's various administrations has been one of the clearest themes of this case study. Changes of central government policy implied direct changes in the administration of the organization, as expressed explicitly through changes in the mission of the company and in the characteristics of the General Directors selected by the Mexican President of the time. These changes had further implications for the company's organizational structure and its information systems. Both the central government and the organization had been immersed in a process of modernization in two distinctive stages: the earlier period (see chapter 5), dating mainly from the end of the 1930s until the early 1980s, was predominantly bureaucratic; from the end of that period until today (see chapter 6), a second phase has seen the economic rationale becoming dominant.

The economic policies of the central government can be understood in relation to the prevailing political stance of each President towards the process of modernization. The Mexican government has regarded the achievement of the ideal goal of modernization as a process led by experts, and its strong intolerance of dissent has also prevented any critical analysis of its policies until recently. The legitimacy of the political position in the first stage was underpinned by the political structure inherited from the nationalistic character of the Mexican Revolution. In the second stage, particularly since the middle of the 1980s, legitimacy has been grounded in the professional qualifications of the people in power who have defined the policies, most of whom have held postgraduate qualifications from outside Mexico.

The elite of foreign-trained professionals is visualized in the local culture as being the carrier of formal knowledge. It is taken for granted that they are the ones who 'know best' because of their qualifications. The *malinchismo* characteristic of the local culture, which privileges what arises from abroad over what comes from local sources (see section 4.2), has also enforced the position of power the professional elite and the institutionalization of values coming from abroad. That elite is seen as the personification of science that carries the

unchallengeable values of progress and modernization, which are perceived as superior to the local culture and possessing a universal and objective character that is value free.

9.2   TWO MAIN HISTORICAL PERIODS

The two distinctive historical periods in the twentieth century identified by this research correspond with the predominance of two main economic strategies followed by the central Mexican government in its process of modernization. In the first period to the early 1980s, the government followed a welfare policy in which the state took responsibility for the creation and distribution of social wealth through its central economic role as a generator of demand. Since then, the neo-liberal paradigm has become dominant and the size of the state has been reduced, but the government has kept the role of regulation and policy formulation. Direct state intervention in the economy has continued only in 'strategic areas', mainly in the oil and power industries.

During the first period, the development of Mexico was subordinate to three main influences: the political life of the country built on the spirit of nationalism aroused by the privatization of the oil industry; the socialist-oriented rhetoric of the post-revolutionary governments; and state control over the labour movement. State participation in the oil industry is an institutional value identified with national sovereignty and sealed as law in the National Constitution of the country. The economic conditions of that period allowed the development of Pemex as an organization that was not required to comply with the dominant economic rationale. Production costs did not matter as operations were financed through public debt in the early part of this period, and since the late 1970s and early 1980s by foreign resources borrowed in the expectation that the oil boom would result in high petrodollar incomes. The predominant institutional environment was of a bureaucracy coexisting with local cultural and political features. During this period, Pemex was an agent of the government which distributed wealth through the creation of employment and generated demand by providing contracts to local companies for services and goods. The operations of the company were subordinated to its political role. They followed a political rationale which was dysfunctional from the perspective of the economic/technical rationale.

By the early 1980s, the second period emerged with the central government's adoption neo-liberal economic policies. Government intervention in economic activities was then greatly

reduced to permit the operation of regulatory market forces. The style of administration of Pemex also shifted to one that sought to follow this economic rationale; this could be seen in its attempts to control and evaluate the operations of the company and to shape the decision-taking processes in its operational areas. Supporters of the economic/technical rationale undertook a struggle against the traditional political groups to make their technical values the predominant institutionalized environment in the organization. During this period, Pemex has struggled to detach itself from its role of government agent in order to become a global company whose operations are regulated by the same economic/technical rationale as a global market-oriented enterprise.

9.3 TWO KEY INSTITUTIONAL DIMENSIONS

The analysis of the data from the case study shows that the social factors affecting Pemex's organizational change and information systems development appear as two main institutionalized dimensions, the 'economic/technical' and 'bureaucratic'[77]; these are identified with the two main political groups who endeavoured to reshape the company's strategy. The 'plurality of worlds' is identified as another important institutional dimension, which this thesis considers as being within the bureaucratic dimension because the values of these two dimensions appeared to be intrinsically linked. In Pemex, local values, such as that of *malinchismo*, were embedded within the bureaucratic order. However, the way in which Pemex has many different premises scattered throughout the country makes it difficult to identify specific characteristics arising from local features. When taking into consideration of the plurality of worlds within the bureaucratic order, these local characteristics are not explicitly highlighted and only the prevailing organizational values are considered for the analysis.

Each of the two main institutional dimensions – the technical/rational and the bureaucratic – is built on different fundamental principles or rationales. The institutional orders and their basic principles build the perceptions of what is 'the right way to do things', reflecting an implicit social order that is taken for granted.

---

[77]Berger, Berger, and Kellner (1973) and Scott and Meyer (1983) identify economic/technical and bureaucratic as the two main institutional dimensions present in modern society.

The identification of these institutional orders is just one possible way of analyzing the case study. The researcher recognizes that this interpretation helps to illuminate the understanding of the social setting because it helps to trace the relationships between the social context, the process of change of the organization, and Pemex's information systems development. Even though this can hide the complexity of the social and political dimensions, a structured approach is used to disentangle these relations.

The economic/technical and bureaucratic political dimensions appear to have been present in the organization throughout its history, in varying degrees of strength. The process of change of the organization is built on the dialectical interaction and tension between them, and their basic principles ground their power and legitimacy in the social context. The bureaucratic rationale is built from the influences of local conditions as shown, for example, in the way Pemex has been shaped by the circumstances in which it originated as a company.

The economic/technical dimension, on the other hand, has rationality as its central principle that is presented as a pressure to conform to universal prescriptions dictated by scientific knowledge. This rationale is institutionalized in formal knowledge and in technology. During the first period of the Pemex study, it was expressed through engineering techniques. The company's local culture has taken for granted that the carriers of such knowledge are the professionals; in the second period, this knowledge was identified with professionals holding postgraduate qualifications from outside Mexico. Such knowledge appears to have an objective character and acts as a universal homogenizing force because modernization and progress promote the imitation of organizations of Western industrialized economies. This has been the ideological force that has shaped the industrialization of Western society in a common pattern of development, with globalization being its latest stage. It has been expressed in Pemex in recent years through the efforts undertaken to transform it into a global company.

The technical rationale is identified with engineering normative prescriptions based on scientific explanations of how operations are to be carried out. The institutionalization of this rationality is presented as free of politics and as the only valid social option. In Pemex, the legitimacy of the economic rationale has been backed by the elite of foreign-educated public administrators who have controlled a majority of the highest posts of country's political

structure since the early 1980s. The legitimacy of the engineering perspective arises from the social recognition of the professionalism of the company's engineers.

9.3.1 Dialectic Interaction of the Two Institutional Dimensions

The economic/technical and bureaucratic dimensions in Pemex do not exclude each other; as the case study shows, their influences are built by the tension of their mutual interaction. Both dimensions are present at any given moment, with each offering its own 'correct way of doing things'. At certain times, one prevails over the other in shaping operational arrangements and information systems in accordance with its values. This tension between the dimensions is not necessarily homogenous throughout the organization.

9.3.2 What Occurred when a Bureaucratic Rationale Prevailed

During the first period to the early 1980s, the economic/technical and bureaucratic dimensions coexisted in a 'working relationship'. At that time, the bureaucratic dimension was dominant and the economic rationale was presented only from the technical perspective of the engineering discipline. This was not the case during the second period, in which the basic principles of the institutionalized dimensions became contradictory and strong tensions arose between groups holding different values. The different groups supported their decisions and vested interests by using as their sources of power the core principles and rationales of the values of the institutionalized dimensions with which they identified themselves. They did not do this consciously, but as a set of taken-for-granted underlying assumptions.

Ultimately, the dominant legitimacy and prevalence of one of the institutionalized dimensions comes from the cultural and political support given to it by the social environment at a particular time. The use of information technology embeds the values of the technical rationale and is applied by engineers in a company as their taken-for-granted way of acting. This institutionalization has enforced the trend of using this technology as an end in itself.

During the first period, the economic/technical dimension was present through the technical rationale of the engineers who helped to build Pemex as a vertically integrated oil company. The engineers' legitimacy was grounded in their vocational training and was frequently based on stories of their performance in difficult technical situations; some stories, like stopping a

dangerous oil leak, became myths and legends which were enhanced by the local cultural facet of the *macho que no se raja* (male that does not give up). The legitimacy from myths gave the engineers political power within the values of the bureaucratic dimension. These leaders were treated with high respect – almost like knights – and their authority was never challenged.

The prime mission of the organization was to produce oil to keep the national economy running, so processes carried out in field operations had priority over any administrative functions. It should also be pointed out that, generally, companies all over the world at that time were production-driven as an institutionalized value. The information systems at the different premises of Pemex were organized manually at the discretion of the local leaders, usually following the style of the systems instituted by the previous owners, the foreign companies that had been nationalized. A multiplicity of diverse manual systems existed across the company. The only data that mattered was the volume of production, regardless of costs. The unique style of each site, the interest of local groups, and the personal preferences of the local leaders made the operation of the data flows discretionary. This led to the data being inconsistent.

The influence of indigenous cultural features of the local social settings can be seen in the *ad hoc* arrangement of information flows, which was representative of the values of the different 'life worlds' embedded within the bureaucratic dimension. The structure of the organization as a public company represented the bureaucratic order of this dimension, through which the political rationale of the country permeated the operations of the entire organization. At a low hierarchical level, this political rationale was expressed in the tortuous bureaucratic procedures and over-abundance of inconsistent data, which was not only often redundant but also frequently collected for no specific purpose. Historically, activities were structured in a way that led to data collection being carried out in a certain way 'because it has always been done that way before'. At higher levels, the strength of the political rationale was clearly seen in a situation where making a decision about technical operations was viewed as subordinate to political considerations. An example of this dynamic was when the organization was importing gasoline although it had spare capacity in its refinery to process crude oil; this was because importing oil represented a loss of sovereignty, whereas importing gasoline did not.

The organization also showed evidence of the power of local managers and union leaders as *caciques*, the 'owners of lands and lives' who had been the country's prevalent political structure. This feature was expressed through the power of the local managers to shape the procedures used in the premises they controlled, in order to suit their specific interests and personal styles. They changed the procedures whenever they considered it convenient, with no notice or advice to central authorities. The local managers also controlled the data to be collected, who received it, and who could provide it; this usually ensured that they themselves were the channels of communication with other authorities, using informal means like telephone calls. This characteristic would have been outrageous in another social setting, but in Mexico at that time it was the taken-for-granted local political style. In this specific context, the values of the political rationale embedded in the bureaucratic dimension served as a force of cohesion to provide identity to Pemex as a unified national organization and as a symbol of national sovereignty.

