A GENERAL MODEL FOR UNDERSTANDING THE RELATIONSHIP BETWEEN INFORMATION TECHNOLOGY AND ORGANIZATIONS

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Outline

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Abstract

The purpose of this paper is to develop a general model of the process by which large organizations develop information technology over long periods of time. A special focus of the paper conerns the question how "social impacts of computers" are produced by management decisions, organizational exigencies, accidents, and environmental forces.

The model is clearly situated in the broader behavioral literature on organizations and organizational innovation. Major streams of behavioral research and assumptions are reviewed. The model assumes an eclectic position: organizational innovation results from both internal *institutional factors* as well as powerful *environmental forces*. "Social impacts of computers" filter out from a reasonably complex interaction between the organization and the environment.

Our goal from the outset was to develop a general model of information technology development which was not a "special" purpose, narrowly framed theory typical of prior management information system research. In addition, we hope to set straight popular misconceptions created by vendors, consultants, and others concerning the question, how do computers "impact" organizations.

A General Model for Understanding the Relationship Between Information Technology and Organizations

The origins of this paper lie in a very practical research problem: how is it possible to understand the experience of very large organizations in building truly large information systems overly long periods of time? In 1985 my colleague Alan Westin (Columbia University), and I began a study of the Social Security Administration's (SSA) billion dollar systems project called the Systems Modernization Plan (hereafter SMP). This project was intended to re-build SSA's very large scale systems developed since 1935.

The study was funded by the Office of Technology Assessment which is a research arm of the United States Congress. In this instance, several Congressional Committees wanted a professional assessment of whether or not SSA's plan to rebuild its aging information systems stood any chance of actually working. By 1985, SSA has spent about 250 million dollars appropriated by Congress. There was by 1985 plenty of evidence that this money had not been well spent. By 1986 we had developed a preliminary general model of information technology innovation and completed our research for OTA.

Our theoretical work was spurred, and supported, by a grant from the National Science Foundation to do a comparative study of the evolution since 1940 of information processing at three federal agencies using our model (NSF Grant IRI-8619301). The agencies are the FBI, IRS, and SSA. This work is on-going.

Very Large Scale Systems: SSA's SMP Plan

In 1982 when it began, SSA's System Modernization Plan (SMP) was one of the largest and most complex American examples of planned organizational change

and innovation in the 1980's. SSA's SMP is an example of a class of information systems we call *very large scale systems* (VLSS). Described in greater detail in a different paper, very large scale systems--briefly--evolve over long periods of time, control the information flow of the central, "core", activities of an organization, and play a dominant role in shaping the organizational metaphor of production and service delivery. Much of what large scale organizations do on a day-to-day basis is shaped by the capabilities, design strategies, and performance of its large scale systems hardware and software.

While the private sector undertakes large system development efforts, none in the 1980's had as large a budget or staff as the SMP, or involved so many clients. Since 1982, several other federal agencies have announced re-building plans of equal or greater size.

Like SMP, many of these other federal system re-building projects are experiencing great difficulties: cost overruns, failures of software, delays in delivery, and outright fraud. Systems of this magnitude rarely "fail" like airplanes falling out of the sky. Instead large scale information systems have "soft", unplanned landings in which major parts fail, planned changes in design never occur, hardware is in place but underused, and so forth.

What is a 'General Model'

From the beginning of our work we set out to develop a general model of information systems innovation-- a model which was not peculiar to information systems technology but instead one which might be applied to any organizational innovation, a model which was directly related to the mainstreams of research in organizational sociology, political science, social psychology, economics, and other behavioral disciplines.

Our view was that the information systems research world was too isolated from the rest of behavioral research, had developed several unique theoretical perspectives and so-called "frameworks" based on the assumption that information technology was somehow different from other technologies or innovations. The findings of this circumscribed worldview of information systems (sometimes called "management information systems") research were, in our view, of limited generality.

By "general" therefore we mean a model which relates information technology innovation and use to the broader context of organizations and the organizational literature.

Our use of terms like paradigm, model, theory, and hypothesis are standard and fit within the framework of "normal science". A model is more developed than a *paradigm*, but not quite a *theory*.

A paradigm is a set of underlying often taken for granted assumptions about the nature of problems, causality, and consequences. These assumptions spawn *models* which are particular arrangements of concepts and variables suggested by a paradigm. *Theories* are testable collections of tightly formulated hypotheses of the form "the more x, the more y".[1]

We had three pressing, practical uses for a general model. Before we could understand the development trajectory of SMP, and later of other large scale systems, their successes and failures, we needed a model to organize our observations. Before we could develop this model we needed a good understanding of *why* organizations innovate in the first place and *how* they go about doing it. And before we could seriously address organizational innovation, we felt we needed some powerful insights into organizational behavior in general. In addition, we needed a framework to organize our search of the literature.

We hoped our model would meet four criteria: utility, simplicity, generality, and provocativeness. The model had to be powerful enough to do a creditable job of organizing the literature; general in the sense described above; simple in order to present preliminary findings to general managers and lay people, as well as academics; and provocative of further thinking about the subject, e.g., hypothesis generation.

These initial perspectives gave us the task of reviewing the organizational innovation literature--a massive job in itself, and then searching for some overarching organizational behavior perspective which could place innovation in the context of general organizational behavior. Once we had this perspective we hoped we could organize the literature review in a coherent fashion.

In order to answer these inter-related questions we reviewed three major streams of empirical literature: organizational innovation and change (a truly massive literature), technology implementation, and technology assessment. The disciplines involved in these literatures are diverse: political science, sociology, economics, law and public policy, history, systems analysis and design. We have included many references to this literature, but the reader interested in a more detailed description should consult the comprehensive review.[2] There are several classic reviews of organizational innovation as well.[3]

In addition to the literature review, the authors have over thirty years of collective experience working with large scale system development projects.

Outline of the Paper

What follows is divided into five sections. Because the practical research setting had a lot to do with theoretical development, Section 1 describes briefly the

practical situation of the Social Security Administration in 1982 at the outset of the SMP from a Deputy Commissioner's point of view. Section 2 introduces the major theoretical assumptions and propositions of the model. In addition we introduce a rough outline of the model so the reader can anticipate the conclusion. Sections 3 and 4 describe and review directly related literature on organizational behavior and innovation which we used to specify and operationalize the model. Section 5 presents a summary of the model, how it is used in our research, as well as some limitations.

I. From a Deputy Commissioner's Point of View: The Practical Research Setting

One way to see the utility of developing a model of IT innovation is to consider the plight of a recently appointed Deputy Commissioner of Systems. Any model of innovation should, we believe, be able to provide guidelines and useful strategies to a senior manager. We can evaluate our model, and various perspectives in the literature, against the practical considerations of a Deputy Commissioner of Systems at SSA. But first you should have a basic understanding of what SSA is and how it operates.

SSA: The Organization

The Social Security Administration was created by Congress in 1935 with the passage of the Social Security Act. The first old age insurance account numbers were issued in 1937, the first year's budget was one million dollars, and the first payments began in 1942. Since then SSA has grown into the largest insurance agency in the world with approximately 50 million monthly recipients. From the beginning in the 1930's through the 1960's SSA was one of the most advanced users of information technology in the world.

Today SSA is an organization with 70,000 employees. SSA operates 1300 district and branch offices throughout the country, 10 regional offices, 75 area offices, 34 teleservice centers, 3 data operations centers, and 7 program service centers. SSA also oversees 54 state Disability Determination Services centers.

SSA remains highly centralized at its Baltimore headquarters where 20,000 employees are located, including 4000 systems personnel at the National Data Center.

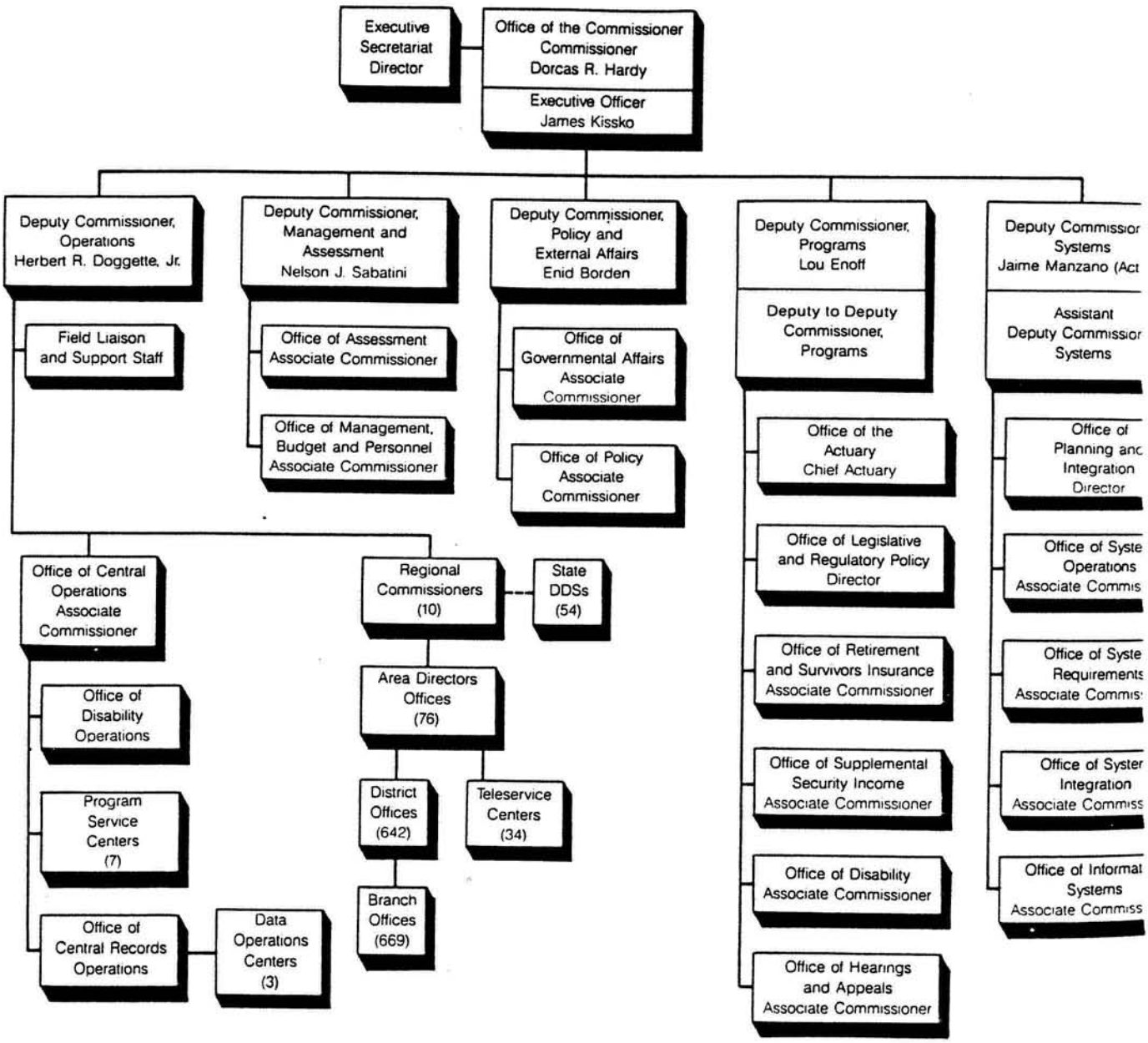
There are four major programs at SSA: OAS (Old Age Survivors), DI (Disability Insurance), Enumeration (distributing SSA numbers to the population), and SSI (Supplemental Security Income). In addition SSA administers a small program called Black Lung which provides disability payments to coal mine workers.

From a political point of view, it is important to remember that SSA was the flagship of the New Deal, the single largest federal intervention program devised by Roosevelt to help re-generate the American economy in the late 1930's. Conservatives in the 1930's denounced it as pure socialism. Throughout the conservative 1980's, SSA was often on the defensive at the White House and in conservative journals.

The Deputy Commissioner of Systems

As an experiment, assume that you have just been appointed Acting Deputy Commissioner of Systems at SSA. Deputy Commissioners are key players in senior management. SSA is divided into five major divisions or functional areas (see diagram) each led by a Deputy Commissioner. The Acting Commissioner of the agency has selected you to plan and implement the Systems Modernization Plan. You are now in charge of a billion dollar project to re-build SSA's old systems and you control as well the entire systems staff and budget (4,000 systems personnel and

Figure 1.1: Organization of the Social Security Administration (December 1986)



a budget of about 150 to 200 million dollars per year for all expenses related to information processing).

The year is 1982 and the agency has barely survived a major funding crisis in the conservative Reagan administration. The old administrative systems are totally saturated and no longer capable of any growth. The delivery of checks to 50 million persons each month is seriously in doubt. Computers and telecommunications are twenty years out of date, much of it no longer manufactured, and operating beyond capacity.

Although survival of the agency appears certain, the President continues to show his displeasure with SSA by refusing to appoint a permanent Commissioner, or to approve any senior level, permanent, appointments including your own. Your real title is "Acting" Commissioner of Systems, with all the limitations implied.

With more than 20 years of agency experience, you begin to think about the task ahead. At one billion dollars, SMP is one of the largest civilian agency system development efforts ever. It would be a difficult task in any agency, indeed, any organization. No private sector business has so many clients, such a large data processing installation, or is so geographically dispersed.

SSA in the past developed systems over decades, piecemeal. Each of the major SSA programs described above (Old Age Survivors, Disability, Enumeration, Supplemental Security Income, and Black Lung) has its own set of information systems developed in isolation from the rest. As Congress passed new programs, SSA developed systems to achieve the legislated goals. That of course is part of the problem: SSA uses 12 million lines of code written by hundreds of different programmers and analysts over decades. Systems people call it "spaghetti code"--the lines of code are all related but in ways that are twisted, complex, and non-linear. The totality is like a major orchestra playing a symphony with many

different composers. The only way music can come out is through Herculean individual and group efforts.

The systems staff available to design and build SMP has years of agency experience, but is woefully behind in modern software techniques, lacks equipment, and often must be dragged into the maintenance of existing programs and systems just to keep SSA working. There is very little extra, trained staff to develop the new systems. Federal wages are low relative to private sector wages and attracting new, college educated, systems personnel is difficult.

In terms of computing power, telecommunications, data storage, procedures design and business practices--the agency is a full computing generation behind (five to ten years).

SSA's Systems employees fear SMP will reduce their power and discretion. They fear any changes will mean the end of their jobs. The union to which they belong (the American Federation of Government Employees) has threatened to stall SMP unless working conditions and jobs are jointly determined. Labor relations are deteriorating because of job cuts, RIFS (reductions in force), and wage freezes. Without labor support, SMP is doomed. Modern systems like SMP will require re-training many of SSA's 80,000 employees. Without their voluntary cooperation, even enthusiastic participation, the project can stall for years.

