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Systems Without Method: The Impact of New Technologies on Information Systems Development Projects

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ABSTRACT

This paper contributes a contrasting analysis of the current role of information systems development methods in today's organizations. Currently the field is dominated by an obsolete nineteenth-century perspective that is unsuitable for *post-modern* organizations. There is strong evidence that a preoccupation with methodical approaches to information problems severely limits our ability to respond effectively to organizational information requirements. The basic assumption that methodical approaches are necessary and beneficial has been obsolete for some time, primarily because newer technologies (such as fourth-generation languages and local area networks) have enabled alternative systems development approaches.

1. INTRODUCTION

The concept of method underlies most of the literature on information systems development (ISD). Both Oxford and Webster's dictionaries primarily define the term as meaning "the procedure for obtaining an object." The secondary definitions fasten on such ideas as "orderly," "systematic," "regularity," and "regimen." This paradigm for systems development presumes orderly, predictable and organized ISD. However, new technologies such as end-user computing (EUC), fourth generation languages (4GL), and local area networks (LAN) facilitate the rapid and non-linear development of fragmented information system elements in many unique ways. This tendency toward

the unique and the fragmented is inconsistent with the traditional, methodical systems development paradigm.

In an era of organizational globalization and competitive information systems, we begin to recognize that undue regularity in an organization (and its information system) may inhibit adaptation and survival. We discover an aspect of organizational evolution that we misapprehended: that human organizations are emergent entities, continually adapting to a set of "goals-in-motion." Regularities imposed upon organizations (such as a permanently developed information system) inherently inhibit emergence and must eventually fail. However, the new technologies are promoting an ISD paradigm that supports, rather than inhibits emergence. This condition is often perceived to be uncontrolled and fragmented systems development. On the contrary, this may, in fact, be the ideal post-modern development environment for information systems (IS): systems development without regularities, structures or regimens -- systems without method.

1.1 Purpose and Definitions

The purpose of this paper is to unveil the fact that methods in general do not and cannot provide the ideal foundation upon which to launch ISD within post-modern organizations. This work is descriptive in the sense that we discover trends that are widely described in the literature, but whose import is largely unrecognized. In the following sections, we offer evidence that methodical approaches are serving to inhibit rather than enhance the effective development of IS. The fundamental principle by which methods are central in our IS development paradigm has been diminishing for some time without notice. This conclusion contrasts the basic assumption that underlies most of the current IS literature. In approaching this issue, we must use the term method in several specific connotations:

> *Method*$_n$ is used to refer to the set of all methods invented by mankind; that is, method$_n$ refers to the idea of methods as an artifact.
>
> *Method*$_1$ is used to refer to the set of known methods used for the production of knowledge. The foundations of the work below include the philosophy of science, where authors such as Gareth Morgan (*Beyond Method*) and Paul Feyerabend (*Against Method*) challenge the domination of a single scientific method.
>
> *Method*$_2$ is used in to refer to the set of known methods adapted for the development of computer-based information systems. Methods$_2$ are defined within object-oriented development, structured development, prototyping development, information engineering, soft systems and others.

Certainly, method$_1$ and method$_2$ intersect (*e.g.*, the roots of Peter Checkland's (1981) Soft Systems Methodology are found in the Action Research Method). We must also retain the terms *method* and *methodical* in their general English sense mentioned earlier, but we often employ these in a provincial way to connote the predominant ideal that underpins all of our current approaches to ISD; *viz.*, that we can or should project structures within which systems development must take place. We will

avoid the term *methodology* altogether, for in the field of IS, the original meaning of this term has yielded to the concept of taxonomies or hierarchies of $methods_n$.

We must also deal with the antithesis, and we use the term *amethodical* to refer to this concept. That is, that it is possible to divorce ISD from the imposed structures of $methods_2$. We do not imply anarchy nor chaos, but idiography. It is possible to manage and orchestrate systems development without resort to $method_2$. Amethodical systems development acknowledges that the development approach must be necessarily unique and distinct for each information requirement that confronts an organization. This does not mean that these are simply "contingent." We refer to a process more fluid than using fixed criteria by which one "selects" the "correct" development $method_2$ for an expected organizational setting.

The post-modern business organization is fundamentally different from current organizational forms which were based on the industrial organizational view of markets, competition and government regulation. This organization does not adhere to the traditional binary organizational forms, *e.g.*, either market-based or bureaucratic/hierarchical structured. Rather it is an organization in a constant state of formation, devolution, reformulation, evolution. It is fluid, flexible, adaptive, open and attuned to its surroundings. It eschews rigid boundaries. It learns and accepts change as the norm. In the organizational literature, it is being called by many names: the dissipative organization (Leifer, 1989), the imaginary organization (Hedberg, 1991), the hybrid organization (Powell, 1987), the adaptive organization (Toffler, 1990, Toffler, 1987) the virtual organization (Mackenzie, 1986) and the semi-permanent symbioses (Huber, 1991).

Our arguments are supported by a fundamental examination of the traditional motives and purposes of $methods_2$. We must consider the role of these $methods_2$ within organizations. As we explore the evolving nature of post modern organizational thought, however, we discover mounting evidence that the basic, unchallenged premise of methodical systems development may be an essential culprit in the mismatch between information systems and the organizations they support. These methodically developed systems will commence as confinements to organizational growth, and will continuously diverge from the organization's real needs.

The paper constructs a post-modern view of IS emergence that transcends method. We consider a paradigm for evolutionary systems without the previously proposed structures of contingency and continuous maintenance. This effort will require an analysis of the current literature from a post-modern perspective. In addition, two case studies illustrate an application of post-modern analysis as an alternatives to the archaic, modern view of $methods_2$.

2. THE HERITAGE OF METHOD IN SYSTEMS DEVELOPMENT

There is a zealous heritage of rationale underlying our ideal of $method_2$. The methodical approach to ISD pre-dates the computer. Techniques such as records management (Maedke, Robek and Brown, 1981) and document flow diagrams like Horizontal Form Flow Charts (Stamper, 1970) were proposed and are used to create manual IS. $Methods_n$ permitted management to "engineer" information flows in an effort to improve the economics of labor and other resources in the production and maintenance of information (*cf.* Taylor, 1911). With the introduction of electronic

computers, this engineering heritage has expanded under the influence of the electronic and software engineers to include additional formalistic and epistemologic aspects.

At a functional level, the methods$_2$ introduce structure into the systems development process and regulate activities. There are four major purposes.

(1) Methods$_2$ provide a taxonomy of activities. Thus, we reduce the complex set of systems development activities with a classification scheme. Importantly, by grouping similar activities, we also hope to achieve economies by reducing redundant activity, which become apparent when similar activities are grouped.