During this first historical period, the strength of the political rationale allowed the development of a network of informal flows of information built upon personal relations, which meant that the provision of information was negotiated among leaders in the company. The automation of procedures through the introduction of information technology followed the same rationale, arguably reinforced by the type of technology available at that time; this was limited to mainframes, so worked only with centralized structures. The implementation of mainframe-based information systems was structured as 'islands of automation', allowing the continuation of the controlled flow of information to other areas of the organization. The automation was carried out mainly in administrative functions or for calculations in high-expertise engineering activities. The information flows in the areas of operations remained under the political rationale of the bureaucratic dimension described above.

During the development of these information systems, the power struggle between central control and the local power bases in which local *caciquismo* prevailed found expression throughout the organization, for example in the development of computer-based systems as islands of automation with *ad hoc* methodologies and styles of operations. There was also practically no previous experience in the organization or the country of these new types of activities. The social features of *caciquismo* were enforced by the technology available at that time, as the mainframes with different and incompatible operating systems encouraged the development of isolated systems. Technical standardization could have been possible to a

certain degree, as was tried with the IBM 'integral system' communication project (see section 5.4.2), but events at Pemex demonstrated that political considerations always prevailed over technical arguments.

The information systems of the organization developed with a strong local orientation that avoided central control from the organization's authorities. This feature was enforced by the central government's procurement procedures. All government information technology procurement had to be authorized by the national institution responsible for the information technology policy. This policy tried to subordinate information technology procurement (including Pemex's) to an economic rationale, in order to protect the development of indigenous hardware production capabilities[78]. Later, when information technology imports were liberalized, Pemex's procurement policy tried to restrict local leaders' political power. In many cases, these procedures ended up restricting the flexibility of the technical rationale.

The influence of the Trade Union in the bureaucratic dimension was considerable. The political power of the Union's leaders and the managers of the areas of operation arose from the political situation formed by the expropriation of private oil assets in Mexico. The workers and technical managers had a monopoly on both the ability to understand and the capacity to undertake the technical processes of production. They used this legitimacy and power, both at the local level and with the central authorities, to keep control over the company's operations. The organization had a predominantly masculine character, arising from both the engineering orientation of the industry and the need for hard manual labour in the operational areas, re-enforced by the national macho culture in which men are expected to display social power and professional development.

The technical operations of the organization were carried out in accordance with a drive towards excellence of engineering techniques: in the words of one manager, "professionalism was embedded in our practices due to our vocational training, we tried to do things using our best understanding of the situation". This was an expression of the subordinate technical/rationale dimension. Pemex achieved international recognition for some of its engineering practices, even though the technical values of the engineering profession were

---

[78] The policy was based on recommendations grounded in the theory of development based on import substitution.

subordinate to the political rationale. Whenever a manager's political capital was at risk, orders from superiors had to be followed up, even if that meant contravening engineering-based recommendations.

Relations with the Union went through a number of stages. The first relevant incident for the case study happen during the administration of Reyes Heroles (1964-1969), who had a difficult relationship with the Union. He attempted a reorganization of the company's operations and managed to introduce some computer-based systems that challenged the power of local leaders. For instance, systems that introduced the economic/technical rationale to payroll and warehouse management challenged the political rationale of the bureaucratic dimension which supported Pemex's historical arrangements. They brought clear-cut benefits in terms of efficiency by reducing the cost of stocks and labour overtime worked, as well as starting the process of standardizing procedures for activities in some areas of the organization.

Pemex's early computer-based systems were modified to suit the local conditions at the work centres, as their developers had recognized how different systems requirements arose both for technical reasons and because of the particular styles of local operations. The political power of the various local leaders was addressed in negotiations during the process of information systems development. The developers tried, when possible, to choose areas for computerization where managers were friendly to the team implementing the system. If the situation became critical, as a last resort the developers would declare open hostilities on the users' resistance; in an extreme case, they even used military force against the users to protect the computer infrastructure.

The current employees of the organization have almost forgotten these first efforts of automation, which were the first steps towards integrating Pemex as a single unified company. Central authorities tried to introduce control over the local operations, which led to a new order arising. From the economic/technical rationale, this was evident in terms of engineering and managerial considerations; from the bureaucratic perspective, it was seen in the creation of a new identity for Pemex as a single national company. These first systems were able to introduce a certain degree of rationality to the operations because they took into account the political rationale in both the redefinition of the software and in the negotiations they undertook with local managers in the implementation.

In the first experiences of automation at Pemex, the institutionalized values of the economic/technical order clashed with the political order of the bureaucratic dimension, leading to openly-organized sabotage of the system by the staff who measured the amount of overtime worked. Despite such resistance, in this case the economic/technical values prevailed over the vested interest of the group whose legitimacy arose from the political sphere and indigenous culture. However, the systems were eventually made to operate, and the benefits gained from them were achieved primarily through the way in which the people developing the systems took into account the existence of the bureaucratic institutionalized dimension and managed that successfully. They did not do this consciously; instead, the use of common sense guided them to negotiate and compromise – although they also had to use military force to address open sabotage from the workers.

The oil boom of the early 1970s saw the rationale of the bureaucratic dimension gaining new power. The organization's goal of achieving the expansion of oil exports regardless of any other consideration boosted the political power of the bureaucratic dimension to its furthest point. This situation was enforced by the local political institution, the *presidencialismo*[79], and the lack of a democratic culture. Fulfilling the goals of the investment programme for the infrastructure expansion had paramount political importance. No one would have risked the political cost of failing to meet deadlines. 'Just do it' was the feeling that dominated the atmosphere in the organization.

The activities of the infrastructure expansion were carried out with enormous buffers to avoid putting at risk the political capital of managers. The economic rationale was displaced during the oil boom, and the events of that period are full of outrageous excesses when viewed from an economic/technical perspective. Within the political rationale that then prevailed, the operations were managed without any regard to financial considerations: the taken-for-granted way of carrying out operations was to do 'anything but stop the expansion'. The political discourse of the President at the time was based on the idea that "we have to manage wealth, we are a rich country". His personal power saturated the political rationale of that period, with the power of the *presidencialismo* stridently enforced. Taking into account costs or any other consideration on the grounds of economic rationale was seen as being out of

---

[79] Concentration of power in a sole political figure, the President.

place. Nevertheless, Jorge Díaz Serrano, Pemex's General Director of that period, explained that the events of those days were subordinate to the economic rationale. In his view, the main goal was to carry out the expansion of the infrastructure at full speed, in order to allow the country to take advantage of the high oil prices prevailing at that time in the international oil market. The expansion of oil export capabilities was seen as the way to maximize the value of the oil reserves in terms of national income.

As the administrative functions and the information systems in this period were basically dominated by the political rationale, the bureaucratic apparatus of the organization went through a great expansion; as a result, the past successes of some of the automated systems, such as the one for warehouse control, were lost because their use was stopped. The expansion of the production activities was developed in an *ad hoc* way suited to the historic conditions, thereby re-enforcing the power of local groups whose vested interests sometimes overshadowed the organization's well being as seen from the economic rationale.

During the oil boom, Pemex's information systems continued to mirror the local political arrangements of *caciquismo*, but the local leaders were greatly empowered by the paramount economic importance that the oil industry for the government and the Union. The local *caciques* were both managers of the organization and leaders of the Union. Their control over information was their main source of power in negotiating favourable conditions to suit their personal political capital and vested interests. Managers portrayed themselves as indispensable because nobody else understood how the expansion and operations could be carried out; they had made sure they were the only one who knew how things were actually done locally. The Union leaders presented themselves as essential because they were the ones who could manage labour relations and avoid conflict. The central authorities could therefore not control operations for two interrelated reasons: the power of the local leaders and the inconsistency of the data flows. It was in this way that the different groups in the organization with their own vested interests were able to free themselves from any control by the rest of the organization.

In the bureaucratic dimension, leaders founded their political power on their social prestige. The political structure was perpetuated because people built up their leader's image to enhance their own personal capital and influence by belonging to a powerful leader's group. In a society where family bonds are predominant, those groups became like families of

patriarchs; in their own words, "benefits splashed" and "it could not be otherwise". Within this cultural setting, an economic rationale was totally out of place – it felt like something alien, unnecessary or, more extremely, as an enemy of the national interests.

The absolute lack of economic rationale during this period faced its own limit because of the flood of inconsistent data provided to the media, which caused problems to the image of the General Director. To solve this problem, the authorities opted to build an institutional database with the aim of centralizing all the data from the organization. They also sought to regulate public relations policy by decreeing that all information given to the media should be based on data coming from this institutional database.

The database was first built on a mainframe. It was structured centrally and access to information was extremely tortuous and tightly controlled by the database manager. The system was clearly developed in accordance to the bureaucratic rationale of tight control of information in order to provide its manager with power. The centralized structure of the database was also enforced by the mainframe technology on which it was built. Later, the responsibility of managing the database was given to an oil worker with an engineering background. He was very familiar with the oil culture and the political structure of the organization, which gave him a clear understanding of the values that prevailed in the company due to the bureaucratic order. He also had working experience in other organizations and had studied a postgraduate course abroad.

This new database manager redeveloped the database with the central goal of providing reliable data to the executive and managerial levels of the organization. However, he consciously took into account the bureaucratic dimension of the organization in order to build an information system appropriate to its environment. He was able to use the feuds over the control of information to build arrangements that could assure the consistency and validity of the data. His understanding of the local conditions then allowed him to build an information system that brought tangible benefits to the organization. The validated data provided by this system was a necessary base for providing legitimacy to the economic/technical dimension, which would gain a dominant position in the second historic period. Such data was the necessary input to the analysis and evaluation activities, but to obtain this he had to manage the flows of information that came from areas where the values of the bureaucratic dimension prevailed.

Both institutionalized dimensions in this first historical period were able to coexist because, ultimately, they had the common goal of producing oil in a context where economic considerations were not being primary and technical considerations were subservient to the political *dictum*. Although the bureaucratic dimension was dominant in the first period, its tension with the technical rationale arose from values that came from engineering disciplines. There was a clear, but not explicitly articulated, definition of the spaces of power that were accepted as 'the way things work'. Engineers and technical experts controlled operations mainly with local manual information systems structured in an *ad hoc* manner to fulfil their needs.

The goal of the managers in the operations centres was to show results only in terms of volumes of the production of oil or refined products that provided the national economy with the fuel it needed. The administrative functions of the company were in the hands of the political apparatus whose main objective was to negotiate with the labour Union and the rest of the government in a way that avoided problems. These management and administrative factors hampered the production of oil for the national market; later, during the boom, they also constrained the expansion of the oil export platform. The relation between the organization and the government was one of 'you make as if you supervise me and I act as if you control me". The real power behind the organization was the Union, and the administration was forced to keep giving it concessions in order to avoid labour conflicts that could disrupt Pemex's operations. Some of these concessions subsequently proved to be too onerous when the economic/technical rationale became the prevalent institutionalized dimension in the government and the organization. During the time when the bureaucratic dimension was prevalent, having reliable data was not an important aspect because the organizational culture did not value structured information as a resource needed for decision making.