The Reagan administration just fired striking aircraft controllers (1982) and is seeking to ban their union. The labor movement perceives the new Administration as an enemy. Simply talking with SSA's union--probably vital to the success of SMP--will be difficult in this atmosphere.

SMP will change how clients are served at 1300 district offices, permit new management information on district office performance to flow quickly to headquarters, challenge the discretion of the appointed Regional Commissioners

(indeed call into question the need for District Commissioners), potentially call into question the need for over 100 million physical file folders stored in the regions.

These aspects of SMP fly in the face of SSA's organizational culture. Many of SSA's services could be delivered through a system like an air line reservations system, or through automatic teller machines. But the bureaucratic ideology of SSA from the beginning has been face-to-face client service based on a one-to-one relationship with a professional caseworker using a physical file. This mode of operation may no longer be economically viable, or technologically necessary. In the 1930's it was both.

As Deputy Commissioner of Systems you know that much more than a selling job will be required to implement SMP. You will have to show the various interest groups in the agency--the systems operations people, the case workers, the regional commissioners, the union, the middle managers--that SMP is in their interest, that it is necessary for agency survival, that despite all the promised changes SMP will not harm them personally. You will have to convince them that SMP should be seen as a personally empowering program which will let them do their jobs better and not as a system imposed from on top designed to reduce jobs, cut wages, worsen working conditions, and monitor every worker.

At the same time, the President's men at OMB (the Office of Management and Budget) are pressuring the agency to come up with some large staff reductions. OMB figures that with one billion dollars in new technology, some labor savings--say a 25% reduction in staff, or 20,000 employees-- are reasonable. Is this a reasonable demand? Should advanced computerized systems lead to labor force reductions at the same time that service is enhanced?

You also know after years in the agency that you don't control all the pieces. No matter how well you plan, no matter how hard you try to build confidence in SMP, events, other actors, and individuals intervene. The President may call for

federal job cuts and use technology as a political weapon to support cuts. SSA may be a target for the President just because it is big. Congress may listen to the President this time, and they certainly will demand better service to their constituents.

The AARP (American Association of Retired Persons) will pull out all the stops to prevent labor force reductions fearing loss of service to their constituents; the unions will join them. Without AARP's support, Congress may not fund SMP. Unplanned disasters--the breakdown of a major mainframe, or a strike in a regional check processing center--are always possible.

At best you can influence the process, intercede only at strong points, weaken the opposition where possible, deflect counter proposals, tilt the debate in your direction, and hope for the best. Maybe all you can do is set a general direction rather than implement a plan.

After reviewing all the pressures and limits on an Acting Deputy Commissioner of Systems, the reader might wonder why take the job? Setting aside that question, if you were in this job yourself a model of how organizations change, a model of the major factors in information technology implementation, might be very helpful and practical for you if it could be used to develop a management plan of action. Where should the Commissioner start, what should he pay most attention to, and how should he order his priorities?

Section 2 Theoretical Assumptions and Perspectives

An Emerging Paradigm

Our theoretical argument begins with the proposition that over the last 15 years of research on the social impact of computers, a rough paradigm of analysis

and thinking has developed among an invisible college of researchers. This is remarkable given the diverse backgrounds of the researchers: computer science, political science, sociology, public administration, and other behavioral disciplines.

There are four central assumptions in this emerging paradigm:

*The environment of an organization is an important factor in the development of it systems.

*Internal organizational factors such as politics, bureaucracy, and culture shape the evolution of systems in an organization over long periods of time .

*Information technology is a malleable set of tools which can and does reflect organizational features rather than shape organizational features.

*The systems development process is a long term process involving adoption, utilization, routinization, and management.

*Information technology, computers, rarely have direct "impacts" on organizations or people. "Impacts" are complex outcomes involving interactions among organizational and technological factors.

Evidence for this paradigm can be found in early work (Laudon, 1974; Kling, 1978; Laudon, 1976; Kling 1980; Danizger, Dutton, Kling, and Kraemer, 1982) which proffered crude but innovative frameworks for viewing information technology. More explicit development of key elements of the paradigm can be found in later work (Markus, 1983; Robey and Markus, 1984:). Explicit recognition of the paradigm and testable theory can be found in Laudon (1985; 1986), and a major forthcoming book by Kraemer and King (1989).

Popular Conceptions of How Computers Impact Organizations

An interesting feature of this paradigm is that it runs directly counter to popular conceptions of the social and organizational impacts of computing. In the popular view, information technology, computers, directly impact participants. Computers in this popular view "flatten hierarchies," "create new organizational

forms," "revolutionize the educational process," or as Forbes magazine put it in an advertisement, computers are "utterly transforming the economy and society."

None of the empirical research conducted in the last fifteen years by researchers in the tradition described above supports these popular views in which computers have direct impacts on organizational process, structure, activities, or management. It is as if high placed journalists, pundits, advertisement copy writers, salespeople, Washington lobbyists, and a few academics have chosen to totally ignore a large body of empirical research which runs contrary to mass opinion.

Re-discovering Internal and External Dimensions of Behavior: A Preliminary Model

As we reviewed the innovation and general organizational behavior literature, we re-discovered the ancient distinction between *internal* and *external* sources of behavior. This distinction is at least as old as Aristotle's Politics where it is used to describe how the various states and societies in the Greek empire evolve.[3] As noted above, with little formal notice scholars have turned to the external environment of organizations for one source of influence over computer projects.

The distinction is tangentially related to the ancient and perennial debate of free will versus determinism which shapes so much of Western culture. It is used as well in a fine review of organizational theory by Pfeffer,[4] and it is an elementary distinction in development economics (exogenous and endogenous stimulants).

In this view, organizations can be seen as behaving in response to external, environmental pressures and opportunities, or they can be seen as behaving in response to internal forces. The distinction between institutional and environmental factors bears some resemblance to that of voluntarism and determinism. In general, *institutional factors* are those over which the organization has some influence or even

control. And *environmental factors* in general are beyond direct organizational control.

The institutional versus environmental perspective supplied us with the overarching, general theoretical perspective from which to describe, and categorize the voluminous innovation literature.

Applied to innovation -just another kind of organizational behavior - we reasoned that organizations innovate for basically two reasons. Either the organization innovates because of *internal (institutional) factors* or because of *stimulation from external (environmental) factors* largely beyond its control[5]. To simplify matters we will use *institutional* and *environmental* throughout the paper.

Applied to information systems specifically, our preliminary view was that external and internal factors determine an organization's major missions and policies. These missions and policies in turn determine the kinds of information systems that are built, and the kinds of implementation strategies pursued. Ultimately, the impact of information systems on organizations, and vica versa, the impact of organizations on systems, result from this process.

The preliminary model is illustrated in Figure 1. Once we had arrived at this preliminary model, we began the process of specifying more precisely what we meant by "external" and "internal" factors, "missions and policies", "implementation strategies" and so forth. This led us to a more fine grained literature review in search of more specific concepts, and operational measures.

The Preliminary Model at SSA

As we explored the preliminary model, we attempted often to see how it worked explaining SSA's own behavior. We had conducted many interviews with SSA senior managers, systems and other unionized employees, as well as vendors,

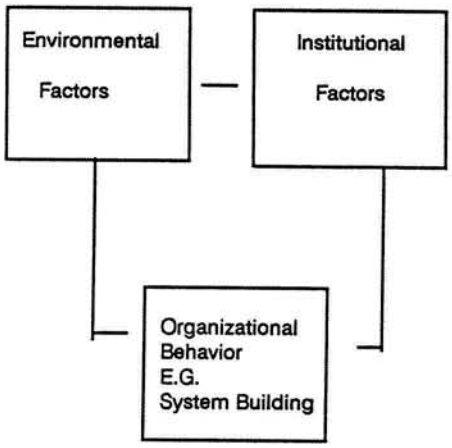


Illustration 1
A Model of Organizational Behavior

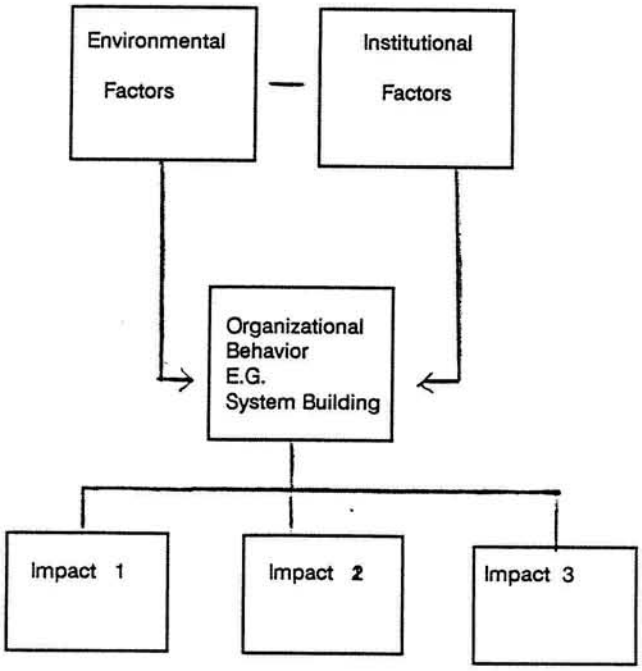


Illustration 2

A Model of the Impacts of
Information Systems

commentators, and auditors of SSA activities, prior to developing the theory as we put together a history of information technology at the agency from 1935 to 1985.

Our interviews showed that the major external factors operating on SSA, at times forcing innovation, are other political actors in Congress and the White House who control the agency's budget, mission, policies, and other resources. In addition, a fast changing technology created by others, and used by competing organizations (private insurance companies), also is a major feature of the environment. As an insurance agency, and a welfare agency, SSA is also powerfully affected by environmental demographic change.

The major internal factors at SSA are the politics, bureaucracy, culture, plans, and accidents, e.g. random events, found in all large organizations.

Together these environmental and institutional forces could be seen as the driving forces behind all of SSA's behavior, including SMP and technology innovation. With this preliminary support for the utility of the distinction between environmental and institutional factors in innovation, we began a detailed review of the literature.

Other Major Assumptions

We began our research with a number of background assumptions based on the literature and our own experience.

Our research had taught us *not all innovations are equal.* As Schumpeter noted, some innovations radically alter the production function of organizations--or threaten to do so, whereas many other innovations impact only technical areas of the organization.[6] SSA's SMP is a non-routine, risky, very large scale innovation which--if it was successful--might alter the production function at SSA along with many fundamental assumptions about how SSA conducts business. Given the size

of the innovation, virtually all of SSA's internal and external political actors would be active players.

Technology is more than hardware and information technology in particular involves many social technologies, e.g., skills, attitudes, management organization, and beliefs. Important technology innovation is a "package" which normally cannot simply be "adopted" like electric pencil sharpeners[7]. Implementing, routinizing, changing people, work, and organizations may be required before new information technology can work properly.

While the classical literature on innovation speaks of "adoption", the last twenty years of research on innovation has clearly found that *innovation is a process not an event.* Following simple adoption comes utilization, long term routinization, and proper management [8]. In the last twenty years many institutions have seen technology adopted, but then not utilized, or routinized, and finally abandoned. SSA's SMP is a ten year innovation process, not a one-shot adoption.

We also knew that *scale of innovation is very important* in understanding innovation in organizations. Whereas we can use the metaphor of "adoption" and "diffusion" when speaking of individuals and small groups, as the scale of innovation goes from individuals and small groups to organizations, and then institutions, the explanatory framework must enlarge. SSA's SMP is a large scale, macro case study where broad social, political, and cultural features are important.

After many years of experience we discovered that *technology is not strictly an independent force* and that *technology does not impact organizations* like some extraterrestrial craft. Technology--information technology--is a product of some organization, some design decisions. A system designed by IBM will be quite different in "impacts" than a system designed by Apple Computer Corporation for the same purpose. Moreover, organizations always modify technologies to fit local circumstances. Hence researchers can never really study a "pure" instance of the

technology, information technology sui generis, for it is always confounded with local variations, and distant design decisions. Technology is a social product.

Last, we are well aware of the dissimilarities between the pubic and private sector (and aware of their similarities). Briefly, public government organizations operate in a political marketplace, insulated somewhat from the economic marketplace; they are constrained and prodded by political forces, statutes, regulations, and Constitutional principles. It is generally agreed that government agencies and non-profit organizations have a restricted range of potential strategic options when faced with declining environments.[9] Government agencies are also players in the political marketplace, not merely reactant to political forces. In some sense they shape their own political environment, have some choice which environments to play in, and what tactics to use, although to a smaller degree than private organizations.

Section 3 The Innovation Literature: Two Perspectives on Social Action

In the last thirty years there has been a marked change in the innovation literature. Work done in the 1940's and 1950's tends to emphasize individual actors, roles, social networks, and personal attitudes as central to organizational innovation. Work done in the 1960's tends to emphasize the centrality of institutional characteristics in the change process.

This work from the 1940's to the 1960's has a decidedly up-beat, optimistic character to it. The message is that organizational innovation is possible and likely if people would just get the right attitudes, the right values, cooperate, and pull together.

The work of the 1970's and 80's tends to focus much more on the broad social, political, and cultural environment in which organizations live. Here environmental pressures are seen as dominant, change is less under control of the

organization, environmental change can be rapid and threatening, and many organizations would rather die than change.[10] This work is not so optimistic. Organizational innovation in this recent work often comes about by old organizations dying and new ones springing up.

Some institutional factors found important to the innovation process are political competition among organizational leaders, bureaucratic opposition or support for change, and deep seated organizational values. Some environmental factors important to innovation are social and political climate, demand for an organization's product, technological change, and support from other organizations.

Some of the literature--as we see below--focuses on the interaction between these factors. This literature reflects the idea that organizations can shape their environments *some times*.[11]

Institutional and Environmental Models

We can use the basic distinction developed above to arrange all of the innovation literature into two basic groups: *institutional and environmental models*.

Environmental models focus on uncertainties or opportunities in the environment that organizations must either cope with or take advantage of through organizational innovation. Failure to do so results in organizational decline and death. Rapid environmental change, loss of legitimacy, growing competition, changing client or customer preferences, demographic change, and the like are examples of environmental uncertainties. Environmental opportunities--though less frequently cited--are exemplified by new technologies, declining costs, market expansion, a baby boom,a new government program which promises funding, and etc.

In environmental models organizations innovate because either they are forced to by the environment or they choose to take advantage of some environmental opportunity. The environment is,in any event, the principal stimulus.