(2) Methods$_2$ serve to organize activities. By ordering phases or steps as the sequence of activities, we hope to improve efficiency by eliminating excessive rework and in-process changes.

(3) Methods$_2$ assure that activities are comprehensive. If we insist that all necessary work is completed without oversight, we eliminate the expense and embarrassment of returning to the project for additional "repair" development after the project's completion.

(4) Methods$_2$ eliminate irrational activities. We seek to eliminate the costs of unnecessary, unproductive, and even counterproductive work. This is an *economic* rationale.

At an abstract level, the purpose of such methodical approaches to systems development are inherited from science. Methods$_1$ permit a universal approach to a wide family of problem situations, reduce these problems to an abstract set of symbols (often a diagram), and usually permit elements of the problem space to be symbolically manipulated with a finite set of operations in order to deductively arrive at the solution. The methods$_1$ apply the science of a profession to a complex reality (*cf.* Schön, 1983). This is a *formalistic* rationale.

At a philosophical level, methods$_1$ assure that we develop credible knowledge about the present and possible future states of nature. As professional techniques, methods$_2$ borrow epistemological assumptions from their reference disciplines. Essentially, however, they provide a structural framework for the acquisition of knowledge about nature. These methods$_2$ are the paradigm within which professionals learn about their surroundings. This is an *epistemological* rationale

Thus, systems development methods$_2$ are motivated by a desire to introduce professional, even scientific, rigor into the system development process. This motivation continues into today's systems development methods$_2$. Underlying this is the need to economize the systems development process.

3. THE IMPACT OF NEW TECHNOLOGIES

Technology is gradually eroding the economic, formalistic, and epistemological rationale that underlies methodical approaches to ISD. Consequently, this trend calls into question the organizational purposes of virtually our entire set of development methods$_2$. In this section, we will

review the evolving technological climate, and consider the implications of this for IS within organizations. Then we will further explore the direct meaning of this for developers and their methods$_2$.

3.1 The Erosion of The Economic Rationale: Evolution of The Information Systems Economy

On the surface, it may seem that project management techniques are concerned with management, while technical systems development methods$_2$ are concerned with achieving technical performance (through formalism and knowledgeable foundation) from the system under development. However, these technical systems development processes themselves serve economic purposes in methodically managing systems specification and implementation in order to maximize the benefits while minimizing the drain on our organizational resources. From this perspective, systems development historically has focussed on method in connection with the economics of early IS. Computers were an expensive commodity, and systems development was an expensive process. Economy dictated that these be efficiently developed.

Economies of computer-based IS are evolving. The average cost of computing hardware has declined at annual rate of about 22%. This has led to the migration away from centralized mainframe computing and the proliferation of minicomputers and microcomputers (Hodges, 1987b). In contrast, the costs of traditional software development continue to rise. By 1986 the average Fortune 1000 application software budget was being exceeded by 65%. As a consequence, there is an increasing dependence upon packaged software. Fueled by microcomputer growth, the software market grew during the 1980s at an annual rate of about 25% (Hodges, 1987a).

Thus we find technology enables a trend toward the replacement of expensive mainframe computers and custom software with batteries of inexpensive small computers operating under cheap packaged software. In contrast, the economic importance to the firm of a multitude of adaptable information processing elements is overwhelming.

The economies of systematic approaches to ISD are oriented toward a few large-scale, long-term development projects. Technology, however, has brought us an era of uncounted, incremental, short-term needs. In the light of these trends, there is a sense that the economic value of systematic ISD may be dwindling. Indeed, we find evidence that present systematic ISD methods$_2$ may even be hindering essential organizational needs in the post-modern era. We should especially note that IT enables (and then economics drives) a variety of new organizational forms for the coming decade of intense global competition.

Technological and competitive environments are evolving so rapidly that organizational forms, operations, services/products and client relations are forced to adjust (incrementally or radically) to assure organizational survival. As an example, consider the financial services industry in the U.S., U.K. Europe and Japan. Clemons and Weber (1991) describe the radical restructuring of the financial services industry which occurred during since 1986 and has cost more than 60,000 jobs in New York City alone. The authors insist that:

> information technology is now itself creating equally fundamental changes in the nature of this [financial services] industry, and these changes are potentially quite damaging to the profitability of the industry. (p. 93)

They illustrate the manner and speed in which the adaptation of information technology can fundamentally alter decades old structures, and power relationships in industries while forcing further technological adaptation upon organizations not because they expect to gain competitive advantage through the new technology but because not to adopt the technology would be fatal. As an illustration of the rate of change imposed by these technologies they describe events surrounding the introduction of the Stock Exchange Automatic Quotation System (SEAQ) into the London stock market.

> One unanticipated result of SEAQ was the quick demise of the trading floor. ...it was clear by the end of the first week [after the introduction of SEAQ] that the floor was obsolete. To some ...the implications were clear even faster..."within five minutes of Big Bang [the system switchover] it was clear that the floor was dead." (p. 104)

With the new system investors around the world could directly access the London market which thus attracted considerable turnover from other exchanges worldwide. Within weeks of the system transition 85% of the Stockholm exchange had migrated to the London exchange and French and German exchanges saw nearly a quarter of their trades move to London. Yet despite this dramatic increase in trading volume London brokerages houses lost nearly 1 billion pounds in 1989 largely because of the market transparency (efficiencies) caused by the new system. Thus the technology introduced in London caused radical adjustment in the financial service industry internationally while having negative impact on the profitability of individual firms within the industry.

Environmental circumstances are changing so rapidly that the organization itself is in a more or less continuous state of adaptation or self-remaking. This also means that the IS must be in a continuous state of adaptation. This, in turn, suggests a spiral where new IS forms trigger new organizational forms and functions. These organizational forms prompt even more rapid organizational adjustment that requires further new IS forms, creating an accelerating spiral of organizational and IS change. These new or emergent organization forms and their IS are so integral to each other that the advent of the IS may require the evolution of the organizational form. The IS thus becomes the catalyst and means of organizational adaptation, change or emergence. Organizational characteristics and organizational forms are evolving into the post-modern era. These new forms are alternately called emergent, virtual and imaginary organizations. IS developers confront the nature of information systems needed to support such organizational forms and the impact that IS have on the organization itself.