Efficiency was not a concern during the oil boom, when the only consideration was the political role of Pemex in ensuring the effective expansion of its oil exporting capabilities. The company was essentially a government agency whose task was to generate the resources needed to finance the development of the country. At this time, Pemex undertook various efforts to develop computer-based systems, but the speed of the expansion overwhelmed its capacity to develop new systems; the central authorities were therefore unable to supervise

and control the operations. The financial control that the government had over the company's budget allocations was also lost due to the General Director's personal relationship with the President. He was able to by-passed the official procedures by asking financial resources directly from the President.

Officially, information systems management at Pemex was totally centralized. This policy was explicitly seen from the technical rationale as 'the best way to organize'. In practice, unofficial informatics centres developed throughout the organization to fulfil local needs, following the orders of local leaders. The centralized activities of the official information systems management were dominated by the values of the bureaucratic dimension. The accepted way of arranging matters in the organization was through detailed classifications covering every aspect of an activity to ensure everything was directed harmoniously by the central control processes. This feature is expressed clearly in Pemex's *normatividad*, the technical and information standardization and regulation of administrative procedures (see section 6.4.2). The *normatividad* was specified in various documents from different periods of time, which included extremely detailed specifications of all types and categories of equipment and software, for example to determine organizational hardware and software standards.

At the same time, the use of information technology in the organization grew relatively smoothly in some respects because it was dealt with in the same way as any other technology in a technology-intensive organization: within the technical dimensions and its institutionalized values. Information technology was new but oil workers did not feel threatened by it, as indicated in typical comments such as: "The only thing we needed to be able to use the new technology was good methodologies to guide us in the application and operation of computers". Throughout the history of Pemex, the technical institutionalized value has remained prevalent in shaping the use of information technology and systems development in the organization.

The breakdown in the relationship between Pemex and IBM in the mid 1970s (see section 5.4.2) shows how events are built from negotiations between individuals who try, to the best of their understanding, to succeed in their daily operations in accordance their mental frameworks. The reorientation of Pemex's computer-based information systems towards open systems platforms illustrates the kind of situated change that is built by daily decisions

regarding operations, in contexts within which many forces interact. The decision to follow open systems as the organizational standard brought in a economic/technical rationale as a key factor in the negotiations for choosing the favoured bid. Nevertheless, the political dimension was also present in the purchasing power of Pemex over suppliers.

The technical rationale was embodied in the intervention of consultants, who were portrayed as providing an 'external objective knowhow with a value-free perspective' that would define the best way to carry out the information systems activities in the organization. The consultants' opinion as an expression of the technical rationale was given preference over the suggestions coming from internal staff, even if they had earlier made the same proposal as the consultants. The cultural feature of *malinchismo* enhanced this 'foreign is best' predominance over local expertise. The proposal to follow an open systems strategy was based on an economic argument because, in the opinion of the manager responsible for technology monitoring, the trends in the market showed the decline of IBM; for him, standards were defined by the market.

9.3.3   The Emerging Strength of the Economic/Technical Rationale

During the second historic period, from the early 1980s, the predominant institutional dimension of Pemex's central authorities and administration came to reflect the economic/technical dimension, which was aligned with the political stance of the central government. Driven by the values of the technological rationale, the process of change in this period headed towards the goal of preventing technical decisions being subordinated to the political goals of the central government. For instance, this was the aim behind the introduction of the concept of cost centres, which allowed the evaluation and control of operations and guided production decisions by technical considerations.

The development of the corporate financial systems was initially dominated by the engineering perspective. However, the imperative to take local conditions into account was soon identified by the staff carrying out the implementation in the various geographically-distributed centres. These developers took into account the political rationale in order to undertake what they described as "trench warfare": implementing corporate systems by "conquering" each site, and "fighting the implementation in each locality".

The corporate financial systems have been severely criticized by those Pemex authorities whose yardstick for information systems development is a rational model that prescribes a universal recipe of how to achieve so-called 'best international practices', based on values that are regarded as being outside of any particular time and place. However, such models cannot value many of the benefits achieved that were meaningful to the specific conditions of the company and the technology available at that time, such as the important contribution made by these financial systems in helping to integrate Pemex into a single organization through the standardization of financial procedures and data. This represented a breakthrough in transforming some of the main features of the bureaucratic dimension of the 'old Pemex'. For example, it was moving to becoming a company with standardized financial procedures from having been an organization that acted as a cluster of different feuding parts, each with a particular way of carrying out the company's administrative function. These corporate systems provided the foundations for the restructuring of key operations of Pemex into subsidiaries during the process of organizational change undertaken by the authorities in order to introduce an economic rationale into its operations. The existence of these corporate systems made possible the creation and operation of the new subsidiaries.

The bureaucratic dimension which prevailed in the organization until then could be countered only by explicitly showing the dysfunctionality of the operation in terms of quantitative analyses that provided 'value free' arguments derived from economic rationale. Reliable data was a pre-requisite for that purpose; the institutional database provided this, thereby laying the grounds of legitimacy to back politically the proposal to split the company. The database system evolved to integrate information from all areas of the organization and to respond to the increasing demand from the new administration for information. The legitimacy of the organizational restructuring process was reinforced and validated through the information that this database was able to provide. The reliable data allowed meaningful analysis and evaluation of the operations and backed politically the decisions that were later taken to continue the alignment of the company's operations to the economic/technical rationale.

During this evolution of the database system, its development did not follow the prescription of how to build standard executive information systems or a corporate integrated database. To fulfil the new requirements for information, the new database manager continued to take advantage of the peculiarities of the organization to make a system suited to the tight network

of controlled flows of information. The data validation process took into account the political structure of the organization and the need to develop it using suitable persons who had technical legitimacy and the ability to communicate, even in the operational areas where feuds existed over information. The volume of data grew incrementally by carefully negotiating each flow of information at an individual level. In these negotiations, the database operators took into account the mental framework of the workers, with whom they established personal contact and clear definitions of the data flows.

9.3.4 Economic/Technical Rationale Enforced by Information Systems Development

The prevalence of the economic/technical dimension in Pemex in the second period studied implied the massive introduction of information technology as an enabler of modernization. The institutionalization of the use of information technology as the route that has to be followed to introduce 'best practices' is clearly expressed in the pervasive nature that information technology has achieved. It became taken for granted in the organization that the way to modernize its operations is by introducing information technology. The legitimacy of such an option, including the related actions of consultancy companies, is grounded in prescriptions from the rational stream of research that addresses information systems development from an analytical perspective in which human aspects are managed just like any other variable, with little regard to social, political, and cultural aspects of local conditions. Internal staff can personally disagree with the consultants' perspective, but they still have to conform to the outsiders' prescription due to the bureaucratic rationale, which dictates that the political capital of the people in the organization will be safeguarded if they do not contradict managers and the consultants they bring in.

Contracts for consultancy services for information systems development generally contain milestones and payments that are determined by 'deliverables', which are typically reports documenting each stage of the life cycle in accordance with the technical rationale. Such a process can become a game of producing deliverables that have no actual impact on the organization because they do not address the other institutionalized aspects. In fact, the decision to bring in the consultants could be interpreted as the dominance of the technical rationale in seeking to inhibit the operation of the bureaucratic dimension.

The decision to choose SAP R/3 as the enterprise resource planning system was made on the technical grounds of following market trends, based on the advice the General Director had received, but it was actually also a political decision. The bureaucratic dimension was considered by allowing the users to 'evaluate' different packages, using the technical rationale that advocates allowing users to choose the most appropriate package to fulfil their organization's particular needs; for SAP R/3 at Pemex, this user involvement came only after the decision had been taken.

The task of implementation was awarded to foreign companies through bidding that followed both technical and economic rationales, but the organization's previous experiences with consultants led to the bid including technical specifications and restrictions to avoid the shortcoming of such consultancies. The strategy of implementing SAP R/3 was defined in accordance to the rationalist perspective of information systems implementation and organizational change. Some oil workers regretted that the corporate systems were not given more of a chance to evolve. In their view, these systems could have then enabled the organization to develop new internal capabilities and knowledge.

Political considerations made Pemex's staff carry on with its information system implementations even though they recognized these developments were faced by risks of severe problems, or even failure. They were well aware that such efforts would imply large costs to the organization and would probably not bring the expected benefits. The strategy took for granted that the development of computer-based information systems would provide structured, reliable, and timely data which would automatically bring a cultural change as it would promote the use of structured information for decision taking. This deterministic view of the use of technology was embedded within the economic/technical rationale. The economic rationale, which sought to institutionalize the value of the use of structured information for decision taking, could not visualize how the bureaucratic rationale that still prevailed in the operational areas saw this type of information as alien and unnecessary.

This indicates why implementing information technology in a social setting needs to consider local conditions in order to make feasible those projects aiming to automate or systemize. On the other hand, the projects whose goal is to informate require a change of the institutionalized values to ensure workers appreciate the value of having structured information as the foundation for decision taking. The institutionalization of the economic

rationale is a necessary implication if informatization is to be the outcome from information systems development. This form of institutionalized rationale regulates most private organizations worldwide, but does not always apply to state-owned companies such as Pemex.

9.3.5 The Economic/Technical Rationale Basis of Consultancy Operations

The power of the economic/technical dimension in the use of information systems that prevailed from the early 1980s within Pemex and Mexican society generally was enforced by the marketing approach of the consultancy firms involved, which emphasized universal solutions. The international character of these firms provided them with a strong image of legitimacy. Information technology, still seen as something alien and technical, was left to guidance "from those who know better in the form of so-called best practices," as an ex-General Director of Pemex commented.

The explanations provided by consultants to the authorities during the process of bidding were usually founded in a rational perspective which is easy to understand. The consultants emphasized how implementation could be controlled by following the steps and activities of a prescribed methodology. The explanations also usually gave the sense that computer-based information systems would bring specific changes to allow better control over operational areas. The national *malinchismo* culture, which allows outsiders to prescribe the correct solutions because they know best, is also advantageous in the political culture because it reduces risk by avoiding the responsibility of decision taking.

The power of consultants is also aided by another institutionalized local cultural value: the promotion of scapegoating and risk avoidance, as summarized in the saying 'people should not move if they want to appear in the picture' (see section 4.2). The tradition in Mexican national culture of blaming mistakes on scapegoats prevents learning from mistakes, which means people prefer to take the safe path by avoiding the taking of decisions and, therefore, the risk of making a mistake. This attitude was institutionalized at Pemex by auditing practices introduced by the central government which reinforced the view that workers could minimize the risk of losing their jobs by never challenging the content of the projects and sticking strictly to prescribed procedures to avoid being accused of bad practices.

The precedent of British Petroleum was used strongly to underpin support of the restructuring process, although by then the British company had begun to encounter problems in becoming a global company based on a corporate group model. The *malinchismo* also prevented Pemex from taking sufficient account of local experience to make sense of new practices. This situation was enforced by the 'conquest syndrome' which sees everything coming from the past as inferior, implying a total intolerance of those who attempt to persist with the old methods. Instead, new practices defined by external consultancy companies were favoured. Pemex followed the international trend of outsourcing and use of packages without challenging this policy's suitability for local conditions. The company's authorities took for granted that an external solution would be better than a local one, as it was seen as value free. They did not consider evolving the corporate systems, which would have represented an opportunity to take advantage of local knowledge and experience at the same time as addressing the specific needs of Pemex as a state-owned company.

