

Concepts Chaos and Complexity: An Alternate Strategic Alignment for Information Systems

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ABSTRACT: *In this paper an alternate theoretical model based on ideas arising from complexity theory, chaos theory, self-organizing systems, knowledge management and systems thinking is considered for strategically aligning information systems to the dynamic nature of business. Failed information systems projects suggest that it is imperative to reconsider the theoretical underpinnings upon which information systems are modeled. The current development trends to re-engineer existing systems using an object-oriented approach is challenged, as are traditional structured systems development life cycle methodologies. The dilemma of modeling a static information system picture of dynamically changing business requirements is also considered.*

Keywords: *Strategic Information Systems, Complexity Theory, Systems Development*

INTRODUCTION

In this paper an alternate theoretical model is proposed for strategically aligning information systems to the dynamic nature of business in times of accelerating change. Enough failed information systems projects are documented (Ewusi-Mensah,1997) to realize that it is imperative to reconsider the theoretical underpinnings upon which information systems are modeled. An alternate theoretical model based on ideas arising from complexity theory, chaos theory, self-organizing systems, knowledge management and systems thinking is considered. The current information systems development trend to re-engineer existing systems using an object-oriented approach is challenged, as are traditional structured systems development life cycle methodologies. The dilemma of modeling a static information system picture of dynamically changing business requirements is also considered. The following basic premises are used in developing this alternate model: data should be stored as close to the point of origin with respect to time, requirement and location; reports should be produced on an "as needed" basis; cognizance is given to both formal and informal organizational information flows and structures; multiple strategies are often required to solve organizational information requirements; the quantity of information stored, required and reported should always be minimized; multiple points of view onto and about information systems solutions should always be considered; and general systems thinking principles are at the core of this alternate theoretical model.

THEORETICAL METHODOLOGICAL LIMITATIONS

Because traditional information systems development methodologies give a static picture of dynamic business there exists a methodological dilemma in traditional information systems development. The changing nature of the business world will always be out of step with a previous time snapshot of an information system. While Ewusi-Mensah(1997) believes that critical factors in IS failures (which are an industry wide problem) are: project goals, project team composition, project management and control, technical know-how, technological base or infrastructure, senior management involvement and escalating project costs & time of completion, it appears that there are many complex reasons why projects fail. Included amongst these reasons are: political, technical, human, organizational culture, organizational structure, outside intervention, over-reporting and monitoring, slavishly following methodological phases which are not aligned with the organization, fixed mindsets, clashes of personality in the development team, different perceptions of what is required of the development team (management and developers) and demotivation caused by different priorities between management and developers.

INFORMATION SYSTEMS DEVELOPMENT IN A DYNAMIC WORLD

The following basic premises are used in developing this alternate model: data should be stored as close to the point of origin with respect to time, requirement and location; reports should be produced on an "as needed" basis; cognizance is given to both formal and informal organizational information flows and structures; multiple strategies are often required to solve organizational information requirements; the quantity of information stored, required and reported should always be minimized; multiple points of view onto and about information systems solutions should always be considered; and general systems thinking principles are at the core of this alternate theoretical model.

Because information technology is essentially a service industry, it is important to remember that information systems professionals are performing tasks for others. No matter how much information technology professionals would like to control their own working destiny they must always produce what the client has requested. It is interesting to note that topics like: how to be of service to others; ego attachment to work output; and humbleness do not figure greatly in information technology education. Ego-attachment to creative development work can become a factor in resistance to the changing nature of organizational requirements.

Information systems projects have unstable information requirements. While Ewusi-Mensah(1997) describes "unstable information requirements" as contributing to information systems failure rate it is more appropriate to talk about the dynamic nature of business.

Rather than consider information systems projects as failures, perhaps consideration should be given to the following:

- (i) Are the goals & objectives too ambitious?
- (ii) Is it the static nature of information systems development versus the dynamic business environments?
- (iii) Is it the uncertainty of predicting requirements in an ever-changing world with the level of certainty deemed necessary in a scientific world?
- (iv) Is it that there is an ever-increasing information overload in organizations exacerbated by the speed with which things happen?
- (v) Is it the multitude of different mindsets involved in IS development and the belief that technical solutions rather than political, social or organizational solutions are required?
- (vi) While the capabilities of the IS project team are vital for success it is also important to remember that the IS development is for the organization.
- (vii) Are traditional lines of authority within organizations appropriate for information systems development?

