



[Chrisanthi Avgerou](#)

## IT and organizational change : an institutionalist perspective

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## **IT and organizational change: an institutionalist perspective**

### **Abstract**

This paper challenges the tendency of the information systems (IS) literature to subsume IS innovation in processes of organizational change, either with the role of the ‘enabler’ of organizational objectives, or as an instrument appropriated by situated organizational actors. Using institutionalist theory, the relationship between information systems development and organizational transformation is studied as the interaction of two institutionalization processes: the increasing momentum and legitimation of IT innovation; and the organizational efforts for the substitution of established structures and activities with new ones which often do not command adequate legitimacy. Such analysis suggests that IS innovation is to a large extent sustainable by its own institutional forces, irrespective of its contribution to the processes of organizational change.

This perspective is demonstrated with the case study of the Mexican oil company, Pemex, which, for almost two decades, has made significant efforts to transform itself from a state controlled bureaucracy to a ‘modern’ market driven corporation and has been engaged in successive IS projects.

### **Introduction**

On the whole, the Information Systems (IS) literature is cautious to avoid technology deterministic ideas and discourage technology-led information systems practice<sup>1</sup>, and tends to emphasize the organizational drivers of information systems innovation. Those

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<sup>1</sup> Yet, technology driven approaches are often blatantly pursued (Mertens 1997), in some countries with visible economic success (Avgerou, Siemer et al. 1999), and in the developing world IT innovation is often advocated as a necessity for achieving the organizational structures and activities required for participation in the global economy (Schware and Kimberley 1995).

who see the development of information systems in organizations as part of planned and formal management have stressed the role of new technology based information systems in enabling desirable organizational change (Earl 1989; Scott Morton 1991; Hammer and Champy 1993; Turner 1998), while those who emphasize the emergent and situated nature of action in organizations tend to view information systems as resulting from the social dynamics of the organizational change process (Ciborra 1991; Ciborra and Lanzara 1994; Orlikowski, Walsham et al. 1996). Both perceptions suggest that IS innovation concurs with and reinforces organizational change, either designed by management or improvised at the work place.

In this paper I argue that IS innovation cannot be adequately explained as an enabler to organizational objectives or as a contributor to improvised processes of organizational change. To a large extent IS innovation processes are self-sustained. This argument does not imply the technology deterministic position that IT imposes organizational imperatives. On the contrary, the research presented in this paper suggests that technology innovation is itself a process combining technical-rational and social forces, neither driving, nor subsumed in the forces of organizational change, but interacting with them.

In a nutshell, I consider both IT innovation and organizational practice as institutions, each of them with its own mechanisms and legitimating elements, but at a very different institutionalization state. While the institutionalization process of IT continues to gain momentum, the most powerful organizational form in modernity - the hierarchical bureaucracy - has been challenged and no new form has gained the legitimacy and confidence it had commanded. Thus, the interaction between IT innovation and organizational change can be conceptualized as a dual process of institutionalization of IT and de-institutionalization of established organizational structures and practices. IT is often the most visible, and best articulated aspect of change within a context of organizational uncertainty and fluidity which does not provide adequate direction.

I demonstrate these ideas with the case study of Pemex, the Mexican oil corporation which has a long history of computerization and modernization efforts. I chose this company as a clear example of continuous IS development within a context of

organizational de-institutionalization. The transformation of Pemex from a hierarchical state controlled bureaucracy towards becoming a market responsive corporation involved more than the reshaping of structures and processes; it has challenged and replaced taken-for-granted fundamentals of the company, such as its mission, power relations that sustained its operations, and widely held perceptions of what constitutes a valid basis of management decisions and actions.

Although unique in its circumstances, Pemex is not exceptional in terms of the institutional forces involved in its transformation. Many organizations in industrialized as well as in developing countries have been facing transformations that encompass changes far more fundamental than the reshaping of their hierarchical structure and fragmented processes. While the particular institutional elements and the unfolding of events manifested in the story of Pemex are specific to its historical conditions, the de-institutionalization elements of its established organizational features is a process recognizable across the world.

Institutional forces stem from multiple layers of sources, including the international, national, sectoral, as well as the internal organizational context (Avgerou forthcoming). However this case study is confined to the internal organizational context, aiming to demonstrate the way institutionalization / de-institutionalization processes unfolded locally. The national, international and sectoral institutionalization processes that influenced the transformation and computerization processes in Pemex are beyond the scope of this paper.

The case is presented in narrative form, first tracing the history of the main events and initiatives that shaped the company up to its current state, and then the history of its computerization efforts. Then analysis of the narrative interprets this history by using concepts of the new institutionalist theory, identifying different phases of institutionalization / de-institutionalization in the interaction between IS development and organizational change.

## **An institutionalist perspective of IT and organizational change**

The new institutionalist theory<sup>2</sup> in sociology postulates that we cannot explain what is happening in organizations by considering only the 'rational' actions of managers and technology experts. It provides a conceptual platform to take into account 'irrationalities' stemming from the context of the organization as well as from cultural systems embedded in organizations.

The concept of institution has a broad sense in institutionalist theory. It refers to authoritative, established, rule-like procedures in society, with a self-sustaining character. Institutions are broadly defined as 'those social patterns that, when chronically reproduced, owe their survival to relatively self-activating social processes' (Jepperson 1991). Institutions are taken-for-granted standardized sequences of activity in their environment. People tend to believe that there is a functional rationale for their existence and purpose, which are historically justified, and don't challenge their validity. Among the examples of 'institutions' suggested by Jepperson are presidency, academic tenure, wage labor, the formal organization. Some of them are found in a few societies only while others, such as the formal organization, constitute established features of all modern societies.

Institutionalization is the process through which a social order or pattern becomes accepted as a social 'fact'. An innovation is first adopted and diffused partly for its technical merits (Zucker 1983), and partly under the influence of powerful actors (Granovetter and McGuire 1998). Subsequently, through institutionalization, an innovation is adopted and maintained because of its acquired legitimacy, irrespective of whether it produces or not its promised technical value, and without having to rely continuously on powerful personalities.

The institutional elements that sustain the concentration and structuring of people's work activities in formal organizations in modern society have been studied extensively in organizational theory (Zucker 1983; Scott 1987; Zucker 1987; Powell and DiMaggio

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<sup>2</sup> New institutionalism is the name given to a stream of research after the 1960s that pays attention to the nature and significance of institutions. The term is meant to distinguish these recent theoretical efforts

1991) and there is no need to elaborate on them in this paper. In brief, they include the values related to the *raison d'être* of the organization, professional roles determining what is valid action for individual members of the organization, structures of authority which determine certain ways of power distribution as valid and others as inappropriate, legislation and supervisory authorities determining the scope and rules of acceptable organizational output.

Moreover, institutionalist theory probed behind the socio-structural aspects of organizations and traced the unconscious central values that keep an organization together as an institutional entity, demonstrating that formal institutional aspects, such as the bureaucratic structure, are sustained and perpetuated by unconscious taking-for-granted the way things are, which makes alternatives unthinkable, and creates institutional inertia. Within organizations we find conformity rooted in 'common understandings about what is appropriate and, fundamentally, meaningful behavior' (Zucker 1983). Actions follow rule-like patterns, 'norms', that are embedded in formal structures and are not tied to particular actors or situations. In this way work practices in organizations, although socially defined, are seen as being 'objective', part of the 'external' world, rather than as being subjective understandings and actions (Zucker 1987; Zucker 1991).