Institutional models of change focus on internal decision making and planning, organizational values, norms, structural characteristics, bureaucratic and political processes, and human resources. Organizations in this view adopt innovations because they happen to have the right structural characteristics (or planned them in the first place), because they have supportive innovative values, because of the outcome of political and bureaucratic intrigues, or because of the happenstance connection of problems with the right solutions.

According to some institutional models, organizations can innovate despite the absence of any environmental stimulus, and without any underlying contribution to "efficiency" or "effectiveness".

Uplifting and Dispiriting Aspects

Institutional models of change are generally uplifting because they emphasize the volitional, planned nature of change. Organizations in this view can choose, manage, change, make progress, survive, and in the long run adapt to environmental change.

Environmental models are often dispiriting because they tend to emphasize the rapidity and harshness of environmental change, turbulence--abrupt change that is not planned, the brittle nature of organizations, the absence of change, the likelihood that managers will misperceive their environments, the dependence of actors on circumstances beyond their control, and the ultimate death of most organizations.

By far the vast amount of research on organizational change focuses on institutional models which emphasize volition, management, and planned change.

Almost all schools of management, both business schools and public administration, teach that organizations can successfully adapt to environments if "the right policies" are adopted. The literature which focuses on "implementation" of innovations fits this mold.[12]

In these management schools and their related literature, failure is treated as an aberration, something to be avoided, something not talked about at any great length. Organizational death, like personal death and dying, is in general a pariah subject even in a market society which presumably counts on inefficient forms disappearing.

With the literature classified into institutional and environmental camps, we can briefly review the major themes in the innovation literature. At appropriate points in the review, we pause to consider how a Deputy Commissioner of Systems might react to the research literature.

Section 4: Institutional Models and Perspectives on Organizational Innovation

In an effort to further specify and operationalize our preliminary model of innovation, we examine briefly the seven leading institutional models of organizational innovation.

Rational Organizations and Decisionmaking

The most pervasive explanation of organizational innovation is the rational adaptation theory. Here, managers perceive gaps between performance and expectations, search for solutions, choose optimizing or satisfying solutions, and bring the organization into a desired relationship with the environment.

Organizations innovate then because they want to achieve certain goals, because they accurately perceive gaps between performance and goals.

How do organization's innovate? The 'rational man' model of decisionmaking is employed here at the organizational level: the organization has more or less perfect information, a clear set of consistent goals, the resources to investigate all alternatives, and the ability to rationally optimize choices.[13]

The environment is generally a supportive tableau. While environments change, organizations adapt in the long run to these changes.[14] There are many variations on the rational model most of which try to make it more realistic.[15]

In the business school field called 'management information systems' (MIS) the rational model is the basis of virtually all textbooks.[16] Managers are taught to scan the environment for technologies, experiment and learn; adopt and implement what benefits the organization.[17]

A special literature called "implementation" argues that if an organization develops the correct roles, adopts the right strategies, and avoids risky technology projects, then success will follow[18].

Business authors and consultants with up-beat messages (captured in titles such as *Thriving on Chaos*) sell millions of copies to business leaders with the idea that organizations can survive changing environments if the "right" strategy is followed.[19]

Even critics of information technology adopt a rational model. For Marxists, capitalist organizations adopt IT because of "the drive to coordinate diversity. . . greater economy, and [efforts] to rationalize the organization" [20]. Another critic sees the technology itself autonomously rationalizing organizations "largely without human guidance".[21]

There is some limited empirical research which supports the rational model. Sometimes things happen as planned just by virtue of dumb luck. Adoption of

criminal justice information systems have, for instance, been linked with the rise in crime rates (and lots of federal cash) [22] and another study found perceptions of "improved organizational performance" resulted from the spread of IT among local governments (even though the actual benefits did not occur).[23]

As we review other perspectives, however, it will be apparent that the rational model of system development is most unlikely as a description of what actually happens in organizations.

Evolutionary and Stage Models

A widespread and popular variation on the rational model of innovation argues that organizations "naturally" go through stages or evolve. Many of the social science classics written by Marx, Compte, Spencer, Weber, Durkheim and others argue some form of inevitable change caused by some deeply held, simple but powerful internal values in organizations --the pursuit of efficiency, profits, control, knowledge, modernity-- and pushed along usually by some contemporary *deus ex machina* (advancing knowledge, falling wages, or competition).

Contemporary versions of evolutionary models are provided by Daniel Bell (the "post industrial society"), John Kenneth Galbraith's (the "new industrial state"), and Marc Porat's (the "information society").

In these theories society and organizations evolve always and inevitably towards some higher state, pushed by advancing knowledge or--in some theories--information technology. Organizations innovate because they vigorously pursue some goal, and adopt whatever is needed to achieve that goal. Organizations adapt to the zeitgeist or whatever else is moving history.

These theories are wonderfully simple, make for fun reading, excellent dinner party debates (are we really advancing?) and serious conversation in

academe (what is the meaning of 'progress'). Unfortunately, all have been seriously challenged and most repudiated as utter intellectual nonsense. [24]

There are of course special versions of evolutionary models in information technology (MIS) literature. The most famous is the Nolan stage theory which claims organizations go through four stages of IT: initiation, contagion, control, and integration[25]. Allegedly, one can discover these stages by looking at budgeting levels and change in an organization.

Stage models are the ideal consultant's magic talisman for which the client pays dearly. By claiming all organizations go through stages of information technology development, the consultant then poses the question "what stage is your organization in?" followed by "what stage should your organization be in?".[26] The answers always are expensive.

Stage theories are rational insofar as they rely on more or less conscious organizational, decisions, as the mechanism of evolution, or on criterion of organizational efficiency to push the model along.

None of the information technology evolutionary models are supported by empirical data and all have been roundly criticized. [27] Many organizations skip stages altogether [28], budgeting for computers (one indicator of a new stage in computing is a new budgetary level of spending for IT) tends to be a relatively constant percentage of gross revenues. [29] And all evolutionary theories posited so far have a teleological bias: there is a single, benevolent end stage towards which all organizations are moving. The possibility of organizations freezing at one stage, or jumping a stage ahead, or adapting the wrong model, or just failing altogether, is not a part of the consultant's evolutionary forecast.

Strategic Planning, and the Strategic Role of Systems

It is a short extension from the descriptive 'rational model' where organizational behavior is shaped by rational decisionmaking, to the prescription that organizations *should* engage in rational strategic planning. Strategic planning -- although accounts differ--basically involves carefully investigating the nature of the business and industry for long term growth potential, establishing corporate objectives, examining alternative strategies to achieve the objectives, operationalizing goals, assigning responsibility for implementation, and evaluating progress towards the goals.[30]

In short, strategic planning literature asks organizations to act like the rational model says they should. The emphasis is on formal planning staffs who churn out five year plans, and coordinate implementation of the plan.

In the strategic literature, organizations innovate because of a strategic plan which resulted from a rational decisionmaking process. Implementation of the innovation is carried out by a trained professional staff which guides and monitors innovation.

There are of course many different recipes for how to do strategic planning--some recommend top down planning by top level senior management, others bottom-up, still others "middle out"; and several authors are now recommending strategic planning in reverse--look at the available means before considering desirable goals.[31]

Pushed along by a fascination with measurement tools and planning techniques, from systems analysis to budgeting techniques (PPBS, zero based budgeting, etc.), American firms widely adopted corporate strategic planning in the 1960's and 1970's. They have just as widely abandoned corporate wide formal strategic planning in the 1980's. Evidence has slowly accumulated that strategic planning created a huge, bloated corporate headquarters staff which fed senior management an endless stream of data and documents; the resulting decisions often

were disastrous.[32] The return on equity--or other measures of performance--for firms which engage in strategic planning is no greater than that of firms which do not follow formal strategic planning methods.[33]

In the words of one corporate planning guru who examined corporate acquisitions over a thirty year period, "The corporate strategies of most companies have dissipated instead of created shareholder value."[34]

Just as corporate wide strategic planning was falling into disrepute, the major themes were picked up by the information technology literature in the mid 1980's. A host of speculative articles appeared all of which argued the vital strategic role which information technology could (should) play in the firm.[35]

As applied to information technology, the strategic argument is that information technology can be used to achieve a more or less permanent competitive advantage over other firms by reducing costs of production or differentiating the product or service. Information technology, according to proponents, can be used to create new relationships with suppliers, employees, customers, and competitors. When successful, it is argued that a firm can use information technology to raise market entry barriers, decrease the possibility of substitute products, and increase the firms power over suppliers and buyers. A common example in the literature is the American Airlines reservation system, SABRE, which has over the years provided American with a powerful competitive advantage.

To date, there is no evidence that firms can systematically, over the long run, consciously use information technology to achieve long term competitive advantage. Virtually all successful "strategic systems" in existence today were drifted into over many years, evolved through several stages, and were not planned. Competitive advantages appear short lived. So-called successful strategic systems--the airline reservation system, American Hospital Supply Corporation, Citibank's ATM

network--are constantly cited in the literature. These systems however often evolved rather casually, without any central plan, and provoked powerful competitive responses. The strategic literature fails to account for the strategic system failures like IBM's and Merrill Lynch's failed stock quotation system, Federal Express' ZAP MAIL, Citibank's failure to increase return on equity despite massive investments in ATM machines, and General Motor's failure to achieve cost advantages in auto production despite truly huge investments in robotics [GM's most productive plant is in Torrance California and does not use robots. Instead it is managed by Japanese from Toyota in a joint venture].

The Deputy Commissioner Responds

The Acting Deputy Commissioner--listening to our description of the rational model--would no doubt be shaking his head in disbelief at this point. The rational models--classical, evolutionary, and strategic planning--seem totally unrealistic. There clearly is not time, resources, or staff to consider *all* possible alternative actions; there is no rational calculus to help choose the "best" option [best according to whom and what?]; there is no consensus on goals among key players; information is not perfect or even shared.

Evolutionary models sound nice--but it is not clear what stage SSA is in. SSA may be unique. Information technology affairs in general at SSA, perhaps the entire administrative apparatus, seem to be evolving downwards, not upwards towards some perfect future brought on automatically by advancing technology.

Strategic planning approaches offer some provocative thoughts. SSA's SMP is a strategic plan. But is SMP the right plan, can it be implemented, and will the changes be accepted? How can SSA use information technology to change the relationship with clients--100 million contributors and 50 million beneficiaries? Would any change in relationship be accepted? SSA has experienced several

strategic planning failures in the 1970's, top down efforts that had little support from the middle management or the 80,000 other SSA workers. SSA is not exactly free to choose what industry it wants to be in, or even how it delivers services. Constituents have Congressmen, and Congressmen sign the check. Would the union and other workers accept massive changes in how SSA accomplishes its work?

While rational models offer the Deputy Commissioner few practical solutions or action guides, the Commissioner does recognize that whatever plan is decided upon, for whatever reasons, it will have to be presented to the public, to Congress and the President, as the result of a rational strategic planning process. Here lies the strength of rational models--as an explanation and supportive rationale of behavior derived from fundamentally other considerations.

Political Perspectives

Political scientists, public administration specialists, and sociologists have often studied the politics of innovation. Here innovations are adopted, used, and managed, as a result of a political bargain struck among key organizational actors. The result is not necessarily "rational" in the sense of "best, optimal decision." The result is, however, "rational" in the sense of producing results which key actors can live with. The test of a good innovation or change is: can people live with it, can people in the organization (and key external groups) support the policy, and therefore can the organization survive?

Why do organizations innovate? In the political literature organizations innovate when it is *politically necessary* because of external environmental demands or internal power struggles. Classical "rational optimal" solutions and those who advocate them are potentially dangerous because they lead to results which may be

scientifically rational but politically unacceptable and potentially threatening to the organization.

Political models of systems innovation assume that organizations are composed of interest groups, and political actors who either represent themselves (their personal interests) and/or the interests of groups. Politics arises because of limited resources and the desire of most actors for more--more of whatever is worth having: money, power, status, and affection. Politics also arises because of deep and basic social divisions created by the division of labor, specialization, and history. Power in organizations is shared; at the top are men and women who differ in points of view; these differences matter. Competition for leadership results; each individual in an organization--from the high and mighty to the floorsweeps--are players in the game of politics. Decision making is the outcome of daily political competition.[36]

How do organizations innovate? Innovation results from the strategies and tactics of key political actors, roles, and groups.[37] Innovation is a process, a struggle, not an event that happens at some time or place. An important aspect of the political model is that organizations to do not "decide" about systems. Instead, systems development is from the inception to the end a negotiating process involving major groups in the organization. Outcomes of the negotiation tend to reflect the power of the parties involved although there can be surprises, countervailing values, and unintended consequences to the game of politics.[38] Moreover, not all actors correctly perceive their interests; some can perceive but cannot act. Therefore, the political outcome can go to the quick and nimble, those who can organize and capture the imagination. Success or failure is not announced, but it is signaled by departures and hires, brief announcements.

When the political perspective is applied to information technology, IT is seen as a resource, and key organizational actors respond to this resource as any

other: they seek to control its adoption, management, and use to pursue their political interests.[39] Building an information system--an online, distributed, integrated customer service system-- is generally not an exercise in "rationality". It is a statement of war, or, at the very least, a threat to all interests who currently are involved in any way with customer service.[40]

What is at stake in important information systems is just about everything: how much power will systems confer on various groups, what values and ideologies does a particular system strengthen; what future potential for political action does a system imply; what changes will occur in working conditions, job definitions, pay, skill, respect, social interactions, leadership, public acceptance, legitimacy, and budget.

Systems which do not impact these matters are, by definition, unimportant.

In this view, information systems require for success not so much a "rational" goal, or management, or strategy, or the right technology, but a political coalition powerful enough to "get it over." The bigger the project, the greater the power, the larger the coalition needed (and the more likely is strong counter-implementation and conflict).[41]

Next to the rational strategic planning model, the political model composes the largest and fastest growing part of the literature on IT and organizations. Some representative findings are: a state governor used the development of a state criminal justice information system as the basis for gaining more control over local leaders and agencies[42], local welfare officials adopted an information system to impress federal welfare officials[43], the development of information systems reinforced the power of existing elites (in a study of 40 cities)[44], the design of a corporate financial reporting system was largely the result of a political process of negotiation[45], the design of a corporate accounting system was dominated by

corporate accounting with the intention of explicitly excluding divisional accountants[46], and the development of a national computerized criminal history system resulted from a series of political compromises over many years.[47]

The Bureaucratic Perspective

In the bureaucratic perspective organizations are composed of sub-units who perform rigidly defined repertoires honed over many years. The learned skills, the routines, and programs developed by sub-units have worked satisfactorily over many years. These qualities of reliability, routine, precision, are highly valued. The culture rewards organizations which can perform reliably.[48]

Organizational sub-units constitute the perceptive apparatus of the organization, the entire set of action possibilities, and the entire problem solving capability of the organization. Organizations are an "iron cage" characterized by structural inertia, cognitive inability to re-think problems, trained incapacity to imagine alternatives, and persistent long term tendencies towards stasis, lack of change, stability.