The introduction of SAP R/3 emphasized the predominance of the technical dimension. In the corporate group, the implementation was carried out initially mainly by considering technical aspects. The technical perspective that was predominant in Pemex project leaders and the consultants permeated the definition of the strategy. When the social elements of the systems started to hamper progress on the project, Pemex hired new consultants to try to address these problems; there was an acceptance that it had been a mistake not to have dealt initially with an issue as important as the human aspects. However, the managers' choice in the selection of the new consultancy company to carry out this change management project was limited because the company's procurement procedures were an expression of the economic dimension.

The new consultants started an independent project for managing the changes and impacts provoked by the implementation of SAP R/3. This was carried out in parallel with the main project, in order to manage separately the variables they had failed to consider previously. Nevertheless, this project tackled these human issues from the same technical perspective that had been used to implement the SAP project because this was their taken-for-granted way of doing things. For them, it was essentially a matter of having a new methodology directed to handling human issues, through training and communication.

It is too soon to have the results of the SAP project, but it should be noted that the model implicit in the package corresponds to the economic/technical dimension that promotes the so-called 'best international practices'. This represents a clash with the features of the bureaucratic dimension that is also a part of the social setting of Pemex. This does not mean to imply a moral judgement on the values of the different institutionalized dimensions, but seeks to highlight the need to understand that both dimensions are active in the social setting and need to be addressed carefully.

Pemex is a state-owned company. It has to provide specific data to the government and to consider these requirements as part of its information systems, even if they do not fit with best business practices. Although it is premature to draw conclusions from the SAP project, comments from people not belonging to the mainstream of the managers implementing it suggest that SAP is working but they have expressed doubts over the permanence and robustness of the project. One middle manager noted: "For political reasons, they had to show that SAP works but the real transformation of the organization has not yet happened. People may have the data, but they still do not know how to use information nor value it." To achieve this, change will necessarily imply a cultural change: a change of institutionalized values in people's minds. The authorities of the corporate group have tried to promote this change primarily through the training addressed by the change management project. However, no significant signs of such changes were visible at the early stages of the implementation of SAP.

10 CONCLUSIONS

This chapter highlights the main conclusions of the above analysis and the overall findings of this research.

10.1 KEY FACTORS TO CONSIDER IN ASSESSING THE USE OF INFORMATION TECHNOLOGY IN ORGANIZATIONS

The influence of the central principles of the two prevalent institutionalized dimensions of the economic/technical and bureaucratic would be present in any instance of a modern society, so they always have to be considered and managed to be able to obtain the expected benefits from the use of information technology – or even to recognize the technology's limits. Information technology embeds social structures that are usually linked to an economic rationale. Its introduction therefore usually implies challenging the indigenous order given by the bureaucratic dimension and the plurality of worlds considered in this analysis. The economic rationale would be represented by the potentiality offered by the technology to allow new ways of operations; this is usually described as 'best practices' and the 'model of a global company' that has 'maximization' as its core value. This economic rationale is an extraordinarily strong force in challenging the *status quo*. It has been said it is the foundation of the industrialization of the world with its enormous material wealth. However, it should not be regarded as the only force to be taken into account.

Another important consideration when using information technology is that humans are *social* beings, whose social needs have to be addressed. It is the overall social setting, the indigenous conditions, that determines the specific ways in which these needs are translated into social, cultural, and political practices. Every social setting incorporates a plurality of institutionalized environments, as shown by the co-existence of the economic/technical and bureaucratic dimensions in modern society. The specific conditions of each organization will necessarily permeate information systems development, even if they are not considered explicitly. Understanding the cultural, political, and social features of the local setting is therefore necessary in order to illuminate how information technology is ultimately incorporated into the practices of the organizations following a drive towards diversity. To achieve the development of information systems suited to the specific conditions to be addressed, it is therefore necessary to build an understanding of the specificity of the social

241

setting and how these characteristics can have an impact on an information system's implementation.

The consideration of local conditions implies addressing the specific needs of each social setting. When trying to mirror the so-called 'best practices' for the use of information technology, consideration should be given to whether the practices are appropriate for the local conditions, or what type of change they imply for the prevailing institutional values. This process of innovation has to be carried out for each particular social setting when introducing information technology, which has its own enabling and restricting social structures. It is not necessary to start from scratch or reinvent the wheel on each occasion, but rather it is a matter of making sense of practices and arrangements by considering the potential of information technology in relation to local conditions.

This consideration of each local setting implies the consideration of the bureaucratic dimension. However, the economic/technical dimension must also be taken into account because it is one of the predominant institutionalized dimensions of Western societies and its application defines the new standards to which organizations are forced to adhere in order to retain their market. The two forces interact, so they must both be considered.

The limits of universal prescriptions for implementing information technology are demonstrated by this recognition of the specificity of each social setting according to the local conditions, as expressed in the plural institutionalized dimensions. However, general guidance on the development of information technology that highlights its potential can prove to be useful if those practices are then translated to the specific conditions of each case, taking into account the characteristics of the other institutionalized dimensions of the organization.

Addressing the social, political, and cultural aspects of system development projects is not a simple task. The recognition of an organization's institutionalized values is very difficult for a member of that organization, whose perception is shaped by those same institutionalized values. The taken-for-granted character of these values does not allow, or makes it difficult, for somebody immersed in a particular social setting to visualize alternatives. The intervention of consultants as third parties who can recognize the organization's values because of their outsider status can facilitate this kind of analysis. Their expertise will be of

value as long as it is reinterpreted in relation to the local conditions of the organization and is not seen as a universal prescription that can be applied unproblematically. These prescriptions usefully highlight the potential of information technology, but not the importance of considering local conditions.

The identification of institutionalized values can be undertaken by recognizing differences between various situations, for example by considering the perspective of other organizations through a qualitative analysis. For such purposes, the development of detailed case studies can prove beneficial if they apply structured theoretical models and are undertaken with a qualitative methodology. Case studies can illuminate alternatives and provide benchmarks for different situations, but these alternatives do not have to be followed as prescriptions. Instead, understanding a case study through a rich description of its social environment, as provided in this thesis, opens opportunities to interpret other local conditions from different perspectives. A case study could reveal that the organization's practices are only one among many ways of doing things. The analysis of local conditions from such a perspective helps to identify local practices by revealing their taken-for-granted character, emphasized through comparative analysis.

Consultants, as outsiders, can have a privileged position for understanding the political rationale because they are not immersed in the closed ideological system of the organization. However, they have to be aware of the rational values that are institutionalized in each specific case. Local conditions should not be addressed with a judgmental attitude, but should seek to understand the values, practices, social dynamics, and political positions of people in their social setting and how this can influence the development of a project. The central principles of the institutionalized environments should also be taken into account because they can be used as sources of power in the negotiations needed for the development of a specific system. In the process of building integrated systems, information technology has been recognized as much more than just a tool for automation, but rather as an organizational tool. Recognition of the institutionalized dimensions within the organization in question would also provide feasibility studies of projects with short-, medium- and long-term perspectives on both information systems development and organizational change.

10.2 MAIN FINDINGS OF THE PEMEX CASE STUDY

The Pemex case study described in this thesis highlights the impact of local conditions on the development of the organization and its information systems. Pemex is the most important company in Mexico because of its position as the state-owned oil company gives it a vital strategic role in the national economy. This study has focused on Pemex's strenuous efforts to modernize its operations through the heavy use of information technology. The local national and organizational conditions in which this has taken place have been analysed in terms of the institutions that shaped people's perceptions and behaviour. This has shown that in Mexico nationally and within the Pemex organization – as in modern society generally – the prevailing technological mode of production and bureaucratic mode of administration combined with other specific local features to constitute the social and cultural background of the case study. The social setting of the case study has therefore been conceived of as a plurality of institutionalized environments, each identified with specific core principles and sets of values. In this sense, information technology carries the values of the technological mode of production; but the potential of the use of information technology and its enabling capacity to promote new ways of operation can be cemented only if the institutionalized environment of the social setting is taken into account.

The study of the use of information systems in organizations has been developed with the aim of understanding this new phenomenon, which is itself changing. Information systems research builds this understanding by employing different perspectives, which are complementary in the sense that they enlighten different aspects of this phenomenon. The research for this thesis was carried out with an interpretivist approach on the basis of considering knowledge as a social construction that seeks to make sense of the world (Walsham 1993). It explores the interaction between the organizational change process and the use of information systems within a developing country, using institutional theory as a way to structure the understanding of the specificity of local conditions. This has been done by identifying the prevailing economic/technical and bureaucratic institutional dimensions and the impact they have on the process of changing the organization and its information systems and how the information systems development efforts had an impact the process of change of the organization. These dimensions represent the taken-for-granted values that determine people's actions.

The contribution of this research can be outlined at several levels. Firstly, it has applied a theoretical framework by using institutional theory to establish a structured understanding of the interaction between the social environment, the organizational change process, and information systems development in Pemex. Using (Berger, Berger, and Kellner 1973) and Scott and Meyer (1983) typology of the prevalent institutions of modern society, the research has been able to address the cultural impact of the social setting by recognizing the two main forces acting in the process that produces changes of the organization and its information systems development:

1. *homogenization* as the pervasive forces driving modernity, expressed in the trend towards a global organizational model shaped by the economic and technical rationale; and

2. *local conditions* that drive towards diversification, expressed in the values embedded in the bureaucratic institutional order of the local, contingent, and specific conditions of each particular environment.

An understanding of both these forces has enabled the research to address the difficult concept of 'culture', understood as shared values and norms that identify people as a group, (Mowshowitz 1980) (Wallerstein 1990) (Anthony 1994) (Korpela 1996) as well as the influence of that culture on both the organizational change process and information systems development. The research therefore understands institutions as the shared values and norms that are the taken-for-granted way of doing things within a specific social context. These institutions shape people's actions, at the same time as these actions reinforce the institutionalization of those values (Zucker 1983).

The research was able to identify at Pemex the institutionalized values embedded in information technology that shaped the company's development of automation and its organizational impact. This identification reinforces Lind's (1991) view that information technology is not value free. Without adopting the extreme position of technology determinism, this research throws light on the complexity implied in the implementation of software packages developed in industrialized countries that encompass models of reality which are different from the social contexts in which they are implemented (Lind 1991). For example, the implementation of SAP R/3 implies the transmission of institutionalized values that will not always suit local prevalent values; this is particularly important in the case of

Pemex because it has the institutionalized values of a state-owned company[80], for instance in terms of the lack of value placed within the company on structured quantitative data as a strategic source for decision taking. This understanding has been developed by taking an integrated perspective on the social setting, which differs from Hoefstede's model (Steinwachs 1999) that considers cultural aspects as variables.