### *IT as an institution*

The use of information technology in organizations has acquired its own codified meaning, and has become an institution in its own right. From the outset we can identify the following institutional elements of IT:

- the established view on the value of technology and knowledge as the axial principles for contemporary, 'post-industrial' society (Bell 1973);
- a network of industries - including hardware manufacturers, telecommunication services providers, software producers, consultants - and units internal to 'user' organizations which are creating, laying, maintaining, and further expanding a

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from earlier, cruder - although fundamental - attempts to conceptualise influences from the broader environment on organizations, by such gurus of social theory as Parsons and Selznick.

complex world-wide network of material resources and knowledge for technical information processing;

- an elaborate set of professional expertise for the development and use of IT applications;
- sets of regulations for IT development and use, such as codes of ethical practice, copyright legislation, data protection acts, or freedom of information decrees;
- professional societies, such as ACM, or IFIP, promulgate standards of technology and practice.

There are numerous rational accounts for the significance of IT in all fields of the social sciences. IT is a pervasive technology, which impacts on all aspects of performance of organizations, and has the potential to alter the socio-economic position of whole nations and regions (OECD 1988; Castells 1996). Some studies portray a more skeptical attitude, showing factors which may inhibit the release of the potential of IT, either at a national or an organizational level (Landauer 1996). However, the momentum of IT diffusion is hardly bound by general theoretical analyses of its value.

The ubiquitous spread of IT is sustained not necessarily because the rational arguments on its value are convincing, but because IT has captured the hopes and fears of people in their professional roles as well as in their personal lives. Although the merits of particular information systems may be fiercely debated within organizations, the wisdom of expanding computer uses in ever more organizational activities is not seriously challenged. IT applications are taken-for-granted as fixtures of contemporary organizations. They have become a 'rational myth' – in the term suggested by Meyer and Rowan (1991).

The institutionalization of IT has involved three interrelated areas of action: the development of IT, communications, and related services industries; government policy and legislation regarding R&D, production and use of technologies; and the development of the IS function within 'user' organizations. The history of each of these areas (English and Watson Brown 1984; Friedman and Cornford 1989; King, Gurbaxani et al. 1994; Caminer, Aris et al. 1998) suggests that IT has become one of the most prominent features of the global economy and, at a micro-level, of the fabric of formal organizations

partly by rationally calculated actions, partly by visionary innovation initiatives, and partly as a matter of faith that computer technology is the basis for economic and social activities of modern society. A detailed account of the emergence of the institutional characteristics of IT along these lines is beyond the scope of this paper. In order to explore the interaction between IT innovation and organizational change the study of the institutional character of IT will be confined here to the discussion of professional practices for the development and evaluation of information systems.

In the 1990s most information systems innovation in business organizations is done in either of two very different ways. The first is development of systems that address the particular information needs of an organization either by in-house teams of systems analysts and programmers or, through outsourcing contracts, by teams of experts employed by specialist services firms. The second is a combination of 'packaged' software implementation and management of change services that transfer generic information processing and communication tools, such as Lotus notes or SAP, in a particular organizational context.

Large organizations, which develop their information systems in-house, invariably rely on standardized methodical professional practices. Software consultants have their own brands of methodology. Moreover, many countries have adopted particular methodologies as a national standard, initially for computerization projects in the public sector, gradually though through market forces as the most widely preferred methodological standard, as for example SSDM in the UK (Downs, Clare et al. 1991), and Merise in France (Pham and Chartier-Kastler 1991). There has been a long debate about what is a good methodology, addressing technical as well as philosophical issues (Olle, Sol et al. 1986; Avison and Fitzgerald 1996; Hirschheim, Klein et al. 1996). Throughout the 1980s, methodological studies devoted a great effort to understand the multiple dimensions of the systems development tasks and to accommodate such research insights into professional practice.

The most widely known and used methodologies have been criticized for their limitations in terms of technical integrity (McDermid 1985), capacity to cope with the social and organizational complexity of information systems projects (Lyytinen 1987), and



efficiency in carrying through the systems development tasks. Rather than being the logically coherent, philosophically consistent, and cost-efficient patterns of action that the pioneers of methodological movement envisaged, the methodologies that became common practice with time provide, at best, systematic compromises of the conflicting aspects the systems development process, and often misleading reassurance of doing so (Beath and Orlikowski 1994). There has been little research about the extent to which methodologies contribute to building systems which serve better the needs of an organization. There is even little evidence that systems developed by following a methodology require less maintenance.

Certainly the use of methodologies is not 'irrational'. The effort to systematize technical practice serves other purposes than the immediate task of building and implementing an information system to support an organizational set of activities. Methodologies made possible the professionalization of systems development by assigning technical roles such as analyst, designer, project manager, or programmer with predefined skills (Avgerou and Cornford 1993). They are used for training of large numbers of 'experts' as required to sustain a booming industry. They established rules of 'good practice' to develop a system, without having to assess results.

The use of packaged software involves similar elements of legitimate, although not always technically rational practice. The way software products are developed and 'packaged' by software companies has been studied much less than in house systems development. There is evidence, though, (Cusumano and Selby 1995) that the production of packaged software and its subsequent acquisition by multiple and diverse organizations bears little resemblance to the systematic methods that were put forward to provide confidence to organizational actors that IT applications suited their needs and offered solutions to their problem. In many organizations such confidence is already well established through a succession of information systems projects. But even those organizations which have had problematic experience with computer applications in the past have no choice but to continue taking up further innovations in IT and telecommunications. The building of networks of computer and human actors in organizations has become irreversible (Callon 1991).

Rather than fulfilling recognized information requirements of organizations, software products, such as SAP, often leads to adjusting organizational practices to those inscribed in the technical object (Gibson, Holland et al. 1999). The major issue in such projects is not the inherent capacity of the software product, but the ability of the organization to exploit its implementation as a leverage for change towards more effective organizational processes. The rooting of software projects in the study of requirements has been the major strong-hold of a rationality which subsumed the technology to the administrative efficiency logic. The combination of the implementation of generic software for administrative functions and management of change interventions blurs this fundamental principle that guided computerization in earlier IT generations.

Another aspect of the institutional character of IT can be traced in the way the practice and theory of systems economic evaluation has changed since the early days of computing. A comparison between typical textbooks on this subject from different periods suggests the way evaluation has changed from a simple and 'useful' investment appraisal exercise to become a rather ceremonial ritual. Gildersleeve's textbook on systems analysis of the 1970's (1978) contains a neat cost-benefit analysis technique to assess whether an organization should embark on the investment of a new computer-based information system, and if so what size of economic benefits should be expected. The undertaking is perfectly manageable, although it may require professional assistance on financial technicalities. A basic textbook on economic evaluation of IT of the 1980's, suggests a much more complex activity, with a high degree of arbitrariness (Parker, Benson et al. 1988). Parker *at al* acknowledge that information systems impact on many aspects of organizational life in many different ways. Their suggestions to account methodically for the economic worth of an information system by measuring such 'soft' changes as the impact of systems on employee productivity is less convincing. Indeed, there is little evidence that information systems evaluation is practiced. Empirical research indicates that systematic 'objective' evaluation is rarely practiced (Farbey, Land et al. 1993). Moreover, evaluation is often used to legitimate decisions on systems development which are already made on the basis of intuition and often particular actor interests, rather than the technical merits of a particular IS innovation.