Why do organizations innovate? In the bureaucratic perspective, they innovate mostly in order to preserve existing sub-units, routines, sources of funds, missions and traditions. In other words, the bureaucratic perspective inverts the normal means-end logic. Instead of asking where do we want to go and what means do we have to get there, under conditions of bureaucratic rationality organizations ask, first, what are the available means and, second, what goals can we therefore pursue.

It is not especially important that an innovation solve some "problem". Many of the problems which large organization's address will never be solved, e.g., education, crime, productivity, market share, strategic position, national security.

The most important criteria for judging an innovation is its contribution to the sub-units survival, first, and the organization's survival, second.

Hence organizations innovate only in incremental ways, and always in ways which support existing repertoires and routines. Of course, there is always minor technical change going on, e.g., faster computers are installed, software engineering is developed, and etc., but these changes are not allowed to impact fundamental routines, the organizational "core" activities, the "core" databases, major groups, fundamental beliefs, or central missions. Indeed innovations are channeled to support traditional conceptions of the organization's mission.

Organizations may change fast in many unimportant ways--areas described above as largely "technical", not involving the "core" of the organization (management or institutional features). Insofar as organizations do change in important ways, a powerful realignment of organizational sub-units, organizational routines, programs, standard operating procedures, perceptions and the like is involved. One might suspect that this kind of powerful organizational change is associated with a crisis, a near miss with disaster, a sharp break with the past, a sweeping change in top management, a radical alteration of the environment which literally forces change.

The bureaucratic model suggests that most organizations probably just die--or freeze up-- when faced with these kinds of alternatives.

Allison's (1971) study of the Cuban missile crisis is perhaps the best known study which used a bureaucratic model (along with a rational and political model) of decisionmaking to show how the President was constrained in his responses to the Russian/Cuban missile emplacements. The choices facing Kennedy were to unleash the Air Force (which could only carry out strategic air strikes for which it had trained since W.W.II), the Marines (who could invade the beaches in an amphibious assault --something they had practiced since 1940), and the Navy (who could

blockade--a procedure learned from the British centuries earlier). When the Naval blockade was chosen, McNamara:

" . . . wanted to know which ship would make the first interception, were Russian speaking officers aboard, how would submarines be dealt with, would Russian ships be given the opportunity to turn back, what would the Navy do if Russian Captains refused to answer questions about their cargo?"

At that point the Chief of Naval Operations picked up the Manual of Naval Regulation, waved it at McNamara and said "it's all in there." McNamara responded, "I don't give a damn what John Paul Jones would have done. I want to know what you are going to do tomorrow!"

The visit ended with the Navy officer inviting the Secretary of Defense to "go back to your office and let the Navy run the blockade." [49]

Bureaucratic theories have been especially useful in explaining failure to change[50], organizational decline, and organizational crisis.[51] Facing crisis, organizations--and especially senior management-- are likely to misperceive the environment, and very likely to repeat the standard procedures and programs which worked so well in the past.[52] The misperceptions of senior management in the face of very large scale environmental change are legendary, but certainly among the most well known is that of Thomas J. Watson, President of IBM in 1948 who said "I think there is a world market for about five computers".53

How do organizations innovate? Bureaucratic sub-units capture those technologies in the environment which strengthen their raison d'etre, historic routines and repertoires. Successful innovations "bubble up" from below. Innovations which threaten other powerful sub-units are killed; organizational leaders who try to impose innovations from the top down are ignored. The leaders of powerful sub-units negotiate with one another for change resources. Innovation

is a political process, a result of negotiations over long periods among operational units. The Strategic Planning Department is simply another sub-unit to negotiate with. They must be told by operational sub-units what is possible and from that construct a strategic vision of what goals might be pursued. The real function of strategic planning in the bureaucratic view is to find new uses for tried and true remedies, routines, and beliefs.

Top down strategic planning, along the lines of the rational model described earlier, is dangerous. Such plans threaten the survival of the organization, fail to take into account what sub-units can actually deliver, hence they are unrealistic and promise what cannot possibly be delivered.

There is of course a strategic planning unit in most organizations. But Strategic planning is an output, a product, of another bureaucratic sub-unit, the Strategic Planning Department. Strategic planning is simply another bureaucratic program whose invocation is loosely--if at all--related to the problems at hand, solutions to problems, or survival. Strategic planning in the bureaucratic perspective is an activity which --if it is to be successful-- identifies what the operational sub-units are capable of and ways to strengthen their capability. The strategic planners must be taught by operational sub-units what is possible and from that construct a strategic vision of what goals might be pursued.

Key actors do not "adapt" to information technology. Rather they capture, use, and modify IT to serve bureaucratic sub-unit repertoires, programs, routines, and professional agendas. These are the permanent parts of organizational life. In this sense, "problems" do not get solved by information technology--any more than education is "solved". Programs are begun, money is spent, systems are built, but a critical observer will see that not much has changed, the same people are pretty much doing the same thing they always did, and the outcomes are pretty much the same.

The bureaucratic literature on IT innovation is fast growing. It is especially useful at explaining decades long change programs engaged in by large organizations such as the FBI's twenty year effort to develop a national computerized criminal history system despite luke warm support from Congress, presidents, and the States [54]. Others have used the bureaucratic perspective to explain how sub units capture technology to serve their interests [55], why classrooms have not been changed much by computer education tools [56], and how the Pentagon could spend 30 years trying--but failing-- to get Generals to agree on common data elements for WWMCCS (World Wide Military Command and Control System).[57]

Empirical studies of office and managerial use of computer based information systems rarely find "work transformed." Instead they find, contrary to speculation and critics of all sorts, that clerical and managerial work proceeds much as before, the computer system is changed in many subtle ways to "fit" in with office life, and few startling gains in productivity result.[58]

The case of the FBI's National Computerized Criminal History Project is especially instructive. Laudon used a bureaucratic model to explain the dogged persistence of the FBI in keeping alive a proposal to develop a national computerized criminal history system run by the FBI (as opposed to the States or other groups) through fifteen years of luke warm support in Congress and the states, five Presidents, radical shifts in political sentiment, and rapid change in Congressional support. Short term political calculations hardly seemed powerful enough to explain why or the how the FBI continually, and eventually successfully, put forward a national CCH proposal which had little chance of achieving its goal--reducing crime.

As it turns out, the FBI succeeded in part because Presidents had no choice. They could not "act on crime" without working through the only permanent, large,

federal law enforcement agency, the FBI. Presidents cannot just create new entities. The FBI was the only agency around with the personnel and routines to "do something about crime."

While a national CCH may have little to do with the incidence of crime, and while there are many other ways information technology could be used to control crime, in a bureaucratic policy world this is not important. Policy makers must work with what is available, not what might be or could have been. The FBI has spent 60 years developing manual criminal history systems. This is the core data base of the agency--the raison d'etre of its existence. This real instrument can be a "solution" to any number of "problems", e.g. identifying victims of disaster, fighting crime, terrorism, sexual abuse, credit card fraud, and etc. The function of strategic planning at the FBI is to find new uses for this powerful tool and to use whatever information technology is available to make criminal files more powerful.

The Organizational Culture Perspective

Most trained observers of information systems have at some point in their work discovered that some important features of systems they observe are due to "organizational culture"-- deeply held assumptions in organizations which shape the building and use of systems.

The idea of culture is used in many ways by different analysts. For some it means regularities of behavior[60]; the working norms or expectations which normal actors invoke[61]; the values of members, especially elites[62]; the feeling or climate of an organization[63]. The notion of culture we use here is that of the Anthropologist Edgar Schein: culture refers to "the deeper level of basic assumptions and beliefs that are shared by members of an organization, that operate unconsciously, and that define in a basic "taken for granted" fashion an organization's view of itself and its

environment."[64] The bedrock assumptions of an organization are taken for granted, learned responses to problems of group survival which work repeatedly, and reliably. In Schein's definition, basic assumptions are like bureaucratic routines: they are learned responses, rarely questioned, unconscious. This means culture must be inferred by the analyst: locals do not consciously discover their culture and talk about it. The locals enact their culture. Technology, organization, norms, and values are simply artifacts of the more fundamental cultural assumptions in an organization.

What are some examples of deep seated cultural assumptions? Here are some: the organization's basic relationship to the environment including what is the product or service, who is the customer or client; the nature of reality, time, and space; the nature of human nature; the nature of human activity and relationships; the nature of the environment [66].

Why do organizations innovate? In the cultural perspective *planned* organizational innovation is designed to strengthen and sustain the fundamental cultural assumptions of the organization. This means organizations do not intentionally innovate in ways which threaten their bedrock assumptions, and it means organizations are continually adopting new technologies to strengthen their predominant cultures.

Sometimes the cultural assumptions of an organization just fail to work. At these times of crisis, many organizations simply expire, others limp along, and still others miraculously arise from the ashes into new forms.

There are many *unintentional* ways in which organizations innovate as well. Culture conflict (exposure to multiple cultures) can provide the source of new assumptions, as can deviant subgroups, and random variation in behavior.

How do organizations innovate? Planned, intentional innovation is led by senior and respected members of the culture. In part, the control which elders

exercise over planned change guarantees a conservative result. The function of leaders is to permit just enough change in the organization's arrangements to adjust to the environment without at the same time destroying the organization's assumptions. Leaders also change the innovations--the technologies in particular--so that they conform to the organizations assumptions. This means much organizational innovation is ritualistic--the forms are adopted but not the substance.

Unplanned innovation is carried out at lower levels by deviant groups and individuals. This activity is continuous, youthful, rebellious, and efforts are made to carefully control the outcomes.

Information technology is a superb area of innovation to observe the power which organizational culture exercises over innovation. One recent study found for instance that a formal systems development methodology which was supposed to allocate responsibility in a project and assure that the system developed in accordance with user specifications, in fact provided "opportunities for covering one's position, blaming others, and escaping responsibility for poor performance." The authors concluded that "rituals in systems development function to maintain the appearance of rationality in systems development and in organizational decision making. Regardless of whether it actually produces rational outcomes or not, systems development must symbolize rationality and signify that the actions taken are not arbitrary, but rather acceptable within the organizations ideology."

Other cultural studies of information technology have explored the social movement character of the technology[69], the manner in which organizational culture permeates the systems analysis and design process[70], the design of accounting systems[71] and office automation systems [72]

The Random (Garbage Can) Perspective

The garbage can perspective on organizational change results from a common observation: things rarely work out as planned in organizational life (even when things out alright). The garbage can perspective on innovation argues that problems, participants, solutions, and choice opportunities follow independent streams. "Things happen" but not necessarily by choice; "solutions" are attempted but problems are not "solved"; "Plans" exist, are implemented, but the objectives achieved are different than planned. There are clear cut strategies and tactics outlined on paper, but the path to any objective generally does not follow the strategy. The entire organizational process seems heavily influenced by individual entrepreneurs and personalities, unexpected coalitions of sub-groups, failed structural solutions, and rapid environmental changes that defy prediction.

Random process models of change focus on the ambiguity of life in organizations. Technology, preferences, participants,the past actions of the organizations (and their rationales) are all unclear. Organizations in this view are organized anarchies.

Why do organizations innovate in this atmosphere? In this perspective organizations are garbage cans in which solutions, problems, decision makers, and choice opportunities are dumped. Each has an independent source. Time--the happenstance arrival of participants, problems, solutions, choice opportunities--connects these elements together permitting organizations to arrive at a "solution", an "innovation".

How does innovation take place? Decision makers at any one point in time become active, identify problems, which may be issues of concern to them personally or to outsiders. Activation of decision makers is often random, but is sometimes linked to outsiders who demand decisions. Solutions are products of decision makers. At any point in time, the organization is filled with solutions looking for problems. Cohen et. al, the originators of this perspective argue:

"A computer is not just a solution to a problem in payroll management, discovered when needed. It is an answer actively looking for a question. . . Despite the dictum that you cannot find the answer until you have formulated the question well, you often do not know what the question is in organizational problem solving until you know the answer." Because of demands on members time, decision makers come and go in random sequences.

Driving the process along are choice opportunities. These are times when organizations are expected to produce behavior called a "decision": spend money, start a plan, hire or fire people, sign contracts, initiate procurements, and etc. There are internal and external time clocks which force choice opportunities, e.g., the annual budget cycle, the annual appropriations hearings. Opportunities are frequent, and the organization can always declare them in the absence of any stimulus from outside.

Culminating thirty years of research critical of "rational" models of choice and change, the random process perspective have been used in computer simulations[73], and empirical case studies from selection of a dean, location of a university campus[74], to strategic planning at the Pentagon, procurement of advanced battlefield systems, and military operations.

When the garbage can perspective is applied to long term change projects--like SSA's SMP--some interesting results emerge. One study examined policy innovation over a thirty five year period at the Canadian National Film Board and found that organizational strategies occurred, happened, without always being intended or planned by the "organization." Looking at the content of 2,839 films, the authors found the National Film Board moving into and out of focus over the years, with content changing in "blips" (a brief out burst) , "trickles" (a steady stream of films with similar content), and "focused strategies" (a large stream of films with shared contents). Planned strategies often never were realized, realized strategies

seemed to emerge from trial and error, chance success, opportunity. The search for a strategy was always on-going, pushed by a need for a "sense of definition," the environment (war pictures in the 40's, then television in the 50's, then social message films in the 60's), and the convenience of harmonious gestalts, configurations, between periods of revolution. In the end, the authors concluded that the National Film Board was adaptive although in retrospect it is difficult to say this adaptation occurred by plan, by intention. It just happened. The authors concluded that a "grass roots" model of strategy is more descriptive of how organizations actually behave than a "top down" model.

A study of the ten year development cycle for major information systems at the Pentagon found that the resulting decisions, and the resulting weapons systems, are often unwanted or unexpected by most major participants. The author describes how major command, control and communications (so-called C3 systems) are developed:

"One need not go more deeply into the C3 acquisition process to understand that the outcomes emerging from these basically ad hoc combinations of processes, procedures, and decisions are not planned in any precise sense.

In general, C3 systems that come to fruition and are finally deployed may or may not support military operations or enhance military capability.

Consider how many different Army organizations formally must "sign off" on the hypothetical system . . in order to get through the Service System Evaluation Stage. Consider the external support necessary in moving from successful system evaluation to planning and programming, and finally the support necessary for budgeting and deployment.

It should be clear however, that without explicit attempts to organize the anarchy, it is extremely unlikely that outcomes will support military operations and concepts in ways intended when a project is initially conceived.