This aspect of the research also offers insights into the content of change and its implications for understanding the impact of information technology use in a social environment. Automation implies the introduction of electronic processing to the organization's data flows, and systemization implies the redefinition of organizations processes' using the potential offered by information technology for integrating internal and external data flows. Automation and systemization imply social changes for the organization in terms of the power structure that controls information flows and job redesign (Avgerou and Cornford 1998). The implementation of such systems allows the organization to change its information flows with the outer world and to redefine its processes and types of links with economic partners (Henderson and Venkatraman 1993) (Bradley, Hausman, and Nolan 1993) (Drucker 1988) (Hammer and Champy 1993).

The type of content of change identified as informate (Zuboff 1988) implies the empowerment of workers by the provision of structured data as a strategic resource for decision taking and embeds institutional values arising from the economic/technical rationale. The automation and, more specifically, systemization types of change content provide the structured data, but do not necessarily imply that it will be used (Avgerou 1991) – and even if that data is used, it may not necessarily be employed in the way it was meant to within a modernization project. Information systems are usually developed to provide structured data for decision taking as well as to align the organization's operations according to an economic rationale and the need for economic maximization and technical optimization.

There is the need for further research to guide the practice of information systems development and organizational change in a way that takes account of changes in cultural and institutionalized values. Further understanding of information system projects that strive to

---

[80] Financial control of a market-driven organization is achieved through its income and cash flow, but in Pemex it is done through its budget allocations.

informate organizations is needed, especially in public organizations in which the use of structured data for decision taking is not necessarily an institutionalized practice (Madon 1994) (Avgerou 1991).

The research at Pemex brings to the particular context of developing countries immersed in the process of modernization an understanding of the vital role played by the forces of homogenization and local conditions in changing an organization and its information systems development. The pervasive homogenizing force of the economic and technical rationale is the *raison d'être* of market-oriented companies and is always embedded in any modernization effort. In other types of organization, like state-owned companies, this is not necessarily the case as their *raison d'être* is driven by other forces; at the same time, there are social pressures, in part perhaps promoted by information technology vendors, that oblige these organizations to strive for efficiency and effectiveness through the use of information technology. The bureaucratic force originating from the social context is the one driving the organization and its information systems towards the diversity that arises from the institutionalized values embedded in the local setting. The social settings of developing countries operate in accordance with different rationales that do not necessarily follow the values of the economic rationale (Avgerou 2000) (Lind 1991) (Korpela 1996).

The research also contributes guidance on practice. Markus (1983) has pointed out that the best prescription for an information system implementation strategy is through a diagnosis of the organizational setting in which the systems will be used. In this respect, the use of institutional theory has offered a way of diagnosing the social setting through the identification of the prevailing institutions of modern society and their interaction with the cultural specificity of local conditions, grounded on the understanding that this is a social construction of the observer (Walsham 1993). Such a structured understanding of the social setting can help to identify problems or specific needs that have to be addressed in implementing information systems development.

This aspect of the research also indicates the potential contributions and limitations that consultants can have, as outsiders, in identifying the institutional values of the organization in which they carry out their professional practice. In addition, the consultants should be conscious that specific institutionalized values embedded in their professional practices can be in conflict with those of the organization hosting them. This theoretical framework

enables research practitioners to identify conflicting values and, in the best conditions, ways of resolving them – or of at least recognizing, as some Pemex oil workers did, the limitations of their standard practices for achieving certain goals in a specific context.

Another practical guideline contributed by this research is the recognition of the interaction of the homogenization and local forces. This can help to identify the limits of implementing particular models, for example in the way Pemex has tried to apply the universal model of a global company to the specific social setting of a state-owned company in a developing country. The pressure to implement information systems will be there due to the pervasive character of information technology, but practitioners should be aware of the need to interpret the project implementation according to the specific conditions of the organization and to draw appropriate projects goals based on this contextualized understanding.

From a general perspective, the historical reconstruction of the use of information systems in Pemex is another contribution of this research. This has emphasized the value of local knowledge and the need to evaluate events within their context, both as social setting and in its historical period of time. This recognition strives for the elimination of the 'conquest syndrome' that belittles everything coming from the past by highlighting the need to consider past experience as an important source of knowledge in understanding current and future situations. As a leading-edge user of information technology in Mexico, Pemex's experiences reflect the way information systems have been developed more generally in this country. The findings of this research can therefore be extrapolated especially to other Mexican organizations to guide their future efforts in modernizing their operations through the use of information technology.

The research has built further understanding of how the process of change of an organization and its use of information technology is actually constructed by people acting in their daily lives (Orlikowski 1996). The application of this theoretical approach has special significance because the case study deals with the change process of an organization in a developing country. In the most recent period studied, from the early 1980s, Pemex undertook a process of expert-oriented planned change to transform itself into a global company. Even in this circumstance, the case study clearly shows how both the organizational change process and its information systems were constructed by the people acting in their social setting. It is in

this way that the research brings further understanding in illustrating how this construction has been built within the specific social setting at Pemex.

The empirical phase of this thesis ended in 1996, when Pemex was starting its implementation of SAP R/3 as part of a strategic organizational restructuring efforts aimed at transforming the company into a global enterprise whose operations would be controlled by an economic and technical rationale. In the six years since then, SAP R/3 is said to have begun operating, but research is needed to understand the true implications of its implementation. Further longitudinal research can also provide insights into the content of change in terms of: how the data and systems are being used. A comparative analysis of the implementation process of SAP R/3 in the four units of Pemex using different consultants companies could help to understand the impact of the different strategies used for the implementation. In addition, recent changes of administration nationally and within Pemex[81] create a rich new setting in which further research could valuably study the interaction of the social context, the process of organizational change, and information systems development.

In conclusion, the researcher would like to highlight the coexistence in modern societies of the homogenizing economic/technical force and the locally-situated bureaucratic force that drives towards diversity in organizational and information systems arrangements. This does not imply that a choice needs to be made to favour one or the other, but it does assert that both will be present and so there is a need to understand the balance between them. The research recognized that the values embedded in the technical and economic rationale encompass the pervasive character of information technology, which has generated what seems to be an unstoppable industrialization of modern society that has brought enormous benefits in terms of material well being – but not without costs. Local institutionalized values are also always present, and are the ones that provide identity to human beings. As both institutional dimensions are found in all societies and organizations, ultimately the outcomes of implementing information systems depend on how the balance is drawn between them to obtain benefits from the use of information technology.

---

[81] In December 1999, the administration in Pemex was changed when the strategist behind the process of change of the previous period was sacked on the grounds of misuse of discretionary power in the allocation of a large contract. The new General Director was Dr. Rogelio Montemayor, who came from the old tradition of politicians. By the end of 2000, a new public administration was formed by the right wing PAN party, after almost 70 years of hegemony by the PRI party. A senior executive of a private petrochemical company, Raúl Muñoz Leos, was appointed as the new General Director of Pemex.

11 REFERENCES

Administración, Dirección Corporativa de. "Manual de Organización Básica de Petróleos Mexicanos y Organismos Subsidiarios.": México, D.F.: Instituto Mexicano del Petróleo, 1994.

Agarwal, R., and V. Sambamurthy. "Principles and Models for Organizing the IT Function." *MIS Quarterly Executive* 1, no. 1, 2002.

Aguilar Monteverde, A. *Globalización y Capitalismo*. México, D.F.: Plaza Janés, 2002.

Albrow, M. *Bureaucracy*. London: Macmillan, 1979.

Angell, I., and S. Smithson. *Information Systems Management Opportunities and Risks*. First ed. London: Macmillan Information Systems Series, 1991.

Anthony, P. *Managing Culture*. First ed. Suffolk: Open University Press, 1994.

Atkinson, P. and M. Hammersley. "Ethnography and Participant Observation." In *Strategies of Qualitative Inquiry*, ed. D. Norman and I. Lincoln. California: Sage Publications, 1998.

Avgerou, C. "Creating Information Systems Infrastructure for Development Planning." In the Proceedings of the 12th Annual International Conference on Information Systems, New York: December, 1991.

Avgerou, C. "The Multiple Rationalities of Information Systems Deployment." In the Proceedings of the Information Flows, Local Improvisations and Work Practices, International Federation of Information Processing Working Group 9.4 on Social Implications of Computers in Developing Countries, Cape Town, May 23-26, 2000.

Avgerou, C. *Information Systems and Global Diversity*. New York: Oxford University Press, 2002.

Avgerou, C. and T. Cornford. *Developing Information Systems - Concepts, Issues and Practice.* Second ed. Macmillan Information Systems Series. London: 1998.

Awad, E. *Management Information Systems.* California: The Benjamin/Cummings Publishing Company, Inc., 1988.

Bada, A. "Actually Existing Globalization: A Case Study of Technology-based organizational Transformation within the Nigerian Banking System." In the Proceedings of the Information Flows, Local Improvisations and Work Practices, International Federation of Information Processing Working Group 9.4 on Social Implications of Computers in Developing Countries, Cape Town, May 23-26, 2000.

Bauman, Z. "Modernity and Ambivalence." In *Global Culture Nationalism, Globalization and Modernity A Theory, Culture & Society Special Issue,* ed. M. Featherstone. London: SAGE Publications, 1990.

Bauman, Z. *Globalization The Human Consequences.* New York: Columbia University Press, 1998.

Beer, M., A. Eisenstat, and B. Spector. "Why Change Programs don't Produce Change." *Harvard Business Review,* no. November - December, 1990: 158-166.

Bell, Daniel. *The Coming of the Post-industrial Society.* London: Heinemann, 1973.

Berger, P., B. Berger, and H. Kellner. *The Homeless Mind Modernization and Consciousness.* Middlesex: Penguin Books, 1973.

Berlin, I. "Philosophy and Life: An Interview by Ramin Jahanbegloo." *The New York Books Review,* May 28, 1992.

Bjorn-Andersen, N. Turner, and J. Turner. "Creating the Twenty-First Century Organization: The Metamorphosis of Oticon." In proceedings of the IFIP WG8.2

Working Conference on Information Technology and New Emergent Forms of Organization, Ann Arbor, Michigan, USA, 11-13 August, 1994, ed. R. Baskerville, S. Smithson, O. Ngwenyama, and J. DeGross. New York: North-Holland, 1994.

Blackler, F. "Information Technology Design and Planned Organization Change: Applying Unger's Theory of Social Reconstruction." *Behaviour & Information Technology* 11, no. 3, 1992: 175 - 183.

Bradley, S., J. Hausman, and R. Nolan. "Global Competition and Technology." In *Globalization, Technology and Competition: the Fusion of Computers and Telecommunications in the 1990's*, ed. S. Bradley, J. Hausman, and R. Nolan. Boston: Harvard Business School Press, 1993.

Broadbent, M., P. Weill, and D. St Clair. "The Implications of Information Technology Infrastructure for Business Process Redesign." *MIS Quarterly* 23, no. 2, 1999.