### *IT institutionalization and organizational de-institutionalization*

The interaction between IT development and organizational change involves the continuing institutionalization of IT intertwined with the de-institutionalization of the dominant organizational form of modernity. These two processes have always been closely interdependent. The institutionalization of IT has been fostered partly within organizations, initially assisting the bureaucracy to increase its efficiency and strengthen its coordination and control mechanisms. While the main impetus for the invention and building of the first computers was the working out of computations required in sciences and supporting military and space program logistics, their pervasive diffusion owes a great deal to their use as data processors in large hierarchical organizations. Within a period of thirty years IT acquired the legitimacy of an 'enabler' for almost anything organizational actors could think as an improvement in their context, and became one of the most significant factors justifying and enacting organizational change.

Until the early 1980s a common theme in studies of organizational impact of computers was their potential for further centralization of bureaucratically structured organizations (Laudon 1974; Simon 1979). More recently, however, IT has been associated with the emergence of new organizational forms replacing the hierarchical bureaucratic structure (Drucker 1988; Powell 1990; Bjorn-Andersen and Turner 1994).

Reporting the findings of a large survey undertaken in the early 1990s, Applegate suggested that organizations are moving towards a 'hybrid' model that combines features from the hierarchical bureaucratic model with alternative more flexible organizational types that had been identified in the management literature. While the characteristics of the hybrid model remained vague, major significance was attached to its networked information infrastructure (Applegate 1994). Two years later, Applegate reported at the International Conference on Information Systems (ICIS) that her continuing research on IT and organizational forms suggested the persistence of the hierarchical structure, rather than its replacement (Applegate 1996).

The in-conclusiveness of such studies to suggest new dominant organizational patterns is highly significant for the institutionalist analysis of the interaction between IT and organizational change. In the 1990s the two processes are so closely intertwined that they

are almost indistinguishable. IS projects are entrusted with working out organizational changes (Orlikowski 1996), and the legitimacy of information and telecommunication technologies as important factor that shapes the new conditions of the contemporary global society is built on the new organizational processes whose emergence allegedly they assist. However, the two processes bear unequal weight on the occurring changes. While the institutionalization of IT is well advanced and self-justified, the emergence and legitimation of new organizational norms of structure and action lacks a commonly accepted orientation.

The necessity for continuous development of IT-based ways of handling information does not need to be justified in any type of market driven or government controlled organization. Particular features of the new information systems may be contended, but the capacity of IT and telecommunications to provide new scope for organizational improvements has acquired a taken-for-granted character. Technological innovation of information systems in organizations has acquired its own momentum, involving its own institutional norms of 'good practice'.

On the contrary, the merits of the bureaucratic organizational form have been challenged, and various different ways of organizing human activity within the prevailing market driven socio-economic regime came to be seen as legitimate alternatives. The quest for and adoption of new organizational features, more suitable for their changing environment constitutes a de-institutionalization process. In most organizations, the effectiveness of their management structure and work processes, the merits of their culture, and often the wisdom of their mission are questioned, and innovation efforts permeating all such organizational elements are frequently attempted.

However, most organizational innovations are only fashions, contributing to a sense of 'short-lived', transient changes, rather than to establishing incrementally new norms for organizational life (Abrahamson 1991; Abrahamson 1996; Pettigrew 1998). Alterations to the taken-for-granted organizational features by rational analysis and choice, whereby analytical tools are deployed to assist managers in deciding what is 'best' for their organizations, are implemented under the shadow of two institutional elements: the

‘fashion’ character of particular innovations, and the ‘cultural persistence’ of the old regime.

In summary, so far I argued that the interrelated processes of IS innovation and quest for new organizational structures are unequally sustained by their respective institutional elements. The taken-for-granted inevitability of technical ‘progress’ of IT, and increasing confidence in the soundness of technological expertise is unmatched by the perceptions of the value of innovations in organizational structures and work activities. While IT development is incremental and cumulative, gradually transforming the landscape of the work place and the nature of work itself, organizational transformation is erratic and often transient and does not contribute to specific new long-lasting patterns.

It is, therefore, misleading to consider IT an enabler to organizational change. To the extent that organizational change is a faltering de-institutionalization process rather than a course of action towards adequately legitimated structures and work activities IT innovation proceeds in a self-fulfilling manner, relying mainly on its own institutional forces. The following case study demonstrates the intertwined but loosely coupled and largely self sustained processes of organizational transformation and IS development. In this case, IT innovation - repeatedly justified as enabler of desirable organizational change - has been hardly curtailed by the setbacks of the organizational change initiatives, or by failing to make any substantial contribution to the organizational transformation undertaken.

### **The case study of organizational change and computerization in Pemex**

The Mexican oil company, Pemex, has been pursuing large scale organizational change and IS development projects for over three decades. Moreover, it has been doing so in a reflexive way, which makes this company a source of data adequately rich to understand the multiple dimensions required for the organizational new institutionalist analysis. From its initial establishment as a state corporation until its current efforts to become a market driven competitor in the international oil industry the affairs of the company have been under discussion both internally and publicly.

I reconstructed the two parallel histories of organizational change and IS development mainly through interviews with managers and IT specialists in Pemex, and to a lesser

extent – mainly for cross checking and contextual information - through secondary sources. My first substantial data collection effort was conducted in 1993, one year after the most significant transformation undertaken by the organization since its initial formation. In a consultancy appointment at that time I was asked to produce a ‘diagnostic report’ on the IS function in Pemex Gas, one of the subsidiaries of the corporation. That appointment provided access to information sources for tracing the recent history of Pemex, its IS development efforts, and its culture. Data gathering lasted two weeks and involved group and individual interviews with the sub-directors and their management teams in all five divisions of Pemex Gas headquarters; the IT managers in the central IT department of the company and the five IT units of the company’s sub-directions; the management team in a production site outside the headquarters; the management team of an IT center of another production site; the IT manager of the corporate headquarters of Pemex.

Interview sessions began with clarifying the objective of the study, and inviting the description of facts and opinions regarding the following areas: the organizational tasks and perceived mission pursued by each division of the company, their information systems and further information requirements, and how they were going about meeting such requirements. With the exception of one sub-director who was laconic and rather un-cooperative, the study was generally welcome by the sub-directors. Introductory team sessions lasted for a minimum of two hours and were followed by subsequent interviews with employees that were identified as additional significant informants. A facilitator and interpreter prepared and mediated the interview sessions when required. Invariably, interviewees gave a historical account of the recent creation of their divisions or offices in order to provide the background that made their descriptions and views meaningful. Also, interviewees were very reflexive, offering explanations about the subject of their description and their opinions, elaborating on the values and cultural aspects they considered significant either in the past or current affairs of the company. The validity of our understanding of the company’s organizational aspects and IS issues was subsequently confirmed with a meeting where an outline of the main, although still not analyzed, findings were presented to a group of informants from all the sub-directions and centers.