After a more than decade long process, involving a cast of characters that is programmed to change (e.g. military personnel with limited tours of duty), compromises in design and concept, as new process and participants are encountered, each with their own concerns and constraints, and changing

technologies and military threats, it is a wonder that any system emerging would reflect any coherent conception at all [77].

The apparent anarchy observed at the Pentagon can temporarily be overcome by the fortuitous arrival of individual entrepreneurs who can shepherd a program through years of resistance, powerful patrons (Admiral Raborn or Robert McNamara) who can put together coalitions and coordinate parallel streams in the anarchy.[78]

There have been few systematic efforts to use a garbage can model in the IT innovation area. Anecdotes in several works stand out. Laudon's description of how a national computerized criminal history system got attached to the problem of "crime" in American society (Laudon, 1986); Kling and Iacono's description of computerization as a "social movement" where computers get attached in the public consciousness to problems in an unpredictable and usually exaggerate manner (Kling and Iacono, 1986); Kling's description of the sustained failure of WWMCCS (World Wide Military Command and Control System) and the negotiated social reality of computing systems which span organizational boundaries (Kling, 1986).

In general, the garbage can perspective is not sanguine about the prospects for long term, closely guided, "strategic" change in an organizations core information technology.[79]

The Deputy Commissioner Considers

Now lets return to our hypothetical Deputy Commissioner of Systems at SSA and get his response to our review so far.

First, the Commissioner would probably recognize the political and bureaucratic perspectives quite easily. He knows that a very large change program like SMP will need the support of powerful political actors in Congress and at the White House, not to mention internal political groups as well. And he also knows that without the support and understanding of existing operations personnel in systems, and operations personnel in the field who actually deliver SSA services,

there is little prospect for a successful SMP program. He knows he must capture whatever enthusiasm for change exists in the organization, and avoid open dissent when possible.

The cultural assumptions of systems will, after a little thought, also be readily apparent to the Commissioner. SSA was built on the assumption of face-to-face client service, a professional case worker, documents and procedures that uneducated people could understand, a district office close to clients, comfortable surroundings, and helpful, dedicated personnel who really understood the rules. Any system which violated these bedrock assumptions of SSA would be in deep trouble from the outset. Every effort in the past to change these assumptions has largely come to naught.

The garbage can perspective would be a little strange at first to the Commissioner. But with a little thought the Commissioner might find some correspondence with SSA reality. SMP is a ten year re-build effort. In that time frame SSA managers and top personnel come and go; Presidents and Congressmen come and go; there are unplanned failures and successes; the computer industry can change as can conceptions on how to use systems, how to deliver service; political agendas change. The window of opportunity in Washington for bringing about significant change at SSA--or other huge agencies--may be much smaller and shorter in length than imagined.

The Commissioner knows very well that he does not control all the pieces of the pie. Whatever does happen with SMP will in part be unpredictable. At best the Commissioner can hope *to start a change process*, and *move the organization in the right direction*, but he cannot hope to dictate the process or its results.

Section 5: Environmental Models and Perspectives on Organizational Innovation

While the institutional perspectives reviewed above tend to emphasize volition, choice, planning, and focus on the *adaptation of individual organizations* to the environment, environmental perspectives focus on changes in *populations of organizations* as environmental features change. Hence proponents of this view refer to themselves as *ecologists*.

Development of the Ecological/Environmental Perspective

The ecological perspective in organizational sociology has developed only in the last 15 years. Contemporary sociological use of the biological metaphor "ecology" to describe social affairs originated in the Chicago School of urban anthropology in the 1930's a concept designed to related individual behavior to territory and city environments in the 1930s. Use of the concept grew in the early 1950's under the influence of the treatise on human ecology written by Hawley.[80] But the focus was not on organizations so much as communities. Interest in environmental and ecological approaches waned in the 1960's under the influence of Parsonian functionalism, then Marxist, neo-marxist, and new left perspectives.

In 1953 the index to the American Journal of Sociology contained only 6 references to bureaucracy, and no references to organization, complex organization, let alone organizational environments. [81] By the 1960's, organizational sociology emerged as a powerful, growing field. Within organizational studies, a major theoretical growth area since the early 1970's has been the so-called "open system natural views" with an emphasis on environmental determinants of organizational behavior.[82] These early works differed from the Weberian tradition of bureaucratic studies which focused almost exclusively on internal, institutional features of organizations, e.g., hierarchy, rules, structure, shared cultural (institutional) assumptions, and a supportive, benign environment.

"Environmental perspectives" are now a standard organizational sociology topic included in most texts and handbooks to the field.[83]

As we see below, the ecological perspective during the 1980s began to influence management schools and writers on organizational innovation. Eventually, these views will have in an impact on theorizing about information technology innovation.

Different Views of the Environment

For some in the ecological school, the environment is hostile, threatening, and troublesome. This group of scholars ("population ecologists") focus on environmental *selection*--the death of organizations and what causes death. Others (so called "community ecologists") focus on *variation*--the continual birth of new ideas, behaviors, and organizations which occur in communities.[84]

A distant but related group of authors focus on the dependency of organizations on the environment for resources and support-- a perspective called 'resource dependency'. For this group, organizations behave in certain ways because outside powerful groups offer (or deny) resources like money, legitimacy, and people. Organizations are a part of networks which control resources, which regulate organizations, and provide support.[85] Resource dependency theorists focus less on populations of organizations, and more on the operation of inter-organizational networks which channel resources.

The commonality among all three views centers about resources: environments affect organizations by providing or withholding resources.[86] The major themes of all environmental perspectives are organizational death, the birth of new organizations, organizational dependency on outsiders for support, population variation and selection, population death rates, and analyzing the dimensions of the environments.[87]

How Organizational Change Happens

According to ecologists, while organizational change is ubiquitous, individual organizations themselves do not change much, if at all, because of internal politics, and bureaucracy. Most organizations die as a result of environmental change. Depending on the richness and munificence of the environment, old dead organizations are replaced by new infant organizations who happen to have the correct resource mixture to survive in the new environment.

In this perspective organizational change occurs at the population level and what needs explaining is not so much why individual organizations fail to adapt (although that is interesting) but rather why and how environments change and cause birth rates and death rates to vary.

Evolution is blind--there is no movement towards a particular form of organization, no stages of development. Innovation (variation) is random with respect to adaptive value. That is, there are always many new organizations with new ideas seeking support. Environments optimize, not organizations. Insofar as organizations survive, it is because they have achieved a niche in a stable environment. Innovations spread through a population and are retained because they work, because organizations using the innovation prosper, because the organization fits its environment, because organizations which do not have the right resource mixture are selected out for extinction and free up resources for survivors.

When the environment changes in even minor ways, old organizations can no longer compete for resources with new organizations, and new organizations spring up all around them who can optimize in the new environment. Old organizations are replaced, not "changed".

The key concepts then are *variation* (the continual development of new behavior, innovations, and new organizations), environmental *selection* through

competition for resources, and *retention*. The key problem is to find out are what are the technical, economic, political, and cultural changes in the environment which shape the birth, prosperity, and death for populations of organizations.

Why Do Organizations Innovate?

Both types of ecologists argue that *individual organizations do not innovate*--at least not in important "core" changing ways. Minor variations, innovations, of course occur all the time--electric pencil sharpeners replace manual models, word processors replace typists. Real innovation goes on at the population level because new organizations arise all the time based on new technologies, new ideas, and new skills. By dying, old organizations free up resources which can be invested in new organizations.

"Resource dependency" theorists have not focused directly on innovation, and tend to focus on maintenance of existing organizations, and existing resource networks, strategies, and so forth. Resource dependency theorists would probably argue (if they were consistent) that organizations innovate when they receive resources and support from the environment and this is problematic.

How Do Organizations Innovate?

At the population level, organizational innovation is accomplished by new entrepreneurial units forming around new technologies, new ideas, and new skills. Innovation occurs in small, recently born units at first. These small organizations have a very high probability of dying in the first year (70% of small businesses die in the first year). However, when a new technology takes hold, and spreads throughout the population, change is abrupt, rapid, and brutal to the old organizations.

Major Sources of Environmental Variation

Some environments seem particularly hostile, others more benign. Life in a benign environment may confer long life on organizations occupying that environment, especially if they can prevent the entrance of new organizations.

What are the major environmental factors which govern survival and innovation? Why are some environments benign, others hostile? Why are some environments hard to survive in?

There are a large number of environmental factors described in previous research.[88] Aldrich's 1979 review of the field listed six central features which summarized much of the previous work.[89] A recent empirical study of 52 manufacturing industries (not firms) by Dess and Beard codified these six dimensions into a more parsimonious set of three measurable dimensions: environmental munificence, turbulence, and complexity.[90]

Dess and Beard found these three dimensions successfully accounted for inter-industry variation in over 20 industry features on which data had been collected by the Bureau of the Census such as growth, sales concentration, diversity of products, instability (sales, price-cost margin,employment, technology, and value added), and geographical concentration. Below we describe these environmental dimensions.

Munificence

"Munificence" essentially refers to growth in market demand or, in the public sector, new public policies which direct specific agencies to expand, new programs, new missions, and a great deal of new money. Munificence can also mean ideological, symbolic support although Dess and Beard eschewed such measures because they felt they were not measurable. This dimension is sometimes called in the sociological literature "environmental carrying capacity."

In government agencies like those we are examining, munificence can be operationalized as budget growth and clientele growth.

Turbulence

"Turbulence" refers to *rates* of change in key strategic areas such as market sales, prices, and production technologies. Other phrases which connote the same meaning are stability/instability, uncertainty, environmental dynamism, unpredictability. This dimension does not refer to "rate of change", but rather unpredictable changes.

In Dess and Beard's study they found, interestingly, that under certain factor analysis techniques the dynamism (turbulence) factor broke into two independent dimensions: *"technological turbulence"* (technology change in capital goods industries) and *"market turbulence"* (changes in sales among all industries).

In government circles, "turbulence" can be rapid change in regulations, benefit formulas, programs, as well as administrative technology. What is involved in turbulence is not high rates of change, but unpredictable change.

In government agencies, "turbulence" can be measured as inter-year variations in budgets and clientele, and the addition of new programs.

Complexity

Highly overused and underspecified, "complexity" usually refers to the heterogeneity of inputs and outputs, but it has also been operationalized as a high degree of geographic dispersion (vs. concentration) of industries.[91] In popular literature, "complexity" is often confused with turbulence, or rates of change, but this view is not standard. When some authors use the word "complexity" they are referring to high rates of change even though in the technical literature this phenomenon is best described as "turbulence."

The more generally accepted view is that complexity refers to a straight count of the number of units involved in organizational life. Industries are complex when firms produce products having a large number of inputs, and they are forced to deal with a large number of suppliers. Likewise, the more products a firm produces, the large the number of customers, distributors, and other market players the firm must deal with. This is sometimes referred to as "organizational density", or the number of players in an organizational "set".

In this view, organizations which serve a geographically dispersed clientele face a more "complex" environment because the organization is forced to operate in several micro-environments each of which is quite different. Greater environmental complexity is seen as increasing the information processing demands, decisionmaking, and knowledge demands on organizations.

For information systems, the number of clients in a system, the diversity of clients, the number of different users, and the frequency of transactions, have been used to measure a system's "complexity."[92]

In government insurance agencies like SSA, complexity can be operationalized as the diversity of programs and services which agencies provide, the geographic and social diversity of clients, the number of formulas (statutory codes and regulations) used to calculate entitlements, or taxes.

Other Dimensions of the Environment

A number of other dimensions of the environment have been noted but ignored by many authors simply because these dimensions are not easily measured. One such dimension is the degree consensus or dissensus in an environment among participants. For instance, in some environments, other occupants may either be supportive or intolerant of others.

Another dimension of environments is the legitimacy accorded a particular environment or environmental niche by the larger culture. For instance, during much the past 20 years there has been a decline in the confidence people express in all levels of government. This decline in confidence may well reduce expenditures for government services.

Management Perceptions of the Environment

A somewhat different consideration concerns management perceptions of environments. Much of the management literature assumes that managers, especially top managers, accurately perceive their environments. As we noted above, this is simply false. Managers routinely misperceive their environments.[93] In crises, managers are just as likely to make things worse as better.[94]

A substantial body of behavioral research on risk taking has established that managers routinely ignore the possibility of high consequence, negative outcomes, misperceive chance events as causally significant, alter their estimates of risk to accommodate anticipated gains (or losses), eschew risk taking in practice while extolling it in writing, alter risk assessment to reflect attention factors, and believe they can manage affairs which are inherently unmanageable.[95] Briefly, the neo-classical view of decisionmaking under conditions of risk where expected values of outcomes are modified by perceived risks of outcomes does not seem to describe how managers actually perceive risk, or behave when facing risky decisions.

A recent study of organizational downward spirals culminating in death documents the role of management inertia, vacillation, stress induced perceptual errors, and resulting strategic extremism, in the *ten year long* declines of bankrupt firms. Despite munificent environments and plenty of financial reserves, managers were still able to sink otherwise healthy firms over long periods.[96]

The Environmental Argument

In general, the less the munificence, the more the turbulence, and the greater the complexity, then the less the chance for organizational survival and/or "success" however measured.

Is organizational death as commonplace as ecologists would have us believe? Most organizations do not survive a human life time. One study found for instance that only (53.6%) of the Fortune 500 survived from 1955-1985.[97] Another study found that of the top 100 industrial firms in 1917, only 17 survived in 1986.[98]

Over a longer time frame survival is very problematic: only 13 of the thousands of businesses in existence at the time of the Revolution still exist in 1976.[99] 50 year old corporations represent only 2% of those initially created; 55 year old federal agencies represent only 4% of those ever created; 30% of the fifty year old private corporations can be expected to disappear in 10 years, as can 26% of fifty year old federal agencies.[100] Of 389 new social service agencies born in Toronto from 1970-1980, only 28% survived ten years.[101]

In general, there is a large body of evidence which indicates organizational survival for more than ten years is highly problematic despite the good cheer in schools of management which promise salvation from these facts.[102]

Relationship to Management Ideology and Management Teaching

The ecological or environment school of organizational sociology and research is directly at odds with much of the philosophy of management, the ideology of management, and what is taught in management schools. Oddly, interviews with real world business managers, entrepreneurs, and financiers, often reveal some support for the ecological perspective--especially the role of luck, chance, and "being in the right place at the right time".

A central tenet of the philosophy of management as taught in American business schools is that managers can act in such a way as to ensure or enhance organizational survival. If only the "right" choices are made, then success and survival are reasonable prospects. Many cases of success are available.