Hedberg (1991) describes a similar emergent organizational form which he calls the "imaginary organization." These organizations are real

> with respect to the market place but non-tangible in the accounting sense [and] lack substance from an accounting point of view. [They are] both real and tangible, but they tend to escape most of the accounting, structural schemes, property rights and

> recipes for efficient leadership that business schools teach. [They] often have information systems as a part of their operative core competence. (p. 4)

Such imaginary organizations have fluid and indistinct boundaries, shifting membership, intangible assets and nontraditional purpose, services or products. These may be termed "virtual" in that they are presented as a reality to the user, customer or member. The virtual organization renders services as if they were being offered in a traditional physical setting (such as a bank, brokerage house or retail outlet) or via traditional media (e.g. paper or voice negotiation). In fact the marketplace may be wholly electronic; and the rendered services may represent the brokering of offerings made by other organizations. Organizational membership may include the customer as a client or alternatively as co-producer of the product together with other organizations bound in a transaction for a limited duration. The organizational purpose is also fluid, since it is closely aligned with the transient needs of members or customers. The services or products it offers are often associated with the sharing of information or knowledge rather than raw materials, goods or tangible assets. Consequently, these organizations are constantly creating, bundling and unbundling various services and products.

From this perspective virtual organizations are a product of the shift to an information society whose assets are often customer data bases, communication networks and service delivery systems. These organizations represent a growing demand for the capacity to rapidly change the IS support in order to match the demands of virtual organizations (Main, 1988). Information as a competitive weapon called for flexible IS architectures that respond rapidly in the reach for "fast" organizations. Virtual organizational survival depends upon a fundamental restructuring of the organization's entire IS architecture to meet the demand for greater degrees of flexibility in IS (Allen and Boynton, 1990).

Authorities such as Gerrity and Rockart speak of "seizing the opportunity" offered by EUC to develop the necessary organizational flexibility with present-day technologies (Gerrity and Rockart, 1986). In this way, IS technologies enable the "incremental change" that can lead to organizational excellence (the accumulated effect of many minor improvements non-synchronously effected by many people). Large scale systems development projects represent the "bold strategic stroke" which is more seldomly brilliant in its effect (Peters and Waterman, 1982).

Rapid, small-scale ISD will be critical if organizations are to adapt quickly to their environments, and thereby find success in the post-modern globalization of commerce and industry. Small-scale also implies short-term planning, but the frequency of such ISD is related to the evolutionary states of the organization, and the speed at which they need to evolve. The call for a "contingency" approach to systems development (Davis, 1982) is a recognition that systems developers must introduce more flexibility into the systems development process, even becoming proactive, in order to prepare quick responses to changing management strategies (Goodhue, Quillard and Rockart, 1988).

But if we follow this line of reasoning further, we find the view that IS developers must become marshals of the "grand plan," the architects of a detailed schematic of small, co-ordinated information system development projects. This is an impossibility since, in all but the most moribund organizations, such a plan depends on a rapidly changing landscape of organizational plans and strategy. Can IS planners hope to outguess the organizational planners? Indeed, the criticality of information resources and the intricate link between organizational strategies and systems

development may mean that IS planning has become too important for analysts (Albrect and Lim, 1986).

John Rockart speaks of the fourth era in information systems as "The Wired Society." In this era, the real benefit of cheaper computing hardware and software is improved communications, and this aspect of systems is the essential key to organizational success. Rockart thinks that the gravity of the decisions regarding information technology have now exceeded the scope of systems developers:

> As information technology becomes increasingly significant in business operations, its use should be shaped by the managers running the business. More significantly, if they are to be operated effectively, today's systems almost always require major, sometimes radical alterations in an organization's structure, personnel, roles, and business processes -- sometimes even in the culture of the corporation itself. Thus the economic, behavioral, and political consequences of today's information technology applications should be well thought out and the requisite change processes effectively managed by those responsible for the management of the business itself. (Rockart, 1988, p. 60)

The IS economy is thus evolving because of technological innovation and the information demands of organizations that are themselves evolving. The demands being levied on systems developers may mean that the role of these systems developers is also evolving, perhaps from systems analysts into business analysts.

We find that the role of $method_2$ in ISD may be shifting with the role of IS within the organization. The economic motive for methodical approaches seems to be dissolving. The "large economy" is disappearing with the routine necessity for giant custom system projects. As end-users increasingly develop applications using desktop tools, and operational prototypes multiply, the resources needed for incremental systems changes become informal and indistinguishably lost in operational budgets (even though, collectively, these may be substantial). The preoccupation of IS professionals with $methods_2$ in systems development thrusts an unnecessary burden -- an imposition -- on an otherwise unstructured, evolutionary process.

3.2 The Erosion of the Formalistic Rationale: Shifting Modes of Development

Goguen (1991) distinguishes between *dry* and *wet* cultures in computing. The dry culture sees computer systems as structured and mathematically specifiable objects. The wet culture sees these systems as social, cultural and political factors. Goguen notes that even the dry culture uses formal $methods_n$ most effectively in a relatively informal way as a means of communication. Accordingly, each requirements $method_2$ assumes an unarticulated theory of organizations with an implicit sociological theory (modern-unitary, modern-dual, post-modern and psychologically based). Goguen's view of the post-modern organization, one composed of many "local language games" that defies formalization because the language game changes within each discourse.

Little wonder that the traditional association with ISD and method is creating conflict in post-modern organizations. For example, software engineers discovered that the majority of software is "domain dependent," and development must be an ongoing process. The continuous interaction of the design process with a universe of discourse poses a fundamental obstacle to the improvement of software productivity through libraries of reusable program code (Giddings, 1984).

Data base design further illustrates this conflict. The integration of an organizational data base may be at the height of methods$_2$ that introduce regularity into corporate IS. The achievement of this data resource is a major focal point of software engineering methods$_2$ (*cf.* Steward, 1987), information engineering methods$_2$ (*cf.* Martin, 1990, Finklestein, 1990), and object-oriented systems methods$_2$ (*cf.* Coad and Yourdon, 1990). It is an important element of methods$_2$ that employ Computer Aided Software Engineering (CASE) (*cf.* Barker, 1990, IBM, 1989). Yet, the achievement of these data bases elude systems developers. Goodhue, Quillard and Rockart acknowledge that data base integration may be inhibiting, rather than promoting organizational flexibility:

> Too great an emphasis on data standardization is a mistake. A detailed corporate-wide data model is probably premature in most companies today because of important hard-to-resolve differences in the way data is defined, stored or used in different parts of the organization. These significant managerial and system differences are a major reason why strategic data planning approaches are so difficult to carry out. (Goodhue, Quillard and Rockart, 1988, p. 390)

The conflict between post-modern organizational needs and systems development methods$_2$ may be overflowing into goal-oriented systems development teams who confront the need for rapid, incremental change with extensive development approaches that prolong the acquisition of short-term solutions. Orlikowski, for example, found that the introduction of CASE tools into the systems development process led to structural changes in systems project teams. Shifts in patterns of dependency and division of labor triggered polarization, territorialism and resentment (Orlikowski, 1989).