Since that initial study I extended and updated the history of events related to the transformation efforts and the use of IT in Pemex through various sources. Additional sources included interviews with directors and IT managers in the corporate headquarters and another subsidiary company, Pemex Refinery, as well as IT service contractors involved in Pemex projects. I visited the company again in 1996 and updated my data on its re-organization and computerization efforts through: a three hour interview with the director responsible for planning and information resources in Pemex Gas; a two hour interview with two and IT managers in Pemex Gas; half a day seminar discussion on the role of IT in the corporation with the participation of IT managers from all Pemex companies; and three interviews with IS services contractors.

For the early part of the history of the successive administration, reform efforts and computerization projects of the company I used also data from the thorough research of a doctoral dissertation (Volkow forthcoming) exploring the contextual nature of IS development. To understand the national context of Mexico, which is very closely related with the history of Pemex I used various publications, such as (Browne 1994; Castells 1997; Economist 1998).

### **The history of the company**

#### *The making of a giant state bureaucracy*

Pemex is a Mexican oil corporation with a history closely linked to the history of that country. The company was created in the late 1930's as a result of the nationalization of American and British oil companies that operated in Mexico at the beginning of this century. The events of the expropriation of the foreign oil companies and the taking over of management and control of operations by the company's employees under adverse conditions of international boycott set an organizational culture which saw oil production as a service to the country. Pemex was established as a non-profit oriented company, with a mission to provide for the economic development of the country. Moreover, during the first months that the company struggled to satisfy the oil demand of the country's industry and to prevent the collapse of its economy, the oilmen's trade union was established as a power source which has had a significant influence on the development of the company throughout its history.

By the end of the 1950's the company was established as an hierarchical, state-owned organization. Its operations covered all activities related with oil exploration, refinement, and distribution of oil and primary petrochemical products. The strategy of the company was dictated by government policy, and its management involved a strong control by the trade unions. With increasing internal demand and low international prices, exports were considered of secondary importance at that time. Moreover, the government taxed heavily the revenue of Pemex to subsidize the manufacturing of value added oil products in order to foster industrialization and job creation. The company was starved of the necessary investment in the technological innovations that became the standards of the international oil industry at that period.

Three centers of power developed in the company: the government, whose economic policy Pemex had to serve; the company's management, which, although headed by government appointed CEOs, was striving to set up company-focused decision making; and the trade union which had enormous influence on the labor force.

Consecutive administrations until the 1970's were acutely aware of the company's increasing inefficiencies, but were unable to remedy its dys-functions. Productivity deteriorated, operational oil reserves were overexploited and depleted. There were bottlenecks and problems of co-ordination between the various parts of the process of production, refinement, storage and distribution. Pemex stopped exporting from 1966-1973, and at times the country imported not only crude oil, but also refined products.

#### *The oil boom decade*

During the international oil crisis of 1973 the financial recovery of Pemex, increase of its productivity, and investment for exploration acquired top priority. The strategy and the management of the company became less government dependent; engineering personnel increased in number and in power. The administration of 1976-1982 pursued an ambitious investment plan to triple oil and petrochemical production, double refining capacity, expand distribution infrastructure, and promote exploration for new reserves. The company borrowed from international financial markets and these goals were achieved, with the most dramatic results in exploration. Huge new reserves were located, and by the early 1980s Mexico became the fourth largest oil producer in the world.



While production expanded, the company continued to be inefficiently managed, without a clear strategy for its own purposes. There were severe problems of coordination among the various parts of the huge, centralized organization. In that oil boom period, while export oil prices were very high, mis-management did not seem to have dire consequences. The ratio of operation costs to revenue looked healthy in comparison to earlier periods, despite continuing gross inefficiencies. The consequences of management inefficiencies and continuing tax burdens imposed by the government were only felt when oil prices fell in the international market. Pemex, facing competition, could not sell its production of oil, it reduce production and cut down prices. The days of export growth and high prices were over and Pemex, having borrowed heavily to implement its expansion, was more dependent on foreign loans than ever before.

#### *The beginning of modernization efforts*

In 1983 the company began the first sustained efforts for re-organization. A cadre of business administration graduates were appointed to lead the modernization of the company, and multinational consultancy firms were used extensively to introduce change. There was friction between the modernizers - consultants and managers appointed by the company's executives to implement their organizational change inspirations - and the oilmen from the old administration, whose trade union was still powerful. One interviewee in our research recalled that the oilmen and old employees in Pemex administration used to call the newcomers in the company at that period – new appointees and consultants – Smurfs, suggesting that they were childish and without identity roots, as the motherless cartoon characters. The oilmen did not deny that the company was inefficient and changes were needed, but they were skeptical about the kind of changes the company was pursuing. They felt that the new managers disregarded experience and lacked understanding of the 'real' power structures, which had remained intact. Therefore they believed that the attempted interventions were ineffective. An interviewee expressed the cynical view developed at that time about the consultants: 'they listen to what the Pemex employees already know, and present it nicely in their deliverables to fulfil their contract'.

The conflict between the trade union and administration reached its highest point in the mid 1980's. It was resolved with political support from the Salinas government, which took office in 1988 with a commitment to implement modernization policies. The union's power was curtailed and a target of nearly 40% staff cuts was announced.

The modernization efforts of the 1980s culminated with a major restructuring in the early 1990s, which abolished the company's existing functional structures and designed new management divisions on the basis of 'business lines' that comprised sets of activities related to particular products.

#### *The making of a 'modern' corporation*

In 1992 Pemex was transformed to a corporation comprising four subsidiary companies: exploration and production, refinery, gas and basic petrochemicals, and secondary petrochemical products. The four subsidiary companies are now headed by a corporate office.

The split of Pemex was part of the government's policy of economic modernization, which involved extensive privatization of state owned enterprises. The transformation of the company from a monolithic organization to a corporation of four self-managed companies was based on a general model of organizational structure designed with the advice of management consultants. The entrusting of the shaping of the corporation to consultants and management 'experts' was indicative of the intended shift of rationality from political decision making processes to business driven decision making.

The transformation process was lead by a transition committee. Executives and technical experts of the company were invited to take part in nine 'technical' sub-committees, responsible for an equal number of broad functional areas. The technical committees had to decide on the allocation of assets, human resources, IT equipment and organizational data, sub-contracting, running projects, accounts, invoices, debts, fiscal duties, plants and pipeline infrastructures.