Ecologists might agree that managers are important but only within a benign, unchanging environment of low complexity, low turbulence, and high munificence. As there are few such environments worth being in, organizations are frequently in trouble. In challenging environments of some complexity, turbulence, and changing munificence, ecologists would argue that environments dominate, luck and chance determine surviving strategies, and that most of the time managers do not respond properly and the firm dies.

Clearly the ecological perspective is beginning to have an impact on management school scholars. One business school group of scholars, in an effort to address the ecologists and preserve some positive role for managers, argues in an award winning paper that superior management can overcome hostile environmental change (Tushman, Newman, and Romanelli, 1986).[103] Four [sic] cases are given as evidence: Citibank, General Radio, Prime Computer, and Alpha Corporation.

Out of the hundreds of thousands of business organizations in existence during the period of the study, shear chance alone would suggest that in some cases some organizations get lucky and ride out the storm. People do win in Las Vegas. Nevertheless, the authors ignore chance altogether and proceed to examine the cases for patterns of survival, for the key management actions that allowed these organizations to survive.

These authors concede that the only way survival can be assured is to occasionally initiate a "frame-breaking" change in the organizational culture, setting

off an "organizational upheaval" led by top level executives who see the handwriting on the wall.

This response, however confident it makes management students feel, seems to miss the point. Top level senior executives are themselves the problem in the ecological perspective because they rarely see the handwriting on the wall until it is too late. Frame-breaking changes are themselves virtually impossible to pull off with any regularity. Indeed, frame-breaking change is somewhat of a contradiction in organizations, commonly described elsewhere as "an iron cage."

Environmental Models and IT Innovation

How do environmental factors affect information technology innovation?

In general, the IT innovation literature has assumed that organizations more or less independently adapt to changing environmental conditions, including new technology. There may be political, bureaucratic, cultural, and random difficulties, but these--it is assumed-- can generally be over come. Politicians may use the technology for their own purposes, bureaucratic sub-units will pursue their traditional goals (preservation of routines), and the technology used may not be optimal, may not "solve" any problems, and so forth. But the end result is still an adaptive organization.[104] But consider the role of environmental factors in the following IT innovations. From 1972 to 1982 forty States developed computerized criminal history systems as the Department of Justice distributed one billion dollars to pay for the systems.[105] All fifty states now have a Parent Locator System after Congress mandated loss of AFDC funds if states refused.[106] All states plan to have in place by 1990 a State Income Eligiblity Verification System (SIEVS) to check all beneficiaries who receive federal funds--or face the loss of federal benefit

dollars![107] In 1985 a coalition of New York retail banks built a network of 1000 ATM machines after Citibank demonstrated the power of its 600 ATM network.[108]

These examples illustrate that powerful environmental forces shape IT innovation. None of these innovations occurred primarily because of internal, institutional factors, independent adoption and innovation. Instead the primary stimulus for developing the information systems in the above paragraph originated outside the organization, in the environment.

Why should changes in information technology be difficult for organizations to cope with? One study found a possible answer. Information technology--like most technology--changes incrementally over long periods, but it is characterized by periodic quantum leaps--the change from vacuum tube to transistor, to integrated circuits on a chip.

When information technology change is slow, organizations enhance their competence, slowly expanding their skill base. This is "competence enhancing" change. However, when technology change is very fast, it destroys the competence and skills of organizations who mastered the old technology and who find themselves unable to master the new.[109]

In these examples a powerful environmental stimulus shapes the concept, design, and even management of information systems which organizations use. The stimulus can be the actions of competitors, the threats and resources of superior governmental units, and new technologies. The local internal politics, culture, bureaucracy are largely incidental to the nature of systems developed in these cases[110].

The Deputy Commissioner Responds

Let's return for one last interview with our Deputy Commissioner of Systems at SSA for his reaction to environmental theories.

"You must be nuts! I was hired to develop one of the most important domestic computer systems in the United States which delivers checks to 50 million people each month, on time, and virtually all accurate. I was not hired to preside over a funeral, saying nothing can be done. Can you imagine if I testified before a Congressional hearing and said, "Ghee fellas, the environment is so bad that I really can't do much about the decay of Social Security's information systems? The agency is just caught up in an "iron cage" right now, most of my managers don't know what to do, and what they think they want to do is mostly wrong." I'd be fired on the spot."

The Commissioner would reject outright the notion that SSA cannot innovate its way out of trouble. Both the population and community ecology perspectives must certainly be wrong he believes when they imply that other new organizations might come along to replace SSA. The resource dependency perspective makes perfect sense to the Commissioner--clearly SSA is vitally dependent on the President's recommendation, the dollars from Congress, and support of the Judiciary. Other outside private groups are vital to SSA as well.

But what organization could possibly replace SSA and handle the case load? Who is politically powerful enough to carry off an attack on SSA? The agency has a long history of incremental change in systems, enhancements, and what's needed now is just more and faster innovations.

Both ecology perspectives run against everything the Commissioner has learned in management schools and training seminars. There simply must be a way to manage SSA out of the troubles it has fallen into. Everyone expects the Deputy Commissioner to do something.

Still, the Commissioner would concede that overcoming the political, bureaucratic, and cultural inertia at SSA will be a monumental problem--perhaps it is the single most important problem over which SSA has some control.

Admittedly, the Commissioner concedes, the rapidly changing technology, coupled with hostile external groups, will be pushing SSA very hard, some conservatives even calling for SSA's replacement by private concerns. But considering life without SSA, and the puny resources available to competitors (who has 12 million lines of COBOL code capable of running a national insurance program?), the Commissioner believes SSA's future will be secure if it can show a good faith effort towards internal change, re-birth. Failing that, the ecologists might just be right and SSA would deserve to die.

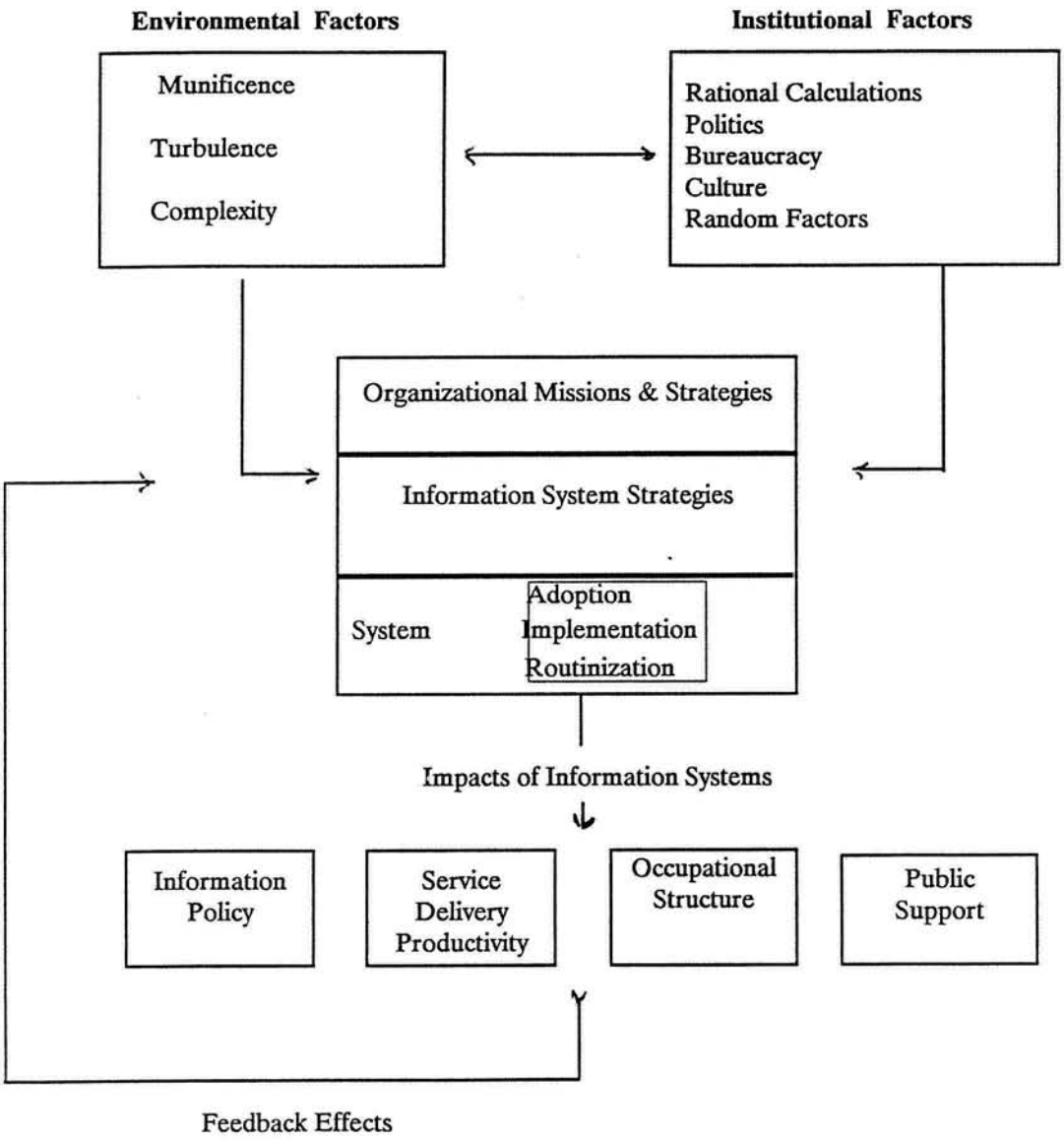
Still, SSA is so much a part of the social, cultural and political landscape, that even contemplating its death is enough to scare any Congressman into voting more funds for SSA. One of SSA's best strategies, in a jam, is to make life uncomfortable for some beneficiaries. In a few hours, Congressional telephones are ringing off the hook, the editorial writers are wagging fingers, and reporters are out interviewing irate citizens. Even Congressional conservative are begging SSA for relief.

The ecological model may be substantially correct, but it is politically, culturally, and socially unacceptable in management circles and wherever power is concentrated and exercised.

Section 6 The General Model Specified

With the foregoing review of the literature, we can now provide a more detailed description of the preliminary model introduced earlier. The illustration below presents the general model with the major blocks of explanatory variables specified.

The Model



The general idea of the model is eclectic: organizational behavior is a function of both environmental and institutional factors or variables. The major environmental variables are munificence, turbulence, and complexity. A variety of institutional factors are pointed to: rational expectations and calculations, politics, bureaucracy, culture, and random processes and events.

Environmental and institutional variables interact and influence one another. Organizations can pick and choose environments, but there are limits to this. SSA cannot become a private industry, or switch roles with the FBI.

Organizational behavior, the central block in the middle of the diagram, is composed itself of three components. The formal organizational mission and strategies are primary, focal concerns in our work. These are shaped entirely by environmental and institutional factors.

Other organizational behavior of concern is information system strategies (the formal and informal plans for building systems) and system implementation (adoption, implementation, and routinization).

The last concern of the model is "impacts." As can be seen, "impacts" of systems do not "hit" organizations like meteorites. Computers per se do not "flatten hierarchies", re-arrange organizations, enhance or destroy skills, and etc.

Instead, computer "impacts" result from the interplay of a large number of factors. At the widest level of analysis, computer "impacts" result from broad environmental and institutional factors. At a more specific level, "impacts" result from how organizations respond to these environmental and institutional factors--from concrete decisions made by people throughout the organization at many levels.

Using the Model

Currently we are using the model as a tool to help organize our observations, and guide our questions. We are not using the model to generate and test specific

hypotheses of the sort, "the greater the complexity of the environment, the more (or less) successful is system implementation." Instead, we are more interested in describing how, over long periods of time, environments and institutional factors shaped the building of systems at three federal agencies since the 1930's.

Time and history have turned out to be important elements of our story. In the illustration below, the potential for temporal comparisons is shown. Over long periods of times (1935-1990), one can ask how does the single Washington environment for the agencies change and with what impact on system building? Or, at any point in time, one can ask how the different micro policy environments of the different agencies impact system building, and produce "impacts" for citizens.

Conclusion

There are several tests for a model: utility, simplicity, generality, and provocativeness were our major goals. We have found the model useful to date in collecting and organizing our observations and data. It is relatively simple and easily explained to decisionmakers, managers, and other academics. The model is clear and transparent with an obvious flow of causality that can be defended and attacked. The model fits into major streams of research in the behavioral sciences with a bias towards sociology and political science. And the model shares some of the major assumptions of other authors in the field loosely called "the social impact of computing" as well as management information systems. It therefore fulfills a criterion of generality. In particular the model is very close to other groups of scholars consciously theorizing about information technology over long periods of time like that Kraemer and King in a forthcoming volume.[111]

Limitations are apparent. Some of the variables cannot be measured easily, at least with our current three cases. For instance, the influence of purely random

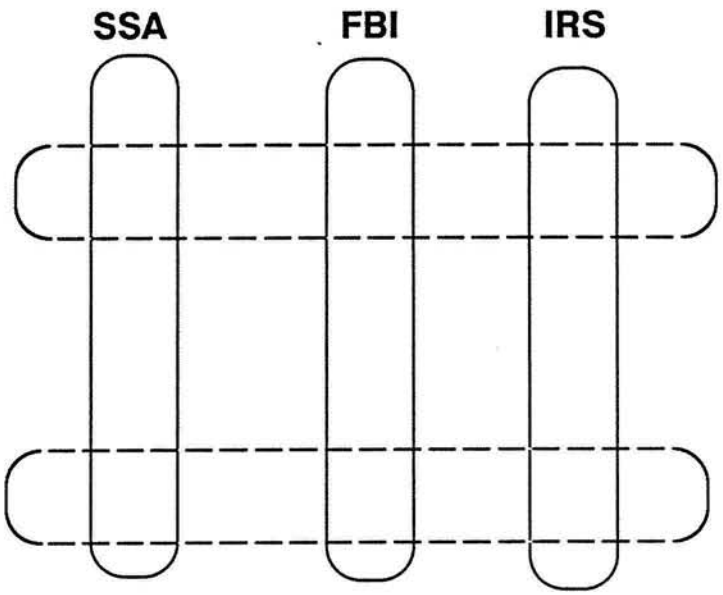


Illustration 3

Temporal Comparisons in a Multi Organizational Qualitative Study

garbage can events can be documented, but they are difficult to measure in terms of their impact. It is difficult to objectively measure "bureaucracy" even though the three federal agencies we examine (SSA, FBI, IRS) are bureaucracies incarnate. It is less difficult to describe instances of bureaucratic tactics, and thinking.

It is also conceptually difficult at times to operationalize the environmental variables. For instance, assume a new technology comes along which drops the cost of computing by a factor of ten. In terms of extant large organizations, this appears to be a munificent event. Technology is, after all, one resource provided by the culture along with money, programs, and budgets.