One might expect that the arena of desktop systems would be less susceptible to the problems of ISD method$_2$ formalisms. The conventional view is that such systems can be acquired outside of the controlled development process, thus leading to fragmented and redundant information system elements (Couger, 1986). Consequently, desktop technologies such as microcomputers appear to be the bane of methodical IS planning and development.

Even here, we can discover conflicts. Zmuidzinas, Kling and George (1990), in a longitudinal quantitative study, discovered that the continuing process of desktop computerization is artificially portrayed in the popular technology press as socially revolutionary. In their view, it is the cost of installation, training and maintenance, not the simple purchase price of desktop computers, that prevents organizations from acquiring new technologies. These costs lie precisely in those areas of desktop acquisition where many organizations still employ some vestige of traditional systems development methods$_2$. This evidence indicates that methods$_2$ are continuing to interfere, even though we are developing more small systems as an alternative to the larger, more formal systems.

3.3 The Erosion of The Epistemological Rationale: The Disillusion of Method$_n$

From a philosophical perspective, methods$_n$ at least provide professionals with a framework for learning about the needs of an organization, and understanding how changes should be introduced into organizations in the form of improved IS. But perhaps this perspective is equally flawed. David Parnas and Paul Clements consider the design methods$_2$ to be "idealized," for a number of reasons. For example, how do you learn the system requirements from people who do not know what they want and cannot explain what they know? Also, considerable backtracking is required as the system details unfold and errors are unveiled during the progress of development. Our methods$_2$ rarely account for the preconceived design ideas and project-specific constraints (*e.g.,* imposed resources such as previously developed software).

Parnas and Clements argue that the rationality of systems design processes are imposed *a posteriori* on design documentation. The actual design activities deviate uncontrollably from the canons of development methods$_2$:

> We will never find a process that allows us to design software in a perfectly rational way. The good news is that we can fake it. . . . The process is "faked" by producing the documents that we would have produced if we had done this the ideal way. (Parnas and Clements, 1986, pp. 251 and 256)

Perhaps we delude ourselves in casting the role of systems development methods$_2$ as a means by which professionals learn about their surroundings. Rather than serving as a means for acquiring systems knowledge, the only epistemological purpose identified by Parnas and Clements for systems development methods$_2$ seem to be as a framework for communication: the organization of records and evidence about the system development project itself, and only indirectly reflecting what may have been learned about the information system that had been developed.

3.4 Summary of The Impact

Thus, the rationale of method$_2$ as an essential tenet in ISD is being crushed by 1) the evolution of technological economy, 2) the changing pragmatics of formalisms in new organizational cultures, and 3) questions regarding our understanding of the process of discovery in ISD. The original purposes of such methods$_2$, unquestioned by modern IS thought, are no longer being served. Perhaps, from a philosophical perspective, these have never been adequately served. There is considerable evidence building that our preoccupation with method$_2$ may even be denying organizations the very information services that such methods$_2$ purport to create.

Under competitive pressures, the mode of development may be uncontrollably shifting, from the structured, orderly and methodical to the unstructured, emergent and amethodical. We recognize a trend in organizational IS that transcends the basic concept of a development method$_2$. Some may herald the growing importance of unmarshaled EUC development (applications written in the macro languages of computer tools such as spread sheets), and unplanned operational prototypes rapidly generated in fourth generation languages as significant improvement in IS flexibility. We see this as

the inexorable transition of ISD from its methodical role in the modern organization to its emergent role the post-modern organization.

4. INFORMATION SYSTEMS DEVELOPMENT IN POST MODERN ORGANIZATIONS

The concept of systems development without resort to $methods_2$ does not necessarily mean a decent into chaos and anarchy. Rather it recognizes that the modern perspective on structure and regularity with organizations was a misapprehension. A post modern perspective recognizes the significance of fluid change and growth within social organizations. Systems developers in the past have inhibited this fluid change by imposing fixed and confining computer-based information flows. That is, methodical systems development approaches must fasten upon and support organizational needs that are perceived and characterized as stable organizational structures and thus enforce arbitrary structures that are barriers to emergence. Our point here is that IS planning and modelling methods seek to formalize organizational regularities. All of the characteristics of method, in general (ordered, systemic, regular, and regimented), contributed to the construction of this information prison. Their systems eventually fail as the organization escapes from this prison. Post modern systems developers face a different challenge. They must develop their information services within a paradigm of constant organizational movement, adjustment and adaptation. In this section, we will consider the implications of post-modern thought, and especially emergence, on the use of $methods_2$ for ISD.

4.1 Modernity and Post-Modernity

The problem of post-modernity is relevant to the development of IS in a world where the default organizational form is seen as the emergent rather than stable organization. Though difficult to define, post-modernism refers to a set of values and attitudes which extend beyond or transcend the views of "modern" science as codified around the turn of this century. Accordingly a description of "modernism" is necessary in order to describe "post-modernism."

Modernism is often associated with the rational scientific approach to the study of the world--both natural and social phenomena. Its intellectual roots date back to the "age of enlightenment." Modernism refers to a position in the philosophy of science which takes human rationality as a basic premise. Instrumental reason and the ability to empirically test ideas begets its $methods_1$ of inquiry. Techniques used to study events in the natural sciences were taken as exemplars for the study of all phenomena both natural *and* social. In modernist thought universal truths are presumed to exist and remain to be discovered and tested. That is, it is a position wherein grand unifying theories of scientific inquiry (e.g the universal scientific $method_1$) or of societal behavior (e.g. dialectical materialism) are proposed and seriously pursued in research or social experimentation. Only those propositions developed "rationally" and which are empirically testable are admitted as scientific and thus contain "truth value." Through the pursuit of scientific truth, and the adaptation of the rational, methodical development of technologies associated with these discoveries, human progress was assured.

Post-modernism, on the other hand, rejects the notions of instrumental rationality and admits a variety of other forms of knowledge into its scientific arsenal. It is a philosophical view arising from the ashes of the first world war (and subsequent social change--e.g. the rise of fascism, the October revolution etc.) (Achterberg, van Es and Heng, 1990) in which the assumptions of human progress, and the benefits of instrumental reason and technological progress were called into question in the arts and literature. The questions raised have steadily spread to contemporary philosophical thought and in the social sciences. Post-modern thought accepts various types of rationality and sees reality as a social construction. Thus it rejects the notion that any issues can be studied with one universal method$_1$ of scientific inquiry. Post-modernism acknowledges that social, political, economic and other environmental circumstances form a context in which socially derived events must be considered. The social world is too complex and interactive to be explained mechanistically. In the context of this view, social organizations are open systems and are self organizing, self-referential (*i.e.*, autopoietic) and are thus in a constant state of defining, redefining and sense-making (understanding themselves and the world at large). Organizational stability, previously taken as a default position, is in post-modern terms called into question.