The shaping of the new corporation was carried out within the then hierarchical culture, in the established spirit that an order had to be implemented at all costs, despite any difficulties. 'It had to be done' was the expression used by an interviewee who took part

in the committee. Each committee contested - rather than formally planned for - as many resources as possible for the area of their responsibility. The implementation of the company split was done on a pragmatic, rather than a formal basis: issues were addressed as they appeared. The directors of the four new companies were appointed by the President of the country and all but one were professional politicians. There was a widespread cynical view in the newly formed companies that their structures were drawn to accommodate the allocation of all old Pemex executives into the subsidiaries

After the transformation, each subsidiary began its own efforts to overcome inefficiencies inherited from the old company, and to implement the new market oriented mission. The first year the major effort was one of muddling through for survival as the management of each new company worked out, on a day to day basis, how to reach that targeted structure and fulfill the new mission.

All companies continued to employ international management consultants for innovations, such as total quality management and business process re-engineering, with mixed results. Successes with particular innovations were only local, difficult to emulate throughout the corporation or to secure their long term sustainability. While there has been no explicit opposition to management innovations, employees have continued to be skeptical about the value of the innovations they are called to implement.

The companies' market driven strategies have been compromised by the fact that the corporation is still under government financial control. Their revenues are deposited to the Treasury, and their resources are allocated through the Federal Budget, after approval from the National Congress. As export of oil continues to be the country's major revenue generator, the budget of Pemex is determined by the overall government economic policy. The corporate office kept responsibility for general business strategy, the setting of organizational standards and regulations, and central financial control. It is also responsible for human resources and overall IS strategy.

None of the subsidiaries was privatized. Plans to privatize the Secondary Petrochemicals company provoked political opposition and were abandoned. Nevertheless, both Secondary Petrochemicals and Pemex Gas are facing external competition and are pursuing realistic - given the companies' circumstances - efforts for working out business

practices which are responsive to market pressures. Pemex Exploration and Production continues to be of the highest strategic significance in the country, and the most reluctant to shift from an engineering driven rationale, which values production at all costs, to a business driven rationale of profitable operations. Efforts to decentralize its management to the areas of production were stopped by Government intervention.

### **The history of IT development in Pemex**

#### *Early successes with computers*

In the early 1960s several payroll and accounting applications were developed in a number of different offices of the company around the country, and in 1965 the Office of Computing was created to coordinate the early anarchic proliferation of computer applications. It had a central office at the headquarters of the company and seven regional offices in main locations of operations. The first major projects undertaken by the Office of Computing were a new payroll system aiming at overcoming chronic delays in processing fortnightly salaries, and an inventory control system for the major warehouses of the company. Both projects were faced with a great deal of resistance, but went through.

The payroll system stumbled on established practices for calculating employee overtime. Manual procedures allowed for arbitrary estimates of overtime by specialized personnel, and fraud was widespread. Although the new system met its efficiency objective, and wages started being paid on time, the system was openly opposed and on several sites sabotaged by destroying print-outs, breaking equipment, and threatening the computer specialists who implemented the system. Indicative of the severity of the situation is that in one of the computer centers the system began operations with the protection of the army.

The warehouses inventory management system was intended to solve bottlenecks in production caused by poor inventory management. The 95 major warehouses of the company were often unable to respond to requests for items required for production, while they kept huge stocks of items with low demand. The use of different names for the same items exacerbated the problem. The development of the computer system to

rationalize the stock control met with suspicion by the warehouses management, but was implemented as intended.

*Consolidation of the IS function, proliferation of systems*

In the early 1970's the company's Office of Computing had a portfolio of projects for the development of administrative applications, mathematical programming for management techniques, and engineering support systems for various areas of oil production and distribution. The main concern was technical completion of the often ambitious for that time projects, and analysts were not particularly sensitive to the needs and the concerns of the users. The Office had no systematic evaluation procedures in place, and there are indications of mixed results. For example a project aiming to set up an infrastructure for data communication among five work centers through a central node in Mexico City failed to meet its specifications. Nevertheless, by the time the company was pursuing its ambitious expansion efforts in the second half of the 1970's computer based information systems were undisputedly considered as necessary means for 'the optimization of the decision processes in order to increase productivity' (Volkow forthcoming).

The increased significance attributed to the information systems function led to the restructuring of the Office of Computing and the upgrading of its status. The Department of Informatics was created at third level from the top within the administrative hierarchy of Pemex. However, the tight centralized control of the IS function could not cope with the demand for new applications in all areas of the company, and soon the Department of Informatics was passed-over by 'unofficial' local computer centers developing their own information systems. Minicomputers and software applications proliferated.

Although the official documents of the 1970s suggest early recognition that the expansion of the company's operations required effective information systems, computerization at that period of the oil boom did not keep up with the information requirements of Pemex. The expectation that computer-based information systems would provide management with reliable information regarding the company's operations was not realized. A major effort to develop an executive information system for the headquarters failed, and executives were well aware that the information they had at their disposal about the company's day to day operations was inadequate and unreliable.

The information systems that supported the various areas of company operations produced incompatible data. For example, data on volumes of oil produced and channeled to other parts of the company or sold did not match with data reported by those other parts of the company on the volumes of oil they handled. The structure of accounting data produced by the various operations of the company was not compatible with budget data. Yet a different data structure was required in reporting the company's financial situation for the purposes of the Government's National Accounts.

To a large extent such data deficiencies were a result of computerization itself. Proliferation of incompatible systems in large organizations is well documented as a general phenomenon at the time technology became available in smaller, affordable, and technically accessible units and organizations developed an appetite for applications that their centralized IS function could not satisfy (Nolan 1979). However, in Pemex there was another factor contributing to informational incompatibilities. The computer-based systems captured only the 'formal' aspects of operations, leaving unaccounted substantial informal procedures. For Pemex, a large bureaucratic company with idiosyncratic and highly political administration, the informal dimensions of its operations and administration were both very significant, and too complex for the technically oriented systems analysts to grasp and handle.

Moreover, computer based information systems conveyed a particular rationality of decision making for the running of the company which was clashing with the covertly political way of managing the company. Accurate reporting and flows of reliable information among the various parts of operations were not really compatible with the culture of managing the organization. On the contrary, control over information was a basis of power that managers were not keen to relinquish by supporting effective information flows for the sake of better decision making in the overall management of the company. Most Pemex employees considered careful recording of data related to their areas of responsibility as an aspect of red tape rather than an element of effective accountability.

The disjunction between the formal information handling processes of the computerized information systems and the 'real' practices in Pemex was exacerbated by the systems

analysts' approach to develop systems without much user participation. An interviewee of this research who was involved in the project of the 1970s conveyed the prevailing rationale of the analysts in Pemex at that time saying: 'people carrying out the daily operations of the organization did not know how computers would help them to do their jobs more efficiently; the analysts knew how work could be done better'. Users did not overtly confront this rationale, but their informal work practices over-passed or marginalized the computerized systems.

### *The appointment of consultants*

Since the early 1980s the development of information systems in Pemex has been linked with the overall modernization efforts of the company. A succession of international and local consultancy firms have been involved in the efforts of Pemex to develop effective computer based information systems that 'enable' its functioning as an accountable, and professionally managed corporation. Usually, more than one consultancy companies were engaged in various projects simultaneously, often using incompatible methods. They were carriers of technical skills for the planning, management, and development of the latest generation of computer applications. They were seen as instrumental for the modernization of the company, developing the means for informed decision making processes.