On the other hand, a technological breakthrough adds to "turbulence": an unexpected breakthrough suddenly makes much of what you do cost ineffective. The computers and systems you just built last year are now a little obsolete. In order to take advantage of some new technologies, your organizations may have to completely re-think how it works, write new business procedures, and so forth. We know from prior literature, that one consequent of technological change is to kill off old organizations that cannot make use of the new technology in a timely fashion.

Because of these difficulties the model has provoked new thoughts on appropriate measures, concepts, and relationships. One new relationship provoked by the model, and careful observation, is that an organization's information system strategies at T1 can shape the organizational mission and objectives at T2 simply because what an organization wants to do is bound up with what its aged, very large scale systems will permit it to do. Clearly the causal relationships implied by the model need more exploration in a number of different settings.

1. T.S. Kuhn, The Structure of Scientific Revolutions, 2nd edition. Chicago: University of Chicago Press, 1970.

2. The detailed review of organizational innovation in general is found in Laudon, "Organizational Change and Innovation--Foundations of MIS I". The detailed review of IT innovation is found in Laudon, "Information Technology,

Organizations, and Society: Foundations of MIS II". Both were completed as part of NSF grant 8619301, Information Technology Development and Impacts.

These papers are available as working papers of NYU's Graduate School of Business, Center For Research on Information Systems, 100 Trinity Place, New York, New York 10006.

3. Aristotle, The Politics, New York: New American Library, 1956.

4. Pfeffer, Jeffrey. Organizations and Organizational Theory. Boston: Pittman Publishers, 1982.

5. See for a similar distinction Van de Ven and Astley, 1981:428; Pfeffer, 1982: 5-12). We use 'institutional' factors throughout the book--rather than 'organizational factors.' 'Institutional' is a broader concept than 'organizational'. Many features of organizations are not generated internally but in fact reflect prevailing conceptions in the society about how things should be done. For instance, universities hold classes at specific times not because they have all decided independently to do this, but rather because this is how the society believes universities should be organized and universities chose to conform to this prevailing conception. We use 'institutional' here in the classic sociological sense of a number of organizations which serve common strategic interests and values in a society. See Gould and Kolb, 1969; Pfeffer, 1982: 239.

The distinction between institutional and environmental factors bears some resemblance to that of voluntarism and determinism. In general, *institutional factors* are those over which the organization has some influence or even control. And *environmental factors* in general are beyond direct organizational control.

6. Schumpeter, 1912.

7. Illich, 1974; Kling and Dutton, 1982.

8. Yin, 1980. Eveland, Rogers, and Klepper, 1977; Tornatsky, et. al., 1983.

9. See David A. Whetten, "Sources, Responses, and Effects of Organizational Decline." In John Kimberly and Robert H. Miles (editors), The Organizational Life Cycle: 342-374. San Francisco: Jossey-Bass, 1980.

10. Compare for instance the literature reviewed by Rogers in 1962 with that reviewed by Zaltman in 1973, and with Tornatsky, et. al., 1983.

11. See Van de ven and Drazin, 1985 for a discussion of the concept of "fit" between organization and environment.

12. There is a vast implementation literature in the information technology area. Unfortunately, even defining what is a "successful" implementation is controversial. The literature focuses on key actors and roles in successful implementation (see Leonard-Barton, and Kraus, 1985: 107; Vitale, et. al., 1986; Huff and Munro, 1985; Zmud, 1987); development of the correct strategy and process of change, e.g., participation, or top down direction (see Mumford and Banks, 1967; Baroudi, et. al., 1986; McFarlan, et. al., 1982); some of the literature describes organizational factors which is the focus of our review; and some implementation literature looks at the nature of the technology per se (see Keen and Scott-Morton, 1984; Ginzberg,

1979; and others who focus on project risk associated with very advanced technology relative to organizational skills).

13. Perhaps the most straight forward description of this model is found in Zaltman, et. al., 1973: 5.

14. See for instance the classic treatment in Weber, 1947; and Crozier, 1964. Most sociological discussions in the 1950's and later picked up the theme of rational adaptation. See Parsons, 1960; 1966; see also Blau and Scott, 1962.

15. Perhaps the best known variant of the rational model is Herbert Simon's model of "bounded rationality" (Simon, 1957; 1947 and also March and Simon, 1958). Related to this work is that of Cyert and March (1963). The basic thrust of these variations is to relax the assumptions of the rational model just enough to make it semi-realistic but not so much as to lose the basic flavor of organizational adaptation. The key ideas of the bounded rationality school are satisficing decisions not optimizing, limited search of alternatives (take the first alternative that works), organizational problems are factored among sub-units who employ tried and true repertoires as solutions.

The classic work of Charles Lindblom (1959) are the science of muddling through deserves mention as well.

Some authors (dubbed the *'institutional school'*) emphasize less the 'efficiency' criterion for adaptation, and instead argue that organizations adapt, ceremonially, whatever the approved rituals, technical lore, values, and norms expected by the environment regardless if they lead to efficiency. See for instance Meyer and Rowan, 1982; Dimaggio and Powell, 1983; Rowen 1982.

Other variants of the rational model are *'contingency theory'* (organizations are constrained by technology to adapt in certain ways). See Thompson, 1967; Lawrence and Lorsch, 1967; Burns and Stalker, 1961; Woodward, 1965. *'Resource dependency'* theory (organizations adapt along lines of available environmental resources). See Pfeffer and Salancik, 1978; and Thompson, 1967. Other variants of the rational organization model-- evolutionary models and strategic planning theories--are discussed in the text.

16. See for instance Lucas, 1986:4; Davis and Olson, 1986:38; and McCleod, 1986:6.

17. See for instance the following articles from Harvard Business Review: McFarlan and McKenney, 1982; McFarlan, McKenney, and Pyburn, 1983; McFarlan and McKenney, 1983.

18. See note 5 for references to this literature.
19. Tom Peters, Thriving on Chaos,

20. Briefs, 1980: 78; see also Mowshowitz, 1976:49-50; Noble, 1984; Shaiken, 1984).

21. Winner, 1977: 105.

22. Laudon, 1986.

23. Kraemer, et. al., 1981: 1-42); in a later work by the same authors the rational model is used again: "Organizational actors decide whether, when, and how to adopt innovations" (1986:23).

24. For excellent critiques of stage theories in general see Van Parijis, 1981 and Dobert, 1981.

25. Nolan, 1973.

26. The most famous stage theory in the IS literature is that of Nolan (1973; 1979). Here the argument is that all organizations go through budgetary stages of computer development (initiation, contagion, control, integration) punctuated by new technological breakthroughs. That is, each new technology trips off another cycle of growth. This stage model is drive then by technology--the deus ex machina before which all organizations fall.

Glaser, et. al. also posits a technology driven stage theory (1983).

For a more recent stage theory see King and Kraemer 1986a; 1986b. There are four stages, from introduction and conquest, to competition and then regulation. It is not clear what drives this model. Internal organizational factors appear to drive the model along: "Endemic computer demand precedes the supply push factors of computing" (p.18) but "we posit external forces [in the organizations environment] are ultimately the dominant forces in change" (p. 21); later "the basic determiner of evolution is the selection process whereby organizations choose to adopt or reject specific innovations" (1986b: 23). In the end, the model is "conservative, adopting a perspective of rational economic decisionmaking." (p. 24). In the end, it is not clear what drives the model.

27.(King and Kraemer, 1984; Benbasat, et. al., 1984).

28. Drury, 1983.

29. Lucas and Sutton, 1984.

30. For a typical statement on strategic planning see Tichy, Noel M. [Managing Strategic Change. New York: John Wiley, 1983]. See also Porter (1980; 1985).

31. For a review of many methods see Chaffee, 1985. Also see Guth and Macmillan, 1986; and a persuasive article which argues for planning in reverse (means before ends): Hayes, 1985.

32. See the following for critical reviews and data: Grinyer and Norburn, 1975; Starbuck, 1983; Hayes, 1985.

33. See Grinyer and Norburn, 1975; Starbuck, 1983; Hayes, 1985; Porter, 1987. Virtually all studies of strategic planing which collected reliable data show no correlation between the use of formal planning mechanisms and organizational success, survivability, or prosperity (Kudla, 1980; Grinyer and Norburn, 1975; see also Starbuck, 1983; 1986).

34. Porter, 1987: 43.

35. Parsons, 1983; Ives and Learmonth, 1984; McFarlan, 1984; Porter and Millar, 1985; Rackoff, et. al., 1985; Vitale et. al., 1986; Bakos and Treacy, 1986.

36. Allison, 1971.

37. Some critical implementation roles identified in the literature are product champion, bureaucratic entrepreneur, gatekeeper, boundary spanners, rich uncles, wizards, weed pullers, and teachers. See for instance Maiduque, 1980; Vitale, et. al., 1986. For a study of the role of political groups in innovation, and implementation tactics see Sapolsky;s study of the Polaris project (1972), Pressman and Wildavsky (1973), Bardach (1977) and Allison (1971). Studies of business leaders usually provide good descriptions of the politics of innovation (Iaccoca, 1985; Donaldson and Lorsch, 1983).

38. See the "reinforcement politics" and "pluralist" perspectives of Danziger et. al., 1981; and Laudon, 1974.

39. See Franz and Robey, 1984.

40. Keen, 1981: 28. The political perspective examines three aspects of organizational life: the structure of power (who holds what resources and possesses authority) , ideology (what are the major ideas and values held by key actors), and process (how do social and political interactions occur, where, how often) (Kling and Iocono,1984).

41. Keen (1981) argues: "[systems require] the careful building of coalitions based on on complex negotiations. The larger the scope of a project and the more strategic its goals, the truer this will be,because of the "geometric growth of interdependencies...".

42. Laudon, 1974.

43. Kling, 1978.

44. Kraemer and Dutton, 1979; Dutton and Danziger, 1982; Kraemer, et. al., 1982.

45. Pettigrew, 1973.

46. Markus, 1984.

47. Laudon, 1986.

48. Hannan and Freeman, 1984. See also Stinchcombe, 1965.

49. Adapted from Essence of Decision by Graham Allison, 1971: 130-132.

50. See the study by Starbuck, Greve and Hedberg, 1978 of Facile AG, a Swedish office equipment manufacturer in the 1960's which refused to switch over from mechanical to electronic computers. Eventually it went out of business because it put more and more resources into becoming the low cost producer of mechanical calculators--for which there was no market! Faced with failure, many organizations pour more resources into doing what they always did.

51. See Starbuck, 1986 and 1983 for a review of some of these studies; see also Nystrom, et. al., 1976; Beyer, 1981.

52. For the connection between bureaucratic structure and personality, including perceptions, see Merton, 1968; Gerth and ills, 1953.

53. Starbuck (1986) cites many other instances of senior management mis perception: "I shall say it again and again: your boys are not going to be sent into any foreign wars." Franklin D. Roosevelt, 1940.

"In all likelihood, world inflation is over." The Managing Director of the International Monetary Fund, 1959.

"I cannot imagine any condition which would cause this ship to flounder. I cannot conceive of any vital disaster happening to this vessel." E.J. Smith, Captain of the Titanic in 1912.

"As far as sinking a ship with a bomb is concerned, you just can't do it." Admiral Clark Woodward, USN, 1939.

There is ample research evidence to believe that senior management, top management, is more likely to misperceive the environment than lower management, even employees. The distorting influence of organizational structure which slants and biases information as it makes its way its way up the hierarchy, the self selective powers of senior management to hear what they want to hear, to be served by staffers who know what senior management wants to hear, are among the findings of research using a bureaucratic model (Wilensky, 1969). Correlational studies relating management perceptions of organizational measurements with objective measurements usually find negative or very low correlations (Tosi, Aldag, and Storey, 1973; Downey, Hellriegel, and Slocum, 1975).
The bureaucratic dynamics literature suggests that the ability of top management, or "the organization", to engage in long range planning, strategic planning, in order to rationally change towards a more surviveable state, is most unlikely on any systematic basis. It can of course happen by chance, and indeed success probably does happen by chance sometimes. This makes for a steady stream of "success" stories.

54. Laudon, 1986: 358-366.

55. Kling and Iacono, 1984.

56. Scheingold, et. al., 1984; Oettinger and Marks, 1968.

57. Kling (1986:51) cites GAO's findings that after 30 years of trying to get generals to agree on data elements, ten years after beginning WWMCCS, the Department of Defense "despite dozens of large scale studies, has failed to make meaningful progress toward implementing a responsive, reliable, and surviveable system . . . modernization planning is proceeding far too slowly" (GAO, Comptroller General, 1979).
In order to explain the failure of WWMCCS, Kling argues that scholars and managers must adopt a much broader understanding of how systems interact with social organization:

"The case of WWMCCS is unusually complex, but nevertheless instructive. Complex computing developments, even thought of substantially smaller scale, are initiated., designed, altered, used, expanded, decommissioned., revised, and superseded by participants acting within constrained negotiation contexts (Markus,

1982). The structuring of incentives faced by different participants and the choices they face are not completely open ended. They develop over time. As particular arrangements are negotiated, they develop into organizational routines, structures, equipment configurations, precedents, etc." (Kling, 1986:51).

Not even advanced information technology can change bureaucratic routines, without itself becoming a part of the routine--much as the Romans were assimilated by local cultures.

58. Kling, 1978; Kling and Iacono, 1985; Strassman, 1985.

59. Laudon, 1986: 335.

60. Goffman, 1959; McHugh, 1968.

61. McHugh, 1968; Homans, 1950.

62. Deal and Kennedy, 1982.

63. Tagiuri and Litwin, 1968.

64. Schein, 1985.

65. There are problems with this definition for it assumes cultural assumptions, basic beliefs, are functional, i.e., contribute(d) to survival, and they work. Some assumptions, racial discrimination or sexual harassment, may not have been functional for the group, and certainly were not functional for the victims. Nevertheless, the emphasis on unstated basic assumptions is valuable and has several implications.

66 Schein, 1985.

67. Robey and Markus, 1984:11.

68. Robey and Markus, 1984:12

69. Kling and Iacono, 1985.

70. Hirschheim and Klein, 1987; 1986

71. Markus, 1984.

72. Bikson et. al., 1985; Turner, 1985. See also Strassman, 1985.

73. Cohen, et. al., 1972; Anderson and Fisher, 1986. Some of the key findings of the simulation research are that decision making and problem solving are not the same; problems are not resolved by "choices" but instead disappear and appear by a logic of their own; decision making is more often by flight from problem to problem or by oversight; case studies of actual organizations have found much more "coupling" (less randomness) of problems with solutions than the simulation models, and powerful impacts of standard operating procedures --especially in military organizations. See also March and Weissinger-Baylon, 1986.