Bueno, G. "Petróleo y Planes de Desarrollo en México." In *Energía en México Ensayos sobre el Pasado y el Presente*, ed. Miguel. Wionczeck. México, D.F.: El Colegio de México, 1982.

Calitz, A. "Transforming Work Practices with IT - A South African Case Study in the Manufacturing Environment." In the Proceedings of the Information Flows, Local Improvisations and Work Practices, International Federation of Information Processing Working Group 9.4 on Social Implications of Computers in Developing Countries, Cape Town, May 23-26, 2000.

Calva-Mercado, A. *El Desempleo en México durante 1998*. México, D.F.: Acus Consultores, S.C., 1999.

Cantarell, A., and M. González. *Historia de la Computación en México - Una Industria en Expansión*. México, D.F.: Hobbiton Editores, 2000.

Cash, Jr. J., W. McFarlan, and James. McKenney. *Corporate Information Systems Management*. Homewood, Ill.: Irwin, 1988.

Castells, M. *La Era de la Información: Economía, Sociedad y Cultura*. Cuarta edición en español 2002 ed.: México, D.F.: Siglo Veintiuno Editores, S.A. de C.V., 1999.

Ciborra, C. "Reframing the Role of Computers in Organizations - The Transactions Cost Approach." *Office: Technology and People*, no. 3, 1987: 17-38.

Ciborra, C. "From Thinking to Tinkering: The Grassroots of Strategic Information Systems." In the Proceedings of the 12th Annual International Conference on Information Systems, New York: December, 1991.

Ciborra, C. "A Platform for Surprises: The Organization of Global Technology Strategy at Olivetti.". In proceedings of the IFIP WG8.2 Working Conference on Information Technology and New Emergent Forms of Organization, Ann Arbor, Michigan, USA, 11-13 August, 1994, ed. R. Baskerville, S. Smithson, O. Ngwenyama, and J. DeGross. New York: North-Holland, 1994.

Ciborra, C. "Improvisation and Information Technology in Organizations." In proceedings of the ICIS, Cleveland, USA, December 1996.

Ciborra, C. "De Profundis? Deconstructing the Concept of Strategic Alignment." *Scandinavian Journal of Information Systems*, no.91, 1998.

Clark, I. *Globalization and Fragmentation: International Relations in the Twentieth Century*. Oxford: Oxford University, 1997.

Coe, L. "Five Small Secrets to Systems Success." In *Strategies for Managing Computer Software Upgrades*, ed. N. Shaw. Texas: IDEA Group Publishing, 2001.

Contreras, A. J. *México 1940: Industrialización y Crisis Política*. México, D.F.: Siglo Veintiuno Editores, S.A., 1980.

Coordinación Ejecutiva de Recursos Humanos, Petróleos Mexicanos. "Acuerdo del Señor Subdirector Técnico Administrativo." In *Asunto: Organización de la Microestructura de la Gerencia de Informática Institucional*: México, D.F.: Petróleos Mexicanos, 1985.

Copeland, D.G. and J. McKenney"Airline Reservation Systems: Lessons from History." *MIS Quarterly* 12, no. 3 September 1988: 353-370.

Cordera, R., and C. Tello. *México la Disputa de la Nación Perspectivas y Opciones de Desarrollo*. México, D.F.: Siglo Veintiuno Editores, 1981.

Cross, J., E. Michael, and J. Sampler. "Transforming of the IT Function at British Petroleum." *MIS Quarterl*, no. December, 1997: 401-423.

Chandler, A. Jr. *Strategy and Structure*. Cambridge: MIT Press, 1962.

Chandler, J., and P. Holzer. "A Contingency Approach to Planning and Control to the MIS Function." In *Management Information Systems*, ed. J. Chandler and P. Holzer. Oxford: Basil Blackwell Ltd., 1988.

Checkland, P. *Systems Thinking, Systems Practice*. New York: John Wiley & Sons, 1981.

Child, J. *Organization A Guide to Problems and Practice*. Second ed. London: Paul Chapman Publishing Ltd., 1984.

Daft, R. *Organization Theory and Design*. New York: West Publishing Company, 1995.

Dahlbom, B., and L. Mathiassen. *Computers in Context The Philosophy and Practice of Systems Design*. 2000 ed. Oxford: Blackwell, 1993.

Danowitz, A., Y. Nassef, and S. Goodman. "Cyberspace Across the Sahara: Computing in North Africa." *Communications of the ACM* 38, no. 12 1995:23-28.

Davenport, T. "Putting the Enterprise into the Enterprise System." *Harvard Business Review,* no. July- August, 1998: 121-131.

Davenport, T., and J. Short. *The New Industrial Engineering: Information Technology and Business Process Redesign.* Cambridge, Massachusetts: Center of Information Systems Research, Mass. Institute of Technology, Sloan School of Management, 1990, CISR WP No. 213.

Davies, L., and G. Mitchel. "The Dual Nature of the Impact of IT on Organizational Transformations." In proceedings of the IFIP WG8.2 Working Conference on Information Technology and New Emergent Forms of Organization, Ann Arbor, Michigan, USA, 11-13 August, 1994, ed. R. Baskerville, S. Smithson, O. Ngwenyama, and J. DeGross. New York: North-Holland, 1994.

De León, S. *Las Crisis Evitables de México.* México, D.F.: CV Ediciones, 2000.

DiMaggio, P., and W. Powell. "Introduction." In *The New Institutionalism in Organizational Analysi,* ed. Paul. DiMaggio and Walter. Powell. Chicago: The Chicago Press, 1991.

Drucker, P. "The Coming of the New Organization." *Harvard Business Review,* no. January - February 1988: 45-53.

Duran, E. "El Petróleo Mexicano en la Primera Guerra Mundial." In *Energía en México Ensayos sobre el Pasado y el Presente,* ed. M. Wionczek. México, D.F.: El Colegio de México, 1982.

Eccles, R., and R. Nolan. "A Framework for the Design of the Emerging Global Organization Structure." In *Globalization, Technology and Competition: the Fusion of Computers and Telecommunications in the 1990's,* ed. S. Bradley, J. Hausman, and R. Nolan. Boston, Mass: Harvard College, 1993.

Economist, The. "A Question of Communication, A Survey of Information Technology." *The Economist.* no. June 16, 1990: 1-38.

Escobedo, G. *La Deuda: Encrucijada Mundial.* México, D.F.: Somex-CEMLA, 1985.

Featherstone, M. "Introduction." In *Global Culture Nationalism, Globalization and Modernity A Theory, Culture & Society,* ed. M. Featherstone. London: SAGE Publications, 1990.

Friedland. R., and R. Alford. "Bringing Society Back in: Symbols, Practices, and Institutional Contradictions." In *The New Institutionalism in Organizational Analysis,* ed. P. DiMaggio and W. Powell. Chicago: The Chicago Press, 1991.

Galbraith, J. "Organization Design: An Information Processing View." In *Organization Planning Cases and Concepts,* ed. J. Lorsch and P Lawrence. Homewood Ill.: R D Irwin, 1972.

Galliers, R. "Choosing Information Systems Research Approaches." In *Information Systems Research Issues, Methods and Practical Guidelines,* ed. R. Galliers. Oxford: Blackwell Scientific Publications, 1992.

Galliers, R., S. Madon, and R. Rashid. "Information Systems and Culture: Applying 'Stages Growth' Concepts to Development Administration." *Information Technology for Development* 8, no. 2, 1998: 89-100.

Galliers, R, and A. Sutherland. "Information Systems Management and Strategy Formulation: the Stages of Growth Model Revised." *Journal of Information Systems* 1, no. 1, 1991: 89-114.

García Hernández, J. *Decisión Inesperada: Expropiación Petrolera,.* México, D.F: Edición doméstica, 1971.

Giddens, A. *Un Mundo Desbocado, Los Efectos de la Globalización en Nuestras Vidas.* México, D.F.: Taurus, 2000.

Grint, K., P. Case, and L. Willcocks. "Business Process Reengineering Reappraised: The Politics and Technology of Forgetting." In *Information Technology and Changes in Organizational Work*, proceedings of the IFIP WG8.2 Working Conference on Information Technology and Changes in Organizational Work, December 1995 University of Cambridge. ed. W. Orlikowski, G. Walsham, M. Jones, and J. DeGross. London: Chapman & Hall (IFIP), 1996.

Gurría Treviño, Á. "La Restructuración de la Deuda: El Caso de México." In *Deuda Externa y Política de Ajuste El Caso de México*, ed. S. Griffith-Jones. México, D.F.: Fondo de Cultura Económico, 1988.

Gutiérrez, R. "Cambios de Matiz en la Estrategia Económica de México: Los Años Setenta y Ochenta." In *Energía en México Ensayos sobre el Pasado y el Presente*, ed. M. Wionczeck. México, D.F.: El Colegio de México, 1982.

Hammer, M. "Reengineering Work: Don't Obliterate." *Harvard Business Review* , no. July-August 1990: 104-112.

Hammer, M. , and J. Champy. *Reengineering the Corporation: A Manifesto for Business Revolution*. London: Nicholas Brealey, 1993.

Handy, C. *Understanding Organisations*. London, UK: Penguin, 1985.

Henderson, John, and N. Venkatraman. *Strategic Alignment: A Process Model for Integrating Information Technology and Business Strategies*. Massachusetts, USA: Center for Information Systems Research, Sloan School of Management. Massachusetts Institute of Technology, 1989, CISR WP No. 196.

Henderson, J., and N. Venkatraman. "Strategic Alignment: Leveraging Information Technology for Transforming Organizations." *IBM Systems Journal* 32, no. 1, 1993: 4-16.

Henderson, P. "Business Processes, Legacy Systems and a Fully Flexible Future." In *Systems Engineering for Business Process Change*, ed. P. Henderson. New York: Springer, 2000.

Hirschheim, R. "A Critical Analysis of Information Systems." In the proceedings of the IFIP WG8.2 Working Conference on Information Systems Assessment, Noordvijkerhout, the Netherlands, 27-29 August, 1986 ed. N. Bjorn-Andersen and G. Davis. Oxford : North-Holland, 1988.

Hirschheim, R., F.. Land, and S. Smithson. "Implementing Computer-based Information Systems in Organizations: Issues and Strategies." In *Human Computer Interaction*, ed. B. Schakel. Amsterdam: North-Holland, 1984.

Históricos, Centro de Estudios. *Historia General de México*. Two vols. México, D.F.: El Colegio de México, 1981.

Hollings, E. "Debating NAFTA Reform Mexico First." *Foreign Policy* 93, no. Winter 1993-94:91-103

Institucional, Gerencia de Informática. "Descripción de los Sistemas Institucionales." In *Informática y Sistemas*. Petróleos Mexicanos, México D.F.: 1992.

Institucional, Gerencia de Informática. "Sistemas Institucionales y su Definición." In *Petrofinanzas*. Petróleos Mexicanos, México D.F.: 1990.

Ives, B., S. Jarvenpaa, and R. Mason. "Global Business Drivers: Aligning Information Technology to Global Business Strategy." *IBM Systems Journal* 32, no. 1, 1993: 143-161.