In 1982 consultants suggested that the centralized IS function was ineffective and recommended that the company should recognize the computer centers that were unofficially operating in the various parts of the company. As a result, the Department of Informatics was replaced by a new center the 'Institutional Department of Informatics', which was intended to have an overall planning and regulatory role. Particular significance was attached to the setting of standards for systems development and performance, so that the various parts of the organization could develop their own applications without introducing further incompatibility. The new management decided to adopt open systems based on Unix and DOS. Indeed, Pemex pursued an open systems strategy relatively early in comparison to other organizations. It was less decisive on adopting a systems development methodology though, and projects continued to follow the various methods of the consultants employed.

The new Department, undertook the demanding task of resolving the incompatibilities of data produced by the various areas of operations and administration. The first such attempt was a project launched in 1982 to create links between operational and financial data. The project involved the design of new company-wide standards for work practices and reporting responsibilities. It met with resistance from the management of several areas of operations, who were reluctant to adopt the work practices entailed by the new system, and was not implemented. Nevertheless, that project prepared the ground for subsequent projects with similar rationalization objectives.

Extending its initial restricted mission for only managing a decentralized IS function, the Institutional Department of Informatics conceived and pursued a strategy comprising a portfolio of eight company-wide systems, for the administration of contracts, the budget, human resources, treasury, costs, auditing, procurements and the management of warehouses.

Those projects met with varying degrees of success. They involved a great deal of trial and error, both in technical tasks and in the relations with users. Several applications were implemented throughout the organization, but did not make a homogeneous information system as it was rather ambitiously envisaged. The size and complexity of developing company-wide systems had been underestimated, and projects proceeded in an *ad-hoc* and piecemeal rather than systematic manner. Without determining a common systems architecture for all projects, and at a time vendors persevered in preserving their own technical features, the company's 'open systems' strategy led to incompatible hardware installations. Nevertheless, communication of data between systems was made possible by developing a layer of interfaces, and the organization managed to form a computer-based infrastructure for its financial data flows.

It proved more difficult to sustain the effective functioning of this infrastructure. With poor maintenance practices the quality of operational systems deteriorated. The technical expertise assembled for the development projects was lost when, at the completion of the projects staff returned to local information systems centers. Some parts of the company were not able to use the systems as intended. Errors in data input affected both the efficiency of the systems - as efforts were made to correct detected errors - and the



reliability of the systems - as many errors remained undetected and were only manifested when information from different areas of operation did not match.

Moreover, the information systems centers of the more powerful divisions of the company, such as exploration and primary production, challenged the authority of the Institutional Department of Informatics to develop company-wide systems. They sought to demonstrate that their own financial administration systems were superior to those of the new systems. The company-wide systems were considered inflexible and unduly complicated. In essence, the central IS management was challenged by the view that information systems should emerge from evolving business practices.

#### *After the transformation*

With the transformation of Pemex in 1992 hardware and personnel resources were haphazardly distributed to the subsidiaries and the Corporate Office. The Institutional Department of Informatics formed mainly the Corporate Unit of Financial Systems and was located in the Corporate Offices. As its name implies, the mission of the unit was focused on financial systems, and continued to be concerned with financial planning and regulation. However the scope and legitimacy of its functions were contested. The Unit had no means of exercising control over the IS functions of the subsidiaries, but its responsibility to provide financial information regarding the corporation to central government implied a certain degree of power. Moreover, this Unit inherited the best of the technical expertise from the old Pemex. The IT staff of the subsidiaries' information systems centers often turned to the corporate Unit for assistance during the difficult first few years they were struggling to establish their services with limited resources.

The six modules of the company-wide systems of the old Pemex were packaged and copied for each subsidiary. Nevertheless, the use of the systems inherited from the old Pemex has varied in the subsidiaries. Some continued operating them as before, while others launched immediately the development of new applications.

The Unit of Financial Systems at the Corporate Offices set up several projects for innovative applications for the whole corporations. However, its planning role proved much more controversial. Arguments for the need of a corporate IS policy did not

convince the management of the subsidiaries, and an initiative to develop a new strategy for corporate financial information systems was not particularly effective.

Each newly formed company set out to develop their own information systems competencies and strategies, relying heavily on consultancy services. Their perceived priorities varied. In some modernization of obsolete production and distribution support systems became a pressing task and absorbed significant investment. In others sales and marketing were seen as the areas of highest priority within their new market oriented mission.

All subsidiary companies continued to aspire to the old Pemex objective of developing integrated management information systems to link the various areas of operations in each company and to provide reliable data for management and planning. In the first few years after the transformation such an objective proved as hard to realize in the new companies as it was for the old Pemex.

More recently, the old ambition of integrated systems appeared to be more feasible as all companies of the corporation, with the encouragement of the Unit of Financial Systems of the Corporate Offices, decided to implement the software package SAP R/3. Implementation is still under way at the time of the writing of this article in all companies with the exception of the Corporate Offices which was the first to complete the implementation of the financial modules of the package in 1997.

The implementation of SAP projects involves two streams of effort, contracted to different consultants: the technical implementation of the software package, and the management of change towards effective organizational processes to be supported by the new systems. These projects run independently from the ongoing efforts of consultant-led organizational change that each company continues to be pursuing since its formation in 1992.

It is too early to detect the outcome of the SAP implementation projects and their impact on the efforts of the Pemex companies to establish themselves as 'world class' businesses in their sectors. Some users in the Corporate Office where SAP has started operations expressed the view that the new systems are not substantially different from the in-house financial systems that were replaced.

In summary, the computerization history of Pemex reveals the development of a number of institutional characteristics.

- From an early stage IT was accepted as a legitimate aspect of modern organizations: first on the promise of efficiency, later for improving accountability, and enabling the development of management functions, such as planning.
- Professional experts, such as systems analysts, acquired legitimate authority to design new work practices and information reporting processes; such legitimacy of expertise was not challenged up front, although the resulting work arrangements were contested and manipulated at the work place.
- The IS function grew its own structures, partly following the organizational structure of Pemex, but also reflecting the development of the general technical and institutional features of IT, for example the debate on centralization or decentralization, and harmonization or fragmentation of the IS services in Pemex is attune to the state of the IT industry (e.g. the struggle for open systems) as well as a result of the Pemex restructuring efforts.
- The computerization projects of Pemex conveyed the jargon and the ‘fashions’ of the IS literature and practice: optimization of efficiency in the 1970s, integration of information for accountability in the 1980s, Enterprise Resource Planning in the 1990s. IT has been mobilized to contribute what was generally promising to deliver at each period.

### **IT institutionalization and organizational de-institutionalization in Pemex**

We can distinguish four phases in the history of events outlined above: The period until the early 1970s, during which the first major computer-based information systems were built within the traditional bureaucratic Pemex administration. The period from the early 1970s until 1980, during which the company, under continuing bureaucratic government-led management expanded IS development, but created a fragmented and grossly ineffective infrastructure of IT systems. The period from 1980 until the mid 1992 during which Pemex began efforts to modernize its structure, processes and mission and to integrate its information systems. The period since 1992 when the company was

redesigned, and adopted a market driven status, continuing efforts to develop systems for its new structure.