The philosophical roots of all ISD methods$_2$ are anchored in "modern" thought. They are, after all, rational, reductionist, empirical and scientific. Two other formative assumptions associated with the notion of method$_n$ are that they presume a default position of a stable set of organizational structures and they are often presumed to be universally applicable over any organizational form. There is a growing body of post-modern work which regards organizations as emergent for which these key assumptions are erroneous.

Emergent Organizational Systems. IS development methods$_2$ assume the existence of organizational structures which have only to be revealed and modeled to be understood. This assumption is critical to most methods$_2$ and tools for the planning, problem formulation, analysis, specification, implementation and maintenance of IS. It is also presumed in IS design when design is seen as creating a fit between IS and existing structure. We define structure as the static aspects of a system that are usually observed by its apparent regularities.

This view has gone unchallenged since the beginning of organizational theory (Boone and Bowen, 1987, Perrow, 1967, Perrow, 1970). However post-modern work is questioning the existence of a stable structures on a number of fronts. Deconstruction theory attacks the philosophy of science, discourse and literary criticism on the grounds that the presumed structures are fictitious or irrelevant (Staten, 1987, Derrida, 1972, Bloom *et al.*, 1988). In general systems theory, the discussion of autopoietic or self-referential social systems describes social organizations (Aulin, 1986, Luhmann, 1986, von Foerster, 1989) which are continuously self-making (autopoietic) via the vehicle of discourse and which never arrive at a stable state. Critical social theory with its emphasis on praxis and continuous adaptation, iteration and critical participation *partially* supports the notion of emergent social systems (Forester, 1989, Heydebrand, 1983). And, in the field of linguistics the notion of formal grammar is under attack because formal grammar does not serve as a useful model for human discourse (Hopper, 1987, Hopper, 1988, Hopper, forthcoming, Hopper, 1990).

Even closer to the field of systems there is a line of thinking -- *emergent systems* -- also rejecting the notion of "given" or *a priori* structures associated with human organizational forms. This line of

thinking is related to the social construction of reality, (Berger and Luckmann, 1966) but extends the notion by rejecting *a priori* structures altogether (Truex and Klein, 1991).

Emergent systems and the theory of emergence are rather compact terms which view behavior from a perspective that replaces fixed structures with one of continuous social re-construction. We use the terms "emergent" and "emergence" rather than "emerging" because "emergent" refers to the state of being in continual process, never arriving but always in transit. "Emerging" differs from "emergent" because it gives rise to the possibility of a current state being a stage to a possible outcome or arrival and always arising from its previous history and context. But organizational "emergence" is not simply organizational change.

The idea of emergent processes differs from the notion of change in that change implies a transition over time (from T_o to T_n etc) and from state to state (S_o to S_n) or from one structure to another. Emergent processes on the other hand may be seen as temporal agreements frozen in the process of negotiation at the time that the snapshot is taken or the observation is made. Our social systems are constantly in use, constantly confronting the world; thus they are always in process of "remaking" themselves.

The concept of emergent systems is built upon the belief that human systems are not deterministic; rather, they are products of constant social negotiation and consensus building. Emergent human systems are in the process of moving *towards* structure and may exhibit temporal regularities of behavior, but are never fixed or structured. There are emergent regularities but not unchanging relationships. There are no points of theoretical stasis, only emergent regularities. And those regularities are always shifting and evolving.

This view lies in sharp contrast to the prevalent view which holds the existence of preexisting forms of life which may be observed or discovered and in which events or human social activities take place. The theory of emergent systems rejects the notion of preexisting structure. Structures are seen as: reflections of the observer's mental models which have been imposed upon the events observed; as or the process of "structuration" (Cohen, 1989, Giddens, 1984) or as "becoming" in the Heideggerian sense.

4.2 The Appearance of Structure: Regularities in Emergent Systems

$Method_2$ suggests a world view of the modern systems developer. Understanding emergence requires an utter reversal of this world view for the post-modern systems developer. Modern systems development must map change onto a backdrop of given organizational structures that persist. Post-modern systems development must map perceived regularities onto a moving back drop of organizational emergence. Thus, in considering what inhibits emergent behaviors, emergent processes may be examined as either 1) an anomaly standing in contrast to the default background of preexisting (*a priori*) structures or, 2) as the organizational default background against which regularities develop and -- for a period of time -- appear to be structured (i.e. the process of

structuration). In the second instance, emergent behavior is considered the norm and structures are temporary fleeting images (like photographs of objects in motion with the foreground in focus and the background a blur of indistinguishable features), whereas in the first instance, structure is considered to be the norm and emergent action arises from it. These apparent regularities are reified social constructions in the sense described by Berger and Luckmann. Although social constructions, these regularities are taken to be fixed, given and inviolate. This "background" serves as a fixed constraint to which IS design is anchored and in that sense there are preexisting and given structures to the design process.

The principal question is then recast as: What allows certain regularities or "structures" to become established? What halts the emergent process in certain instances such as the temporal validity of a data model or the human interrelationships in social organizations? In linguistics Paul Hopper addresses the emergence of grammar as a type of structure as follows:

> "Emergence" means that structures are always in a process of being created. Therefore, we don't know in advance what kinds of regularities are going to lead to structure. It isn't a mere question of directionality. In language, regularities of all kinds exist, but not at a homogeneously statable level. Grammaticalization is simply a level at which certain kinds of regularities gel. But these "gelled" regularities are always decaying. There is the need to ask the right question, which is not "why do things change?" but "what forces act to inhibit change?" (Hopper, 1990)

This question, namely that change is somehow normal, and lack of change is somehow abnormal applies to all spheres of life, including systems development. Important for systems development is the distinction between explicitly defined rules and regularities that emerge in human activities. The latter are like living traditions, where the apparent regularity captures a moment in the *process of evolving*. Rules are apparent regularities of social systems that are affected by power relationships, the perceived legitimacy of leadership or governance roles, negotiations, bargains and agreements. In other words, sufficient power can freeze human organizational design, and an employer, data analyst or corporate planner may *impose* their particular perspective on the system design. Rules may attempt to impose an artificial, idealistic or obsolete regularity on social activities. In this way, power-players may employ IS methods$_2$ in a futile attempt to inhibit the emergence process.

4.3 Emergence and Information Systems

We have seen above that the property of emergence arises in linguistics. This tradition is relevant because IS planning, modeling, development and maintenance activities occur in a social context, and are discussed, defined and understood through the vehicle of language. The methods$_2$ and tools we use to describe and build IS thus define new language uses and new socially agreed-upon meanings. Therefore, the social context as a whole evolves in a similar fashion as language. For example, an organizational data model may be seen as a representation of the organization temporally frozen and formalized at some arbitrary point in time. The data model is a social artifact because the relationships represented in the model reflect agreements within the organization about key objects in its domain of work.