Jones, M. "Don't Emancipate, Exaggerate: Rhetoric, Reality and Reengineering." In proceedings of the IFIP WG8.2 Working Conference on Information Technology and New Emergent Forms of Organization, Ann Arbor, Michigan, USA, 11-13 August, 1994, ed. R. Baskerville, S. Smithson, O. Ngwenyama, and J. DeGross. New York: North-Holland, 1994.

Kanter, R., B. Stein, and T. Jick. *The Challenge of Organizational Change How Companies Experience it and Leaders Guide it.* New York: The Free Press Macmillan, 1992.

Kanungo, S. and M. Chouthoy. "IT Planning in India: implication for IT effectiveness." *IT for development* 8, no. 2, 1998: 71-87.

Kaplan, M. *Crisis y Futuro de la Empresa Pública.* México, D.F.: UNAM - Pemex, 1994.

Keen, J. *Managing Systems Development.* Chichester : Wiley, 1987.

Keen, P. "Information Systems and Organizational Change." *Communications of the ACM* 24 No. 1, no. January, 1981: 24-33.

Kirk, D. , V. Grover, and J. Teng. "Information Technology-enabled Change: Risks and Rewards of Business Process Redesign and Automation." *Journal of Information Technology* , no. 9, 1994: 267-275.

Klenke, K. "Information Technologies as Drivers of Emergent Organizational Forms: A Leadership Perspective." In Proceedings of the IFIP WG8.2 Working Conference on Information Technology and New Emergent Forms of Organization, Ann Arbor, Michigan, USA, 11-13 August, 1994, ed. R. Baskerville, S. Smithson, O. Ngwenyama, and J. DeGross. New York: North-Holland, 1994.

Korpela, M. "Traditional Culture or Political Economy? On the Root Causes of Organizational Obstacles of IT in Developing Countries." *Information Technology for Development*, no. 7, 1996: 29-42.

Kovacevic, A., and N. Majluf. "Six Stages of Information Technology Strategic Management." *Sloan Management Review* no. Summer, 1993: 77-87.

Kraemer, K., and J. King. "Social Analysis in MIS: the Irvine School, 1970-1990." In proceedings of the of Twenty-Third Annual Hawaii International Conference on Systems Sciences, California, 1990.

Kraft, P., and D. Truex. "Postmodern Management and Information Technology in the Modern Industrial Corporation." In Proceedings of the IFIP WG8.2 Working Conference on Information Technology and New Emergent Forms of Organization, Ann Arbor, Michigan, USA, 11-13 August, 1994, ed. R. Baskerville, S. Smithson, O. Ngwenyama, and J. DeGross. New York: North-Holland, 1994.

Labastida Ochoa, F. "Preface." In *Crisis y Privatización de la Empresa Pública*. México, D.F.: Grupo Editorial Miguel Ángel Porrúa S.A., 1983.

Land, F. and R. Hirshheim. "Participative Systems Design: Rationale, Tools and Techniques." *Journal of Applied Systems Analysis* no.10, 1983: 91-107.

Land, F., E. Mumford, and Hawgood. "Training the Systems Analyst of the 1980's: Four Analytical Procedures to Assist the Design Process." In *The Information Systems Environment*, ed. H. Lucas. Oxford: Noth-Holland, 1980.

Laudon, K. and J. Laudon. *Management Information Systems New Approaches to Organization & Technology*. Seventh ed. Upper Saddle, New Jersey: Prentice Hall International, Inc., 1998.

Lawrence, P. and J. Lorsch. *Organization and Environment: Managing Differentiation and Integration*. Boston: Harvard Business School Press, 1967.

Leavitt, H. and T. Whisler. "Management in the 1980's." *Harvard Business Review* , no. November - December 1958: 267 - 274.

Leavitt, T. "The Globalization of Markets." *Harvard Business Review* no. May-June, 1983: 92-102.

Lederer, A. and V. Sethi. "Critical Dimensions of Strategic Information Systems Planning." *Decisions Sciences* no.22, 1991: 104-119.

Lind, P. *Computerization in Developing Countries Model & Reality.* London: Routledge, 1991.

Lind, P. "On the Applicability of a Computer Model for Business Performance Analysis in SME's: a Case Study from Chile." *Information Technology for Development* 9, no. 2 2000: 33-44.

Lindblom, l. "The Science of Muddling Through." *Public Administratio,* no.19, 1959:79-88.

Long, L. *Management Information Systems.* Upper Saddle River, NJ: Prentice-Hall International, Inc., 1989.

López Gallo, M. *Economía y Política en la Historia de México.* México, D.F.: Ediciones "El Caballito", S.A., 1973.

Lucas, H. *Managing Information Services.* London: Macmillan Publishing Company, 1989.

Madnick, S. "The Information Technology Platform." In *The Corporation of the 1990's Information Technology and Organizational Transformation. Information Technology and Organizational Transformation,* ed. M. Scott Morton. New York: Oxford University Press, 1991.

Madon, S. "The Indian Computerized Rural Information System Project." In *Information Technology Policies and Applications in the Commonwealth Developing Countries,* ed. M. Odedra and J. Liebenau. London: Commonwealth Secretariat, 1993.

Madon, S. *Designing Information Systems for Development Planning.* First ed. Lavenham, Suffolk: Alfred Waller Ltd. Publishers, 1994.

Margain, E. *Los Intereses, el Poder y la Distribución del Ingreso en Relaciones Internacionales Altamente Asimétricas: El Tratado de Libre Comercio y la Crisis del Neoliberalismo Mexicano.* México, D.F.: Universidad Nacional Autónoma de México, 1995.

Markus, M. "Power Politics and MIS Implementation". *Communication of the ACM* 26, no.6, 1983:430-444.

Martin, J. *Managing the Data Base Environment.* Englewood, Cliffs, N.J.: Prentice-Hall, Inc., 1983.

Méndez, J. S. *Problemas Económicos de México.* México, D.F.: McGraw-Hill Inrteramericana Editores, S.A, de C.V., 1998.

Mexicanos, Petróleos. "Cuadro Comparativo entre el Decreto que Crea la Institución de Petróleos Mexicanos; al Ley Orgánica de Petróleos Mexicanos y la Ley Orgánica de Petróleos Mexicanos y Organismos Subsidiarios." *Información Legislativa LEX.* México, D.F.: Petróleos Mexicanos, 1993a.

Mexicanos, Petróleos. "Reglamento de la Función Informática para Petróleos Mexicanos y sus Organismos Subsidiarios." , ed. Dirección Corporativa de Finanzas: México, D.F.: Petróleos Mexicanos, 1993b.

Mexicanos, Petróleos. "Lineamientos Básicos de la Reestructuración." , ed. Comité de Transición: México, D.F.: Petróleos Mexicanos, 1992a.

Mexicanos, Petróleos. "Proyecto de Reorganización de Petróleos Mexicanos." : México, D.F.: Petróleos Mexicanos, 1992b.

México, Banco de. *Informe Anual.* México, D.F.: Banco de México, 1993.

México, Gobierno de. *El Petróleo en México - Recopilación de Documentos Oficiales del Conflicto de Orden Económico de la Industria Petroleras*. D.F., México: Gobierno de México, 1940.

Meyer, J. and B. Rowan. "Institutionalized Organizations: Formal Structure as Myth and Ceremony." *American Journal of Sociology*, no.83, 1977: 340-363.

Meyer, J., and B. Rowan. "Institutionalized Organizations: Formal Structure as Myth and Ceremony." In *The New Institutionalism in Organizational Analysis*, ed. W. Powell and P. DiMaggio. Chicago: Chicago University Press, 1991.

Meyer, J. and R. Scott. "Centralization and the Legitimacy Problems of Local Governments." In *Organizational Environments: Ritual and Rationality*, ed. John. Meyer and R. Scott. California: Sage, 1983.

Meyer, L. *México y los Estados Unidos en el Conflicto Petrolero 1917-1942*. México, D.F.: El Colegio de México, 1981.

Meyer, L. "Los Petroleros Británicos, el Nacionalismo Mexicano y el Gobierno de su Majestad Británica (1901-1947)." In *Energía en México - Ensayos sobre el Pasado y el Presente*, ed. M. Wionczek. México, D.F.: El Colegio de México, 1982.

Meyer, L. and I. Morales. *Petróleo y Nación (1900-1987) La Política Petrolera en México*. México D.F.: Fondo de Cultura Económica, 1990.

Miles, R., and C. Snow. *Organizational Strategy, Structure and Process*. New York: McGraw Hill, 1978.

Mowshowitz, A. *Ethics and Cultural Integration in a Computerized World*. North Holland Publishing Company, 1980.

Mumford, E. *Designing Human Systems for New Technology Ethics the Method*. Manchester: Manchester Business School, 1983a.

Mumford, E. "Participative Systems Design: Practice and Theory." *Journal of Occupational Behaviour* Vol. 4 1983b: 47-75.

Nolan, R. "Managing the Crisis in Data Processing." *Harvard Business Review* 57, no. 2, March-April, 1979: 115-126.

Noriega Blanco, P. "La Política Informática de México." *Boletín de Política Informática* XV, no. 1 1992: 4-11.

O'Brien, R. *Global Financial Integration: The End of Geography*. London: Pinter Publishers, 1992.

OECD. *New Technologies in the 1990s. A Socio-economic Strategy*. Paris: OECD, 1988.

Ohmae, K. *The Borderless World*. London: HaperCollins Publishers, 1990.

Ojo, S. "Socio-Cultural and Organizational Issues in IT Applications in Nigeria." In *Social Implication of Computers in Developing Countries*, ed. S. Bhatnagar and O. Odedra. New Delhi: Tata McGraw Hill Publishing. Co. Ltd., 1992.

Orlikowski, W. "The Duality of Technology: Rethinking the Concept of Technology in Organizations." *Organization Science* 3, no. 3, 1992: 398 - 427.

Orlikowski, W. "Improvising Organizational Transformation over Time: A Situated Change Perspective." *Information Systems Research* 7, no. No.1, March, 1996: 63-92.

Ortega San Vicente, A. "Marco Jurídico-Político del Petróleo en México: Apuntes para su Estudio y Comentarios sobre la Nueva Ley Orgánica de la Industria." *Información Legislativa LEX*. México, D.F.: Petróleos Mexicanos, 1993.

Ortiz Wadgymar, A. *Política Económica de México 1982-1995. El Fracaso Neoliberal*. México, D.F.: Editorial Nuestro Tiempo, S.A., 1997.

Ortiz Wadgymar, A. and R. Núñez. "Perspectiva de la Economía Mexicana 1996-2000 (El México Post- TLC con el Avance Político de la Oposición)." In *La Economía Mexicana al Filo del Cambio*. México, D.F.: Editorial Nuestro Tiempo, 1998.

Paz, O. *El Laberinto de la Soledad*. México, D.F.: Fondo de Cultura Económica, 1981.