*First phase, until 1970: Beginning of IT institutionalization within a highly institutionalized organizational context*

IT was first introduced in Pemex in a government controlled bureaucratic organizational environment, with the aim to increase the efficiency of its well established administrative functions. During that period Pemex had long-established institutional characteristics. Its mission to serve the country's economic development was taken for granted. The nearly heroic status of its employees, the 'oilmen', legitimized the power of the trade union. The prevailing mentality to 'do the job at all costs', kept the company going under difficult circumstances, but led to tolerance of administrative inefficiencies. A fundamental feature of the company's culture was the co-existence of two rationalities: engineering, to cope with complex technical activities, and political, to fulfill the organization's perceived mission and to deal with personnel issues.

Efficiency, the main effect expected from computers, was compatible with the values of the engineering-led company. The use of IT was seen as means to assist the hierarchical organization to fulfill its mission. Although the first major IS projects - for the payroll and the warehouses management systems - challenged some of the most politically oriented features of the organizational context, such as the role of the intermediaries who estimated staff overtime, it did not upset the institutional character of the company.

With the implementation of the first generation of systems the development and management of the operations of computer-based information systems became a visible new function within the company, with its own momentum. Systems development was pursued primarily as a technical activity, by 'experts' primarily concerned to work out technically reliable systems. Resistance to the new systems was associated with covering up fraudulent activities and suspect management practices. Computer projects were engineering projects - people's issues, when they were manifested as resistance to change, were addressed by exercising power, rather than by adopting responsive systems development practices.

*Second phase, 1970 – 1983: Increasing institutionalization of IT within the traditional organizational context*

During the oil boom in the 1970s, exposure to the opportunities and risks of the international market challenged the status quo of the ‘company that served the nation’. The beginning of organizational de-institutionalization is discernible during the company’s expansion, as its management acquires more autonomy from the government, and the engineering imperatives become more prevalent than its political mission. However, the structure and management of the organization remained unchanged at that period. The expansion of the 1970’s was achieved by the centralized administration of a huge hierarchical structure. Management became increasingly aware of the company’s inefficiencies, but in the hectic period of expansion, the company relied on its established bureaucratic practices.

Computerization efforts were pervasive in Pemex in the decade of the 1970s. The IS function, sheltered within the hierarchical structure of the company, pursued extensive computerization plans in a top-down fashion. In addition, computer applications undertaken at the initiative of local managers proliferated in the various production outlets of the company around the country.

Within the engineering culture of Pemex computers had an obvious place in the production and distribution of oil products. Despite the formalistic bureaucratic culture of the company, computer-based information processing was seen as means for improving decision making. A careful analysis of the information flows and management processes would have identified the political basis of decision making in the company, and the very significant informal processes of management that were employed behind the facade of bureaucratic formal/rational structure. While the political rationality in managing the company had not been challenged, rationalization of decision making through computerization was considered as necessary for the company’s expanded operations.

Such unqualified expectations demonstrate the general belief in the capacity of IT to improve management that was widespread at that time. In the 1970’s the potential of computers in managing efficiently and rationally large hierarchical organizations had acquired a taken-for-granted quality. However, in Pemex, rather than contributing to the

optimization of decision processes, computers were assimilated within its highly institutionalized organizational culture and accentuated its inefficiencies. IT was applied in a piecemeal way around the company, used by management in the traditional way of carrying out the company's expansion to the best of their ability, but without contributing to an overall technical/formal accountability.

In short, IT – an institutional force on its own right by that time – was widely adopted in Pemex not only on efficiency grounds, but also as means for improving accountability and management. However, within the formalistic blend of hierarchical deployment of engineering expertise and cultural mobilization of people's commitment to achieve set missions at all costs IT did not have the expected effects of improving the effectiveness of management.

*Third phase, 1983 - 1992: IT institutionalization and the beginning of de-institutionalization of the traditional organizational form*

In the 1980s the organizational traditions of Pemex were shaken. A new business rationality challenged the adequacy of good engineering and service-to-the-government values. CEOs introduced new business administration expertise, the tacit ways of running the company were questioned, and the power of the trade union was constrained. Modernization became the new powerful slogan, conveying new values of a company responsive to the market rather than the nation, and suggesting a new work context. Employment in Pemex could no longer be guaranteed as a secure life long service. The company came to accept that it had to depart from its traditional mission and management, and that it needed a market oriented mission, and professional business management.

However the new orientation was unclear. It did not have a coherent set of organizational objectives. It was a period of unsettling the old and developing a new vision, but there was no concrete goal for the process of change. What new structure would substitute for the bureaucratic hierarchy, what management style would be appropriate for a highly technical oil company, what kind of business administration would be possible within an industry still considered constitutionally as the responsibility of the State, were unresolved questions in the minds of managers.

IT was perfectly compatible with the emerging new business rationality. The professional ethos encouraged by the new organizational regime contributed to making the IS function more independent of the crumbling centralized bureaucracy: systems development and management became officially more decentralized, and outsourcing made IT-mediated change more visibly a professional intervention that followed its own technical norms of a universal rather than local validity. Initiatives such as assigning a strategic and regulatory role to the central IS management unit, the planning for integrated systems, and the adoption of open systems standards indicate that Pemex was at the frontiers of international 'best practice' of that time.

Nevertheless, the still unsettled conflict between the old and the new elements of the organizational context had significant effects on the computerization efforts of the company. The open systems policy and the integrated systems plans were eroded as they did not command long lasting compliance within the fragmented, in terms of management loyalty, huge company. The development of company-wide systems was a major IT innovation, achieved against all the odds in an uncertain organizational environment. At the same time it was a futile effort to provide an integrated infrastructure for rational management in a company whose established bureaucratic rationality and integrity were at risk and had not established any credible alternative ways of management.

*Fourth phase, since 1992: Highly institutionalized IT within a weakly institutionalized organizational context*

The transformation of Pemex in 1992 marked the beginning of a new era, but the new organizational context has remained ambiguous in many respects. The four subsidiary companies are autonomous, but still reporting and controlled by the government. They have a market orientation, but they have not faced a great deal of competition and cannot be privatized. They can develop information management strategies to serve their purposes, but they must also comply with the policies of the Corporate Office, which draws its power partly through accountability to the state.

The transformation was accompanied by continuous managerial innovation. On the surface, the new Pemex companies had embraced a culture of modernization, willing to

pursue new ideas about organizational design. They employed international consultants, and attempted to transfer business 'best practice'. However, such an apparently vibrant environment of change hid a great deal of skepticism about the meaning of the modernization effort. Many saw the innovation initiatives as transient, and informal ways of conducting work were a significant aspect of maintaining continuity and organizational memory. The shared meanings and value systems in the new Pemex companies were not substantially different from the old Pemex.