The data model defines new language uses because it is a linguistic artifact (Klein and Lyytinen, 1991). The components of a data model (e.g. a data entity or its attributes all aggregated in a data dictionary) with the rules governing their use collectively define the elements and structure of a formal data modelling grammar. Yet the relationships represented in the data model -- like relationships between words in language -- are temporal. The data model does not stop the organizations from changing. As it is likely that relationships within the organization modeled continue to change after their "formalization" in the data model the data modeling grammar becomes outdated. Therefore, just as natural grammars emerge through usage, data models must be built to be flexible and extendable to compensate for organizational emergence realized in software maintenance.

Organizational planning as a prerequisite for information engineering is seen as a way to provide stability to organizational operations (Martin, 1990, Finklestein, 1990). By identifying and negotiating organizational missions, goals, critical success factors and the like, the organization is selecting a path from an almost unlimited number of alternate paths. It is, for a period in time, freezing its assumptions about itself and its environment for the purpose of getting on with its activity.

From a post-modern perspective, this predilection towards seeing existing structures or towards imposing structure on organizational sub-systems may inhibit emergent behavior. In an increasingly competitive and adaptive global environment, such $methods_n$ may endanger the survival of the firm.

5. TOWARD AMETHODICAL SYSTEMS DEVELOPMENT: TWO CASE STUDIES

From the evidence in the sections above, we have learned that computer-based IS have always been problematic in their match to organizational needs. However, in the modern climate, these problems were not fully comprehended. The consequent systems were endured because of various economic values. However, the economies of such problematic systems are receding. Post-modern thought opens for us the recognition that organizational needs are emergent.

Therefore, IS developers may benefit their organizations by focussing away from development $methods_2$. Rather more important are fluid organizational "strategies" for positioning information assets and facilitating EUC and grass-roots development projects. Such strategies must be artfully constructed to individually match an organization, and must emerge with the organization. The pioneering concepts of contingent systems and continuous maintenance were a first step toward this ideal. However, on the one hand these impose artificial, predicted structures on systems emergence. On the other, these strive to maintain systems functionality in the face of growing obsolescence of purpose. Clearly, $methods_n$ in general, as we know the concept, will be less effective for post modern systems development.

The learning in the foregoing paper is derived from a hermeneutic analysis of a series of two action research projects conducted during 1987 through 1990, and described in the appendix. The learning expresses a theory that evolved gradually, as the research sought to satisfy a broad range of explicanda. The interpretation regarded organizational texts, which included a range of phenomena, such as action, as captured in developers' field notes, developers' diaries, project documentation, and

final project reports. As with any hermeneutic analysis, these organizational texts are open to alternative readings and interpretations. For example, in case Alpha, alternative readings might raise the question as to whether the information analysis was flawed or incompetently conducted, or that the follow-up development teams wanted to place their own imprimatur on the new design rather than adopt the old design.

As this research is both interpretivistic and interventionalistic, the work is neither value-free nor unbiased by the organizational culture. Indeed the researchers find this reading to be the most interesting and richest of the alternatives based on their close involvement with the organization and key actors during the research. After repeated readings of the organizational texts, the interpretation which we present constitutes a theory that satisfies the broadest range of the explicanda presented to us by the cases, without inducing inconsistencies.

5.1 Learning from The Cases

Case Alpha illustrates how an IS method$_2$ can fail because time elapses during systems development. During that elapsed time, the subject organization may well emerge. The regularities captured by the initial steps of the method$_2$ will be inconsistent with the regularities revealed in later steps. The developers of Case Alpha continued use of the method$_2$, but repeated early work as the development progressed.

Case Beta illustrates how a development method$_2$ can become a destructive tyrant when closely followed. Methods$_2$ impose artificial regularities upon the development process itself, actually inhibiting the effectiveness of the developers. In this case, the development organization become itself emergent, and the method$_2$ was reconsidered -- transcending steps or cycles in favor of a loosely orchestrated co-operative effort.

Firstly, the cases reveal how ISD methods$_2$ are invariant with regard to the organizational form and context. More often than not they are presumed to be equally valid when applied to one organization as another. As methods$_2$ are proposed and taught, a presumed and implicit lifecycle dictates steps of hierarchies of events which are supposed to lead to successful systems development. It is not enough to claim that the selection of a given development approach (*e.g.* process oriented versus data oriented, structured methods$_2$ versus soft systems approaches) is contingent. The internal structures of the "contingent" method$_2$ will assume invariant structure (*e.g.*, generally sequential series of activities).

But we should also consider that there is a deeper structure in development methods$_2$, just as there is a deeper structure in IS (Wand and Weber, 1990). These methods$_2$ are imbued by their chief proponents with a set of epistemological and ontological assumptions which may or may not be understood, accepted or employed by the user of the method$_2$ (Zmud, 1991). The underlying values of those proposing the methods$_2$ (*i.e.*, the set of organizational norms or culture) and those of the analysts/developers applying the methods$_2$ may be in conflict with the values, norms, and ontology of the organization. We have the potential for a three dimensional conflict. One has only to visualize

this conflict as a mapping arrangement to understand the structural nature of these dimensions (Baskerville, 1991). Considering the emergent nature of both developers and subject organizations, our obsession with universal development methods$_2$ becomes highly questionable.

Secondly, the cases illustrate how organizations are themselves virtual, emergent, contingent, contextually directed. The systems needed to address rapidly unfolding events are short-lived, contingent and disposable. The approaches used to specify and build those systems must themselves be emergent and virtual. A post-modern approach to ISD cannot adhere to regularities and universals. These approaches must themselves be emergent: short-lived and disposable. That is to say, each systems development approach must be incremental and unique. A methodical approach cannot account for the entire panoply of factors that envelope the planning and construction of a systems element. Given the organizational demands in both cases for more rapid adaption, the possibility of critical oversight was unavoidable. The approaches taken by each development team became idiographic. They developed their approach as they developed their system. These systems development projects became amethodical.

Thirdly, while the ISD in both cases became amethodical, in neither case did anarchy or chaos reign. Both development projects proceeded toward their goals in an organized, controlled, and managed way. However, in both cases the decision was made to deviate substantially from the mandated method$_2$. The teams transcended their imposed method$_2$ in the course of organizational or developmental emergence. Their approach more closely resembled Gareth Morgan's idea of *engagement* (Morgan, 1983) than traditional systems development method$_2$. Had the original structure of the method$_2$ been enforced, it is unlikely that the development teams would have held together even long enough to complete their tasks. It is even less likely that the ensuing system would have been suitable and thus, durable.