74. March and Olsen, 1976.

75. March and Weissinger-Baylon, 1986.

76. Mintzberg and McHugh, 1985.

77. Crecine, 1986: 97-99.

78. Organizational leaders can also introduce structural solutions--such as executive committees within DOD which attempt to coordinate services and coordinate system development with military needs. Nevertheless, structural reforms usually fail, Crecine argues, because they paper over underlying organizational dilemmas (the National Security Act of 1947, and the resulting organization of DOD, effectively remove military needs and requirements from playing a primary role in weapons development and procurement!).
Crecine concludes that while the garbage can of C3I decisionmaking may result in poor communications for the military, may dismay the theorist looking for clarity, it is an opportunity for the astute political player. Crecine's "Machiavellian guide" for organizational tactics in organized anarchies includes the advice to:
*be persistent
*be flexible on priorities and goals (and the way they are ordered and pursued).
*link preferred solutions to problems in an opportunistic way
*trade symbols for substance
*create "ad hoc" choice opportunities
*manipulate energies and activities of other participants, especially your enemies, i.e., keep them busy elsewhere. See Crecine, 1986: 113-114.

79. IT innovations will of course occur, but on a much more local, episodic, and undirected basis. This is true of both tightly and loosely coupled organizations. See Weick, 1976.

80. Amos Hawley, Human Ecology: A Theory of Community Structure, New York: Ronald Press, 1950.

81. John H. Freeman, "Organizational Life Cycles and Natural Selection Processes," in Research in Organizational Behavior, vol. 4, edited by Barry Straw and L.L. Cummings. Greenwich, Ct.: JAI Press, 1982.

82. For a comprehensive review see W. Richard Scott, Organizations: Rational, Natural, and Open Systems. Englewood Cliffs, N.J.: Prentice Hall, 1981. Second edition 1987.

83. See for instance a fine, brief review by Howard E. Aldrich and Peter W. Marsden, "Environments and Organizations," in Handbook of Sociology, edited by Neil J. Smelser, Berverly Hills, CA.: Sage Publications, 1988.

84. The two schools are called "population ecologists" and "community ecologists". Whereas population ecology focuses on organizational evolution within a single population or lineage, community ecology focuses on the development of new populations, new lineages.
Population ecologists point to the steady development of new organizational forms in populations which are saturated with competition and up against finite fixed resources (e.g. ,the shakeout stage of mature industries where products

become commodities, and competition focuses on price not innovation). Community ecologists argue there is not much change in such situations.

Community ecologists focus instead on where the action is: where new populations are forming, where untapped demand exists for new products, where competition is based on innovation, where products are new, where environments are new, unsaturated, and munificent. These situations permit far reaching innovations and wide disparities in organizational form.

In this view old, stable populations continue to exist, drag on, for long periods of time, and really do not change much at all. But new populations spring up--not gradually--but abruptly, episodically. Old populations likewise are suddenly extinguished (after reasonable periods of co-existence). Evolution is not slow and gradual (so-called phyletic) but bumpy like a "punctuated equilibrium" (Astley, 1985).

What causes evolution and organizational change and innovation to be bumpy and step-like? Sahal (1981) studied patterns of technological innovation in different industries. He found industries to be "technologically insular" from one another and unlikely to change "core" technologies despite the presence of new technologies and forms of organization all around them.

Sahal examined the tractor, airplane, and electric motor industries, all of which rely on core technologies more than 50 years old. While each industry has made cost improvements in the technology, there have been no wholesale changes in core technology. However, when a change occurs in core technology, it triggers abrupt, rapid change in which many old organizations disappear.

As Astley (1985) notes, there are declining marginal returns on investment in any technology (see also Kuznets, 1930). If technology is constant, populations of organizations eventually exhaust the possibilities, and change ceases.

Chandler (1977) found the spread of the modern American multi-unit business form to be abrupt, occurring between 1870 and 1920, and related to the rise of new industries based on new technologies.

Mensch (1979), studying the impact of technological change on long term industry trends, found that "basic innovations" lead to whole new branches of an evolutionary tree with new markets, customers, and competitors. But "improvement innovations" simply involve linear extensions of existing branches. The pattern of long term innovation which Mensch found was characterized by spurts of innovation followed by improvement innovations followed by a "running out of steam" which he characterized as "technological stalemate." Industry populations at this point must switch to new basic innovation to grow and expand.

The direction of evolution is different for population and community ecology theories. In population ecology, populations become homogeneous over time as successful forms imitate one another or organizations are selected out for extinction. In community models, evolution is blind but open-ended: new branches, niches, and environments are opening up all the time. New technologies are appearing all the time; there is a plentiful supply of new organizations (organizational variation) to exploit new technology. Historical happenstance, chance, link up new techniques with new organizations to make for "organizational divides".

The driving force behind evolution in these models is not selection, but organizational variation. As Astley notes, "selection is the regulator of evolutionary change; variation is its dynamo" (Astley, 1985:240).

What about the mechanics of change? Organizations choose to move into open environmental spaces. They are not optimally fit,but "tolerably fit" to exploit new opportunities--new technologies, resources. The community grows new populations in this open environment until community closure sets in and competition for resources begins. Populations become more similar under resource constraints; between populations, symbiosis (interdependencies) emerge. Selection eliminates

weak organizations. The community stabilizes and sets the stage for its own demise. The return on investments in the established ways of doing things declines. Depressions occur. New technologies come along in spurts, and bunches--related to underlying basic innovations--and capital seeks new investments which promise much greater returns (Mensch, 1979). Change is abrupt once it occurs: old communities are abandoned (Astley, 1985).

What fosters organizational variation? Basic technology change is one factor. Astley compares it to gene mutations. But in order for mutant genes to take hold, they need to be isolated from the dominant gene pool. Isolation is the second factor which along with technology makes for organizational variation. New technologies cannot thrive in old populations, or communities.

The semi-conductor industry is used as an example: new technologies (transistors, integrated circuits, large scale integrated circuits) were dependent on new isolated organizational units (businesses like Texas Instruments, Fairchild, and Intel) to survive and prosper. Despite enormous investments by RCA, GE, and Westinghouse, these larger older firms could not keep up with the likes of the newer firms. The old firms tended to smother new innovations even though they invested millions in their development. The Silicon Valley phenomenon of one "spin off firm" after another making up a community exemplifies the process of community ecology change. At times community ecology slips away from environmental determinism into opportunistic choice as the engine of change--really into an institutional perspective where the organization can exercise choice over its future.

Environments in this view can be seen as "open environmental spaces" (Astley, 1985:233) which contain opportunities and can be exploited. Niches do not pre-exist, waiting to be occupied; niches instead are created by organizational action. Wherever there is environmental "openness" (unfilled ecospace) there is opportunistic choice as the engine of change.

But community ecologists are not "free choicers": existing organizations do not change; new organizations must be formed first.

The open ended character of community ecology views is noted by Astley:

"Strictly speaking there is only one source of change, namely, organizational variation. Environmental selection only stabilizes population forms and, in effect, retards evolutionary change. . . When selection criteria shift, it is only because organizational variations are successful in establishing new populations in which competition for scarce resources ensues." (Astley, 1985: 240).

85. See Evan, 1966; Perrow, 1972; The strength of networks, degree of coupling, and role of regulation in shaping organizational behavior is a major theme in this literature. See Weick, 1976; alford, 1977; McNeil and Minihan, 1977; Salancik, 1979; Laumann, 1976.

86. Dess and Beard, op. cit., 1984. See also Aldrich, op. cit., 1979.

87. For the most part, the unit of analysis is a population of organizations and the findings of this research, strictly speaking, apply to populations, not to individual organizations. Nevertheless, the findings of this stream of research have relevance for assessing the situation, the history, and likely future of single organizations. See Hawley, 1950, for the classic description of human ecology concerns.

88. We constructed a table (below) of some of the leading authors and environmental factors. We used this as a guide to observations at SSA.

Table 1

Author	Environmental Change
Pfeffer and Salancik (1978)	**Environmental cycles** in three dimensions: Concentration (power and authority); Munificence (available resources); Connectedness (interaction network). These factors determine the levels of conflict, interdependence, and uncertainty in the environment
Tichy (1980)	Environmental cycles in technology, politics, culture
Brittain and Freeman (1980)	Uncertainty of environments, Compatibility of new environments Grain (fine vs. coarse) Degree of change Economics of organizing (entry costs) Density of environment (carrying capacity) Environmental munificence
Whetten (1980)	Organizational Atrophy (success breeds failure, organizations continue to invoke standard procedures despite change) Vulnerability (liability of newness, and re organization) Loss of Legitimacy (problem depletion) Environmental entropy (decline in total environmental resources)
Rowan (1982)	Institutional consensus (Major environmental actors agree on course of action)
Hannan and Freeman (1977)	Capacity of the environment (a fixed capacity of an environment to support organizations Population rate of change (a rate of population change when environmental resources are plentiful) External constraints (laws, regulations,etc.)

Source: Authors

Several articles have explored the role of external legitimacy in determining the fate of new organizations. See Singh, Tucker, and House, 1986. They found that lack of support from external organizations-- lack of external legitimacy and institutional support-- were the largest factor in organizational death. Internal factors, such as difficulties of administration and organization experienced by new organizations, were not powerful. The only exception here was senior management change: firing senior management had adaptive value (increased survival).

89. Aldrich and Marsden, op.cit., 1988.

90. Dess and Beard, 1984; Aldrich, 1979.

91. Child (1972) op. cit. was among the first to clearly describe this dimension, which has been followed by most other authors.

92. See Laudon, "Privacy and Federal Databanks," Society, January 1980.

93. See Barry M. Staw, Lance E. Sandelands, and Jane E. Dutton, "Threat Rigidity Effects in Organizational Behavior: A Multilevel Analysis," Administrative Science Quarterly, vol. 26, 1981.

94. See William H. Starbuck, Arent Greve, and Bo L.T. Hedberg, "Responding to Crises," Journal of Business Administration, vol 9., 1978.

95. For a recent review of this literature see James G. March and Zur Shapira, "Managerial Perspectives on Risk and Risk Taking," Management Science, vol. 33, No. 11, November, 1987. See also Amos Tversky and Daniel Kahneman, "The Framing of Decisions and the Psychology of Choice," Science, 211, 1981.

96. See Donald C. Hambrick and Richard A. D'Aveni, "Large Corporation Failures as Downward Spirals," Administrative 'Science Quarterly, vol. 33, No. 1, March 1988.

97. Hannan and Freeman, 1977: 959.

98. Forbes Magazine, November 1987.

99. Nation's Business, 1976.

100. Starbuck, 1983: 101. On the other hand, Kaufman found that government organizations are far more resilient than expected. Of 175 federal government organizations in existence in 1923, 85% were still alive in 1983; moreover, the population of public organizations has grown exponentially in the last 50 years Kaufman, 1976). But Kaufman did not account for mergers of agencies into other agencies, or change in mission (but retention in name). See Kaufman, 1976.

101. Singh, et. al., 1986.

102. Most businesses in the United States are small (out of 2.2 million corporations, 89% have assets of less than 1 million dollars). In 1980, about 525,000 new businesses were launched, and about 76,000 businesses failed (U.S. Department of

Commerce; Statistical Abstract, 1980: Tables 949 and 971). If proprietorships and partnerships are included, the percentage of new firms that survive the first year of business is around 30%. Studies of new industries like electronics, and especially the semi conductor industry, find exceedingly high birth rates. The history of the vacuum tube-transistor-integrated circuit industry from 1950-1980 is one of continual change in technical and manufacturing leadership, of staid old line organizations (Westinghouse, G.E., RCA, Sylvania) being overwhelmed by swarms of new comers specializing in new techniques suitable for new market niches (Fairchild Semiconductor, National Semiconductor, Intel, Motorola) (See Brittain and Freeman, 1980). This has led researchers to talk of "waves of organizing over time" or cycles of birth (Stinchcombe, 1965; Aldrich, 1979).

103. Michael L. Tushman, William H. Newman, and Elaine Romanelli, "Convergence and Upheaval: Managing the Unsteady Pace of Organizational Evolution," California Management Review, vol 29, No. 1, 1986.

104. In prior work there is little opportunity for the environment to act directly on the innovation process. In Laudon's model of 1974, to Kraemer and King's model of 1985, the environment acts indirectly on IT innovation through its influence on organizational structure, politics, and values. The possibility that the environment can directly effect IT innovation, or so overwhelm organizational features so as to make the organizational elements almost incidental, is not considered.

Prior research on IT innovation has not used any of the environmental models with any fidelity.

Of course environmental variables do appear in other works as well. In Laudon (1974), Kling (1978), Westin (1972), Danziger et. al., (1982), and Kraemer et. al. (1981) environmental sources of funds, technology, and support are described. But here the environment is seen as little more than a tableau, sometimes enabling, sometimes constricting, on which organizational forces act.

Without denying that environments act through organizations and indirectly influence IT innovation, there is anecdotal evidence to support much greater research on the role of environments acting directly on IT innovation.

105. Laudon, 1986.

106. Laudon, 1986.

107. Laudon, 1986; see also the Deficit Reduction Act of 1984.. Laudon, 1986; see also the Deficit Reduction Act of 1984.

108. Laudon and Laudon, 1988: Chapter 3.

109. Tushman and Anderson, 1986. See also Mensch.

110. Scholars tend to resist the idea that environments dominate system development and design. But the impact of environmental variables is so strong that researchers purposely control out the effects of these environmental factors in order to observe and study the operation of political, policy, and other institutional factors.

For instance, Kraemer and King (1985) in their study of computing in OECD and American cities found that the environmental variable city size was powerfully related to other variables such as computing installation and use, policies, problems, and benefits. It was only by eliminating size as a statistical variable that other relationships--much weaker--could be examined (see King and Kraemer, chapter 6).

The sheer power of the environmental variable (size) weakens "rational" and decisionmaking models. Once size is considered, there is not much variance left that political, rational, or other variables can explain. King and Kraemer conclude both that "size is not a basic explanatory variable" and "Size is, therefore, a critical and underlying environmental variable that simultaneously creates an impetus and regulates the flow of resources for the development or lack of development of the computing environment" (page 156).

111. Readers are referred to the very impressive forthcoming volume by Kenneth L. Kraemer, John Leslie King, Debora Dunkle, and Joseph P. Lane, Change and Control in Computing: Managing the Information Systems Function. Irvine, CA: Public Policy Research Organization, University of California, 1987 (xerox). This is a superb longitudinal study of computing in seven local governments. The theory developed in the first chapter is parallel with our own model proposed in this paper. The author is indebted to Ken Kraemer and John King for our many discussions about theory and empirical research over many years.