One year after the transformation I found three different attitudes among the directors we interviewed. Some were convinced that their company was on route to become a world class business corporation, although disappointed with delays and obstacles they thought unnecessary. Others were optimistic in a more reserved manner, expecting that the real transformation will take time, as the company will gradually develop new market driven strategies and work organization. Several directors though were more skeptical about the essence of the transformation. Indicative of the ambivalent attitude towards the company's new orientation towards market competition were the views of the director of gas production interviewed for this research. First he described in detail the company's efforts to become a market driven concern, implementing the most established business management approaches. When asked to give his opinion on the significance of the changes he had described he revealed that he could not see why the 'competition logic' was more appropriate than the old mission of providing gas for the needs of the country. He saw little opportunity for export, and was uncertain whether the new regime was ultimately offering benefits to the consumers in the market of the country.

Four years after the transformation there was little dispute that a great change from the past had happened, but the companies were still in an experimental state with respect to innovation in the organization of work. 'We have no alternative but to learn to operate and manage the company as a competitive business organization' the director of planning stated; '...and we must continue experimenting with the methods of international business management'. Nevertheless, it became clear that 'modernization' did not mean abolishing nationalistic concerns over the ownership and management of the corporation (Economist 1998).



The new regime allowed ample scope and generous investment for the computer based information systems. However, it did not provide convincing requirements, and IT development followed its own institutional rituals. The following example from the first efforts of Pemex Gas to develop its IS infrastructure demonstrates the lack of articulation between IT initiatives and organizational change.

The IS manager organized the IS function in a decentralized way, devolving systems development and management duties to user departments, and only retaining a strategic and facilitatory role for the central IS unit. He mobilized the management of the five divisions of the company to define their critical success objectives, and formed a strategy for integrated information systems for the new company accordingly. Initially there appeared to be consensus both for the IS management structure and the IS systems development strategy. Yet, at the time of my first research in the company - a year later - no progress was made with systems development. The directors interviewed for this research were loudly complaining that the IS strategy would not deliver the systems they needed and most of them had alternative projects under way to develop applications for their business areas. The IS manager was perplexed, since he was convinced that he had done what was professionally correct in order to set the course for effective systems development, and he believed he had achieved a consensus on his plans. A more careful examination of the situation though indicated that the lack of opposition to his initially proposed plan did not imply endorsement and commitment to implementation. The whole process of deriving an IS strategy from business objectives was a professional ritual without substance, as none of the directors at that time had clear objectives to commit themselves to. This did not stop the computerization process in the company. Several projects were launched, and the ambition for integrated systems surfaced again a few years later with the decision to implement the SAP software.

All companies have embarked on extensive computerization programs, including SAP implementation, relying on external professional services. IS projects are considered to be opportunities for working out new work processes, and involve substantial resources for the management of such change. However the organizational context does not provide

reliable objectives for such change, and the meeting of set objectives continues to be vulnerable to the interplay between the stated targets of change and the enacted work.

## **Conclusions**

The interrelated histories of organizational change and IS development in Pemex demonstrate the interaction of two institutionalization processes: the gradual development of IT as a course of activities with its own taken-for-granted validity, and the uncertain efforts to achieve a radically different organizational regime in the company. In Pemex there is no question about the potential value of IT. Computers were considered to be valuable for improving the efficiency of its earlier hierarchical structure, and – in the jargon of the time - were then seen to be enablers for its modernization. The results did not entirely satisfy such expectations, but this hardly inhibited the corporation from continuing IT investment. No other option is perceived but to intensify IS development.

The company's transformation from a politically controlled monolithic state bureaucracy to a market-oriented corporation attempted a dramatic organizational de-institutionalization. In many respects the organization was ready for the radical change of status. The old organizational regime was discredited by its inefficiencies, and the change was in tune with broader political shifts in the country and new views about the organization of production activities in the global economy. Nevertheless, the elements that legitimized the departure from the old regime did not provide a clear new form for its substitution.

Despite the widespread rhetoric about the imperatives of global economic trends the new mission of Pemex does not command the legitimacy and commitment that the 'company that served the nation' did. Pemex is not exceptional in finding it difficult to command a high degree of faith in global market forces as its new mission. The profoundness of economic globalization through the mechanism of the free market is questioned by several economic analysts, particularly in industrialized developing countries. The necessity of the breaking of bonds between state and business is not as taken-for-granted as it is often assumed in the business literature stemming from advanced industrialized countries (Haggard 1995; Archibugi and Michie 1997; Castells 1997).

There is similar uncertainty at the microcosm of work processes. Organizational trends such as downsizing, flattening the pyramid of management, or outsourcing do not constitute coherent and convincing guidance for organizational change. In a company's quest for modernization no models for the organization of work have acquired the unquestioned validity that the bureaucratic work culture they seek to replace has commanded.

Turning now to the questions regarding the relationship between IT innovation and organizational transformation, the institutionalist analysis of the interaction of IT and organizational change in Pemex suggests that IT did not gain its unquestioned presence in the company by enabling either its planned or improvised efforts for organizational improvements. The continuous efforts for the introduction of state-of-the-art IT in Pemex have been linked with the company's relentless efforts for overcoming its organizational inefficiencies – initially by rationalizing its established bureaucratic functioning, and since the 1980s as an enabler of its transformation. But they have proceeded unaffected by the setbacks or the ineffectiveness of organizational change interventions.

The first lesson that the case of Pemex demonstrates is that IS plans do not compensate for weak or disputed organizational change orientation. On the contrary, in the history of the last 15 years of IT and organizational innovation in Pemex, the initial plans of major IS projects were modified to achieve a compromise with the organizational pressures and obstacles raised during implementation. Pemex has systematically applied professional expertise to align IT with business objectives. Nevertheless, as the objectives were regarded with skepticism by some senior management, and as the new formal business structure was not in harmony with the shared meaning and values of the company employees, the development of the information systems and their implementation took place in a context of unclear organizational orientation.

Second, the development of IS infrastructure was part of, but did not have a decisive role in the improvised and politically negotiated actions of organizational change that have accompanied the implementation of the company's successive organizational interventions. Indeed, most of the history of IS development in Pemex refers to improvisations and piece meal adjustment or distortion of initial plans under the

influence of highly political organizational behavior. The information systems and organizational adjustments that resulted incrementally from such processes had a significant effect in overcoming some chronic inefficiencies in the organization, but there is no evidence that these amount to a significant contribution to the change of the institutionalized structure of power, and work practices.

Third, failure to contribute to organizational transformation objectives did not curtail its further deployment. Initial plans of both organizational reform and information systems have on many occasions proved irrelevant or unrealistic. This has not stopped the IS innovation process. Particular aspects of IS projects and IS use have been continuously negotiated in Pemex, but after the first computerization attempts went through, the overall potential value of IT innovation has never been seriously challenged. The development of information systems has often been triggered by the efforts of the company to transform itself from a state controlled bureaucracy to a market led corporation. Irrespective of whether and to what extent such transformation has been achieved, Pemex has been developing an infrastructure of technology based information systems that is now vital for its operations and management.

The story of Pemex demonstrates that the course of IT innovation has its own momentum, and does not depend on its contribution towards a superior organizational form. When the objective organizational change is of ambiguous validity, both planned and improvised efforts to harness IT for organizational change are likely to be erratic. Yet, IT innovation tends to intensify rather than being held accountable for organization transformation results.

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