Finally, the amethodical nature of the projects was enabled by newer development technologies. Both cases were operating in LAN, 4GL, CASE and database environments. These technologies allowed the teams to deviate from the presupposed methods$_2$ without incurring the fatal overhead that was inherent in older development technologies. There were no redundant hardware elements, excess COBOL modules, or unneeded program flowcharts to be discarded. Instead, a relatively small amount of labor was entailed as data dictionaries were reworked, screens, menus and reports upgraded, network elements reconfigured and documentation automatically regenerated.

6. CONCLUSION

Systems development methods$_2$ are the foundation upon which we begin learning about a new information system, *not* the means by which we acquire that knowledge. In those cases where such methods$_2$ are used as the strict means for organizational learning and discovery, *i.e.*, as the method$_2$ required for systems development, then one of two results seem likely: (1) The systems development method$_2$ is "faked" -- imposed *a posteriori* on the development documentation; or (2) the methods$_2$ inhibit necessary organizational emergence, and thereby either the system or the organization must fail.

On the one hand, methods$_2$ are somewhat of a fiction -- a delusion of systems developers (or their managers). On the other hand, methods$_2$ are a burden, constraints imposed upon systems developers that ensure development of an inappropriate system. The interaction of several factors: changing economies, new technologies, and more emergent forms of organizations permit us to resign the paradigm of methods$_n$ for systems development. It is a paradigm that Feyerabend labels unrealistic, pernicious and detrimental (Feyerabend, 1978).

Amethodical ISD, the alternative paradigm, is not restricted to Feyerabend's theoretical anarchy. Newer ISD technologies support rapid, ad hoc construction of small-scale, temporary IS elements. These new technologies enable a shift of mandate, a devolution of systems development authority to more fundamental organizational levels. Elements of the IS thus emerge according to the needs, world views, and ontologies of the constituent organizational elements (whether these be virtual, imagined or real).

This is not an idealistic view of some utopian system development world of the future. This a recognizable trend, a present-day event, in the practice of current ISD. A trend that our preoccupation with the methodical has prevented us from recognizing. Further, this lack of recognition prevents us from supporting amethodical systems development. From this view, the current information systems profession may be retarding, rather than promoting, the success of post-modern organizations.

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APPENDIX

The learning mentioned in the main body of this paper is derived from the two case studies which we describe below. A brief section on the interpretive validity of these case studies concludes the appendix.

Case Alpha

Setting and Organizational Description. This study was undertaken as part of an enterprise analysis leading to the creation of an information architecture for a city government in a community of 55,000 people. The study team was invited to make preliminary recommendations for the development of IS within city government. The initial contact was made by the city's planning director. The planning director saw that, while the city had few current hardware and software systems in place, the demand for office automation and other specialized systems for the police, fire, building and construction, tax assessment, code enforcement and other departments was escalating. He saw that systems in place were unable to communicate and share resources and he feared the tower of babylon effect. He saw the current data processing staff of 2.5 people to be overwhelmed with current transaction processing activities. He also realized that their was very little recognition of the potential problem of systems and data incompatibility among higher management.

Activity Under Way when the Data Surfaced. The analysis teams conducted an enterprise analysis leading to an information architecture using the Business Systems Planning method$_2$ as a template and guide to the process. Prior to the organizational intervention the senior researchers developed a questionnaire to be completed by department heads. The questionnaire was designed to help elicit descriptions of process/functions performed, data created and used and problems encountered by the department. Analysis teams examined the completed questionnaires, interviewed key organizational players, examined policy and transaction documents, defined business processes, developed process organization matrices, defined business data (data classes and entities), prepared data class/process matrices and constructed the information architecture. The final report to the organization included the process and data class descriptions plus the architecture. It also provided recommendations for further work and observations regarding data inconsistencies and data sharing problems within city government. The report was presented in written and oral form to all the organizational participants and other organizational actors invited by the director of planning. The study was reviewed, discussed and accepted by the host organization. The study team was invited back to develop process specifications for one department and database prototypes for four departments.

Actors. The study team consisted of three IS faculty experienced in various ISD, information engineering and data modelling methods$_2$, seven four or five-person student analyst teams and five four-person data base prototyping teams. The city assigned two staff in its planning department to work with the data base teams. The Director of Planning served as project coordinator and project advocate within the city and garnered the support and cooperation of the five department heads four the units involved in the project.

Account of Events. The second group of analysis and database prototype teams had the advantage of having the architecture developed two months earlier and having one or more team members who had participated in the development of the architecture. Nevertheless each of the teams virtually abandoned the architecture and data descriptions in order to complete the database prototypes and data dictionary for the prototypes and process specifications.

Observation and Findings. The data architecture, prepared two months earlier, was deemed by the second group to be unsuitable as a basis for further systems development. It is unlikely that the data architecture was signally incorrect, since the client had participated in creating and validating the architecture. During the intervening months, however, the organization had continued its normal process of change. Perhaps its emergence had been accelerated by its acute awareness of the various data inconsistencies and data sharing problems raised by the first group. Perhaps an economic crisis ongoing at that time pushed the change process. Perhaps the pace of its emergence was normally fast.

At any rate, the organizational regularities had shifted considerably from those captured in the original study. The second group found the work of the first to be too irrelevant to the (then) current regularities exhibited by the City. The first study was discarded, and the data base was designed from scratch.

Case Beta

Setting and Organizational Description. This study regarded a project for the development of a procurement budgeting system for a government agency. The preexisting systems were mostly manual, supported by a few microcomputer spreadsheets, and access to a peripheral mainframe database facility which contained data relating to one budget area. The study team was invited after two previous analysis and design efforts had failed. A previous relational database-oriented analysis and design project failed when the designers attempted a strict canonical design based on the current paper forms and records. The resulting specification was massive, and the estimates for implementing the system ranged above three calendar years. The client rejected the specification for a number of reasons, including (1) the specification was already becoming obsolete when it was submitted, indicating the final system would be too outdated; and (2) no one in the organization who understood the applications could understand the specification. The users were suspicious of the complex specification, and the project failed.

Activity under way where the data surfaced. The study team established an action research infrastructure, the diagnosis focussed on the semantics of the user-designer dialogue and experimentation with a semantic database design technique that minimized the user frustration during interviews. A series of operational database system prototypes would anchor the semantics in a computer-based artifact. This activity is described in detail in Baskerville (1991).

Actors. The study team consisted of an experienced team leader with a strong practical background in logistics and IS, an analyst with a strong background in the procurement system, and a scientist commissioned as an action researcher. Later, a programmer and an additional analyst were added.

Account of the events. The team conducted an initial rapid database prototype of the database design. A database prototype for an integrated database is a very large undertaking. A database with 30 entities can be expected to generate 50 or more screens and an equal number of printed listing programs.