Pellicer, O. "La Política Estadounidense y el Petróleo Mexicano." In *Energía en México Ensayos sobre el Pasado y el Presente*, ed. Miguel. Wionczeck. México, D.F: Colegio de México, 1982.

Peters, T. and R. Waterman. *In Search of Excellence*. New York: Harper & Row, 1982.

Pettigrew, A. "Contextualist Research: A Natural Way to Link Theory and Practices." In Proceedings of the Conference on Conducting Research with Theory and Practice in Mind, Center for Effective Organizations, University of Southern California, Los Angeles, California, November 1983.

Pettigrew, A. *The Awakening Giant - Continuity and Change in ICI*. First ed. Oxford: Basil Blackwekk Ltd., 1985.

Pettigrew, A., E. Ferlie, and L. Mckee. *Shaping Strategic Change*. London: SAGE, 1992.

Polany, K. *The Great Transformation*. Boston: Beacon Press, 1957.

Poniatowska, E. *La Noche de Tlatelolco*. México, D.F.: Biblioteca Era, 1997.

Porter, M. *Competitive Strategy*. New York, USA: Free Press, 1980.

Porter, M. "How Information Technology Gives Comptetive Advantage". *Harvard Business Review* 63, No.4 1985:149-160.

Prevot-Schapira, M. F. "Los Trabajadores del Petróleo y el Poder Sindical en México." In *El Petróleo en México - Recopilación de Documentos Oficiales del Conflicto de*

Orden Económico de la Industria Petroleras, ed. M. Wionczek. México, D.F.: El Colegio de México, 1982.

Ramarapu, N. and A. Lado. "Linking Information Technology to Global Business Strategy to Gain Competitive Advantage: An Integrated Model." *Journal of Information Technology* no.10, 1995: 115-124.

Ramírez, S. *El Mexicano, Psicología de sus Motivaciones.* México, D.F.: Enlace, Grijalbo, 1977.

República, Gobierno de la. "Programa de Ajuste de la Política Económica de México." México, D.F.: Gobierno de la República, 1982.

Riding, A. *Distant Neighbors A Portrait of the Mexicans.* New York: Vintage Books, 1989.

Robertson, R."Mapping the Global Condition: Globalization as the Central Concept." In *Global Culture Nationalism, Globalization and Modernity A Theory, Culture & Society Special Issue*, ed. Featherstone M. London: SAGE Publications, 1990.

Robey, D. "Implementing Information Systems in Developing Countries: Organizational and Cultural Considerations." In Proceedings of the Conference IFIP TC9/TC8 Working Conference on The Impact of Information Systems in Developing Countries, New Delhi, 1988.

Rockart, J. *A Perspective on Information Technology in the Process - Oriented Organization.* Cambridge, Mass.: Center of Information Systems Research, Sloan School of Management, Massachusetts Institute of Technology, 1991a, CISR WP No. 224.

Rockart, J. and D. Hofman. *Improving Systems Delivery: A Managerial Perspective.* Cambridge, Mass.: Center for Information Systems Research, Sloan School of Management, Massachusetts Institute of Technology, 1991b, CISR WP No. 223.

Rotemberg, J. and G. Saloner. "Interfirm Competition and Collaboration." In *The Corporation of the 1990's Information Technology and Organizational Transformation. Information Technology and Organizational Transformation*, ed. M. Scott Morton. New York: Oxford University Press, 1991.

Rumelt, R. *Strategy, Structure and Economic Performance.* Boston: Harvard Business School, 1974.

Sachs, J. "Development: A Guide to the Ruins." *New Internationalist* , no. No.232, June, 1992.

Sahay, S. and G. Walsham. "Information Technology in Developing Countries a Need for Theory Building." *Information Technology for Development* no. 6, December, 1995: 111-124.

Sampson, A. *The Seven Sisters.* London: Coronet Books, Hodder and Stoughton, 1988.

Sánchez, M. Á. and T. Bardacke. "La Reestructuración Forzada." *Este País,* Marzo, 1992: 2-12.

Scott Morton, M. *The Corporation of the 1990's Information Technology and Organizational Transformation. Information Technology and Organizational Transformation.* New York: Oxford University Press, 1991.

Scott, R. and J. Meyer. "The Organization of Societal Sectors." In *Organizational Environments: Ritual and Rationality*, ed. J. Meyer, and R. Scott. California: SAGE, 1983.

Schein, E. *Organizational Culture and Leadership.* 2nd ed. San Francisco: Jossey-Bass, 1992.

Secretaría de Energía, Minas e Industria Paraestatal. "Ley Orgánica de Petróleos Mexicanos y Organismos Subsidiarios." *Diario Oficial de la Federación*, July 12 1992.

Shulgovski, A. *México en la Encrucijada de su Historia*. México, D.F.: Ediciones de Cultura Popular, 1977.

Silva, L. and J. Backhouse. "Becoming Part of the Furniture: The Institutionalization of Information Systems." In *Information Systems and Qualitative Research*, ed. L. Allen, J. Liebenau, and J. DeGross. London: Chapman and Hall, 1997.

Simpson, J. A. and Weiner E. *The Oxford English Dictionary*. 2nd ed. Oxford: Clarendon, 1989.

Solís, L. *La Realidad Económica Mexicana: Retrovisión y Perspectivas*. México, D.F.: Siglo Veintiuno Editores, S.A., 1981.

Sprague, R. and B. McNurlin. *Information Systems Management in Practices*. London : Prentice-Hall, 1993.

Steinwachs, K. "Information and culture - the impact of national culture on information processes." *Journal of Information Science* 25, no. 3, 1999: 193-204.

Subdirección de Planeación y Coordinación, Pemex. *Base de Datos Institucional Manual de Usuario*. Vol. Versión 1.0. México, D. F.: Petróleos Mexicanos, 1992.

Tello, C. *La Nacionalización de la Banca en México*. México, D.F.: Siglo Veintiuno Editores, 1985.

Tello, C. *La Política Económica en México 1970-1976*. México, D.F.: Siglo Veintiuno Editores, 1993.

Thorne, F. "Exploiting the Strategic Value of Information." In *Management Information Systems*, ed. J. Chandler and P. Holzer. Oxford: Basil Blackwell, 1988.

Todorov, T. *La Conquista de América*. 8th ed. México, D.F.: Siglo Veintiuno Editores, 1997.

Touraine, A. "The Idea of Revolution." In *Global Culture Nationalism, Globalization and Modernity A Theory, Culture & Society Special Issue*, ed. M. Featherstone. London: SAGE Publications, 1990.

Tricker, R.I. "The Management of Organizational Knowledge." In *Information Systems Research Issues, Methods and Practical Guidelines*, ed. R. Galliers. Oxford: Blackwell Scientific Publications, 1992.

Trist, E. and L. Branforth. "Some Social and Psychological Consequences of the Longwall Method of Coal Getting." *Human Relations* , no. 4, 1951: 3 - 38.

Van Der Blonk, H. "Institutionalization and Legitimation of Information Technologies in Local Contexts." In the Proceedings of the Information Flows, Local Improvisations and Work Practices, International Federation of Information Processing Working Group 9.4 on Social Implications of Computers in Developing Countries, Cape Town, May 23-26, 2000.

Van Ryckeghem, D. "Implementation of Information Technology: Socio-Cultural Issues." In *Social Implication of Computers in Developing Countries*, ed. S. Bhatnagar and M. Odedra. New Delhi, India: Tata McGraw Hill Publishing. Co. Ltd., 1992.

Venkatraman, N., and J.E. Short. *From Order-Entry to Valued-Added Partnerships at Baxter*. Cambridge, Mass.: Massachusetts Institute of Technology, Sloan School Working Paper, 1990.

Villareal, R. "Deuda Externa y Política de Ajuste El Caso de México 1982-1986." In *Deuda Externa, Renegociación y Ajuste en la América Latina*, ed. S. Griffith-Jones. México, D.F.: Fondo de Cultura Económica, 1988.

Villegas Moreno, G. *La Industria Petrolera en México Cronología 1857-1988 - 50 Aniversario*. México D.F.: Petróleos Mexicanos, 1988.

Volkow, N. "Strategic Use of Information Technology Requires Knowing How to Use Information." In *Information Technology in Context: Studies form the Perspective of Developing Countries*, ed. C. Avgerou and G. Walsham. Aldershot: Ashgate, 2000.

Walsham, G. "Information Systems as Social Systems: Implications for Developing Countries." In Proceedings of the Conference IFIP TC9/TC8 Working Conference on The Impact of Information Systems in Developing Countries, New Delhi, 1988.

Walsham, G. "Decentralization of Information Systems in DC's: Power to the People?" In *Social Implications of Computers in Developing Countries*, ed. S. Bhatnagar and M. Odedra, 197-217. New Delhi: Tata McGraw-Hill, 1992.

Walsham, Geoff. *Interpreting Information Systems in Organizations*. Sussex: Wiley Series in Information Systems, 1993.

Walsham, G. *Making a World of Difference IT in a Global Context*. Chichester: Wiley, 2001.

Wallerstein, I. "Culture as the Ideological Battleground of the Modern World-System." In *Global Culture Nationalism, Globalization and Modernity A Theory, Culture & Society Special Issue*, ed. Featherstone M. London: SAGE Publications, 1990.

Warner, B. and G. H. Litwin. "A Causal Model of Organizational Performance." *Developing Human Resources* , no. Annual 1989: 277-288.

Westney, E. *Imitation and Innovation - The Transfer of Western Organizational Patterns to Meiji Japan*. London: Harvard University Press, 1987.

Westrup, C. "What's in Information Technology? Issues in Deploying IS in Organizations and Developing Countries." In Proceedings of the Conference IFIP WG 9.4 Implementation and Evaluation of Information Systems in Developing Countries, Bangkok, Thailand, 1998.

Woherem, Evans. "Strategy for Indigenisation of Information Technology in Africa." In *Social Implications of Computers in Developing Countries*, ed. S. Bhatnagar and O. Mayuri. New Delhi, India: Tata McGraw Hill Publishing Co. Ltd., 1992.

Worsley, P. "Models of the Modern World-System." In *Global Culture Nationalism, Globalization and Modernity A Theory, Culture & Society Special Issue*, ed. Featherstone. London, UK: SAGE Publications, 1990.

Wuthnow, R., H. Bergesen, and E. Kurzweil. *Cultural Analysis*. Boston: Routledge and Kegan Paul, 1984.

Yergin, Daniel. *The Price*. New York: Simon & Schuster, 1991.

Zuboff, S. *In the Age of Smart Machine The Future of Work and Power*. New York: Harper Collins Publishers, 1988.

Zucker, L. "Organizations as Institutions." *Research in the Sociology of Organizations* 2, 1983: 1-47.

Zucker, L. "Institutional Theories of Organization." *Sociology* , no. Annual Review, 1987: 443-464.

Zucker, L. "The Role of Institutionalization in Cultural Persistence." In *The New Institutionalism in Organizational Analysis*, ed. P. DiMaggio. Chicago: University of Chicago Press, 1991.