Prototyping methods$_2$ call for a cycle of at least three steps: (1) user interaction, (2) analysis/review and (3) prototype modification. In this case, the large number of system elements meant that the first analysis/review generated documentation for coding 100 or more programs. The rapid and effective programming which is achieved by the use of fourth generation techniques assures that the programmers could code the prototype. However, the design quickly broke down. Since the project was large enough to warrant separate analysts and programmers, the analysts had to work in parallel with the programmers. After each visit with the users, the analysts would invariably alter program specifications for portions of the prototype that the programmers had already completed. The deadline effect of the first prototype delivery date was unbearable. The lead programmer threatened to demand a transfer.

The team decided to discard the method$_2$, while retaining the basic concept of user interaction as a learning approach. The strategy was borrowed from the conceptual shift required by programmers who moved between declarative and procedural programming languages, and was named *declarative project management*. All direction for the team members was restricted to a minimized set of "rule-type" statements that were non-exceptional in nature. All design and project management documentation was eliminated except for certain diagrams. As a result, each team member autonomously interpreted the rules in each different problem situations.

The strategy worked. When prototype delivery dates approached, each team member made necessary adjustments (*e.g.*, shifting work to a subsequent prototype delivery or creatively inventing unique design approaches). The project, which almost collapsed in its attempt to meet the first cycle of the prototyping method$_2$, was successfully completed on schedule by ignoring the method$_2$ and focussing on strategies.

Observations and findings. As described earlier, Parnas and Clements argue that systems developers actually impose method$_2$ on their documentation, but not their design processes. In their view, this fact is unrecognized in the study of methods$_2$. In this case, however, the project sought to validate a method$_2$, and the attempt to strictly adhere to the method$_2$ almost defeated the project. The entire team had to openly reject its regularity in favor of an unstructured, open-ended declaration of goals. No method$_2$ for achieving these goals was prescribed. Thus, in each problem situation, the team members engaged the problem with approaches that seemed, or had proved useful in the past. Thus, method$_2$ yielded to learning-based strategy. In doing so, a large system prototype was reconstructed and evaluated in short time frames within minimum labor.

Interpretive Validity

Validity in interpretive research evolves in two dichotomous streams. On the one hand, the hermeneutics of Heidegger and Gadamer regards the importance of an existential understanding in interpretative works. Post-modern validity progresses from this sense. On the other hand, the modern sense of interpretive validity is classically expressed in the hermeneutics of Dilthey and Betti that, while not discarding the subjective moment, recognizes an objectively verifiable meaning in the text (*cf.* Palmer, 1969). The learning described in the main body of this paper, and the case descriptions above constitute valid readings of the organizations from both post-modern and modernist perspectives of hermeneutics.

With regard to the post-modern reading, all analysis is text-based, and texts are comprised by all phenomena and all events. In this regard, the emersed nature of the action research enabled the researchers to consider this broad fabric of the organizational emergence. According to post-modern thought, there is no single meaning for any text, and the reading as presented is one of an infinite number of possible valid readings (Rosenau, 1991).

As to the modernist perspective of hermeneutics, this reading is consonant with four criteria of a "good" or "valid" interpretation of organizational texts (Lee, 1991):

Firstly, *apparently absurd or irrational behaviors would no longer appear so*. Given the organization's response to our findings, we were forced to dismiss the earlier theory that the information analysis was incompetent. In the case of the information analysis and concomitant data class/entity model, the design was reviewed and subjected to considerable discussion by the organizational members responsible for the processes and data classes included in the model. These persons participated in the analysis and were frequently queried as questions arose during the design process. These parties ultimately accepted the design as accurate. Shortly following the process of the analysis and the presentation of findings the organization responded by both formally (i.e. officially) and informally adjusting organizational procedures and behaviors to correct problems uncovered during the analysis. This behavior would seem irrational unless the organizational leadership had considered the information analysis to be competent.

Secondly, *new observations would not surprise an observer/analyst.* During early cycles of interpretive readings, new observations constantly upset the various theories-in-use. Since adopting the amethodical framework, new observations have fit comfortably under the theory. Three researchers accepted the reading as useful and robust given their knowledge of organizational events.

Finally, *an observer would be able to enter the organizational world of the observed human subjects, whereupon he or she could communicate with and be accepted as one of them*. Subsequent development teams entered the organization armed with the information architecture and were able to: 1) successfully complete initial stages of data base prototypes and process specifications and 2) interact with organizational players. The previous work provided a sufficient platform for further organizational interaction, but not for complete system development. The reading of the data provided to them was sufficient to enable them to enter the organization and proceed with the process if later on they discarded the original model as being out dated.

Information and Communication Technology (ICT) provides access to data and new methodologies in commerce, industry, health, education etc.Â Information and Communication Technology (ICT) is a blanket term encompassing all the technologies and services involved in computing, data management, telecommunications provision, and the internet. These technologies all deal with the transmission and reception of information of some kind.Â Traditional on-premise private branch exchange (PBX) telephony systems built on hard-wired exchanges and equipment are giving way to a new telecommunications infrastructure, based on digital data transfer. Home Â» Information Systems Management Â» Impact of Information Technology on Organizations. Impact of Information Technology on Organizations. The impact of information technology will have significant effects on the structure, management and function of most organisations.Â It demands new patterns of work organisation and effects individual jobs, the structure of groups and teams, the nature of supervision and managerial roles. Information technology results in changes to lines of command, authority and the need for reconstructing the organisation structure and attention to job design. Computer based information and decision support systems influence choices in design of production or service activities, hierarchical structures and organisations of support staffs. @inproceedings{Baskerville1992SystemsWM, title={Systems Without Method: The Impact of New Technologies on Information Systems Development Projects}, author={R. Baskerville and J. Travis and Duane P. Truex}, booktitle={The Impact of Computer Supported Technologies in Information Systems Development}, year={1992} }. R. Baskerville, J. Travis, Duane P. Truex. Published in. The Impact of Computerâ€¦ 1992. Computer Science. The technical presentation allows studying the process of combining capital, information technology and labor in a large number of enterprises, at the same time, the behavioral model makes it possible to see the direct impact of these technologies on the internal work of the organization [8]. From the point of view of the development of economic processes, modern information technologies are tools that.Â Any technology introduced in production, regardless of its belonging to the technical or informational side of the process, becomes a catalyst for changes that affect all areas of the company. At the same time, with each new round of informatization, a new level of information use for a further development of technology is required. Key words: Technology, process, information technology, automation, modern information technology, stages, operations, operations, communication system, automated information technology, electronic office, automated research systems, automated design system. In industrial production, any technology represents a set of components that cover the technological process from the beginning to the end of product creation.