Pinsonneault & Rivard(1998) suggest that breakdown in communication is an inherent property of traditional hierarchical organizational structures. There is always a restricted information flow down the hierarchy. This is regarded as a control measure within an organization. As people are promoted up the organization there is more likelihood of ego-attachment to positional power. Another control measure related to upper management is information hiding. Information systems development teams work best in an atmosphere of open communication, trust, minimal organizational reporting and relaxed controls.

THE DYNAMICS OF THE BUSINESS WORLD AND THE STATIC NATURE OF IS METHODOLOGIES

These dynamic times in which business operates are characterized by:

- (i) Accelerating technological change. Information technology is driving the changing structure of business. The global rise of electronic business is possible because of the Internet. Marketing, advertising, recruitment, the media, publicity, stock market trading and real estate auctions are but a few areas in which the shape of business has changed dramatically. Global markets for all businesses are now possible once they have a presence on the Internet.
- (ii) The sheer volume of globally available information is both a blessing and a curse. Ackoff(1971) suggested that too much information soon reverts to data. Organizationally we exist in a world with exploding information availability. Emerging from this explosion of information is an increased stress level in dealing with information overload. An interesting emergent property is a shortened attention span. As more

information floods in less time is spent in processing each new data item. The micro-time phenomenon is with us. While researchers in London have discovered that brain functioning can change with predominant mental activities (London taxi drivers who are required to memorize many routes, street names, places and locations have enlarged hypothalamus), information in the business world is pouring in much faster than most of us can handle at any one time. Strategies to deal with information overload are outlined in the model outlined below.

- (iii) As information pours in there is an exponential decay in the timeliness of available information. Decisions made may be based upon information that is out-of-date before it is processed. Information stored in ever-increasing databases and knowledge repositories may be of little use for today's decisions. Problems that emerge with current information systems are: how to store increasing volumes of information; how to access what is required in a timely fashion; and when to know the right set of information is available.
- (iv) Maintaining up-to-date knowledge repositories within organizations becomes a major issue. Traditional information systems designed to provide support at the operational level do little to support strategic decision-making. The emerging, evolving multiple solutions are surprisingly straightforward once traditional organizational control is relaxed in favor of self-organized teams re-forming to meet dynamic organizational needs;
- (v) The importance of capturing tacit knowledge is dominant in the minds of many organizational managers. Both technologically assisted and human resource solutions are being touted as the means of achieving access to tacit knowledge within existing organizational structures. Before tacit knowledge can be accessed and made available within an organization, the culture must change. Nobody in their right mind is going to release what they perceive to be their chunk of organizational power because they are the only person to have within their mind a piece of information vital to the success of the organization. If there is a lack of trust or fear that their employment might be dissolved then their tacit knowledge will never be disclosed. Ways of addressing organizational culture issues are addressed below.

COMPLEXITY THEORY TO THE FORE

Complexity theory applied to information systems development provides a more flexible-thinking framework in which to situate a different strategic information system model. Stacey(1996), Plsek, Lindberg, & Zimmerman (1997)and Lindberg(2000) have been in the forefront of examining the application of complexity theory to organizations. A logical extension of these ideas therefore is the application of complexity theory to strategic information systems. Fitness landscapes, strange attractors, shadow systems, complexity lens, multiple points of views, many paths to solutions and emerging evolving solutions have inform these ideas on aligning strategic information systems in dynamic times.

The information systems development methodologies (Avison & Fitzgerald, 1995) developed in the late 1960s, of which there are many, mostly follow a variation on a system life cycle. Underlying ideas are that the development of an information systems is a project, carried out in a limited time, according to a rigid plan, with multiple, highly structured phases or steps with built-in control mechanisms. This view of information systems development assumes a static picture of business requirements. This underlying assumption is the major problem in a traditional approach for strategic direction. Because businesses exist in a constantly changing global environment, it is no longer valid to consider an information system as a static picture of the information needs for the organization. Business requirements are changing far too fast. The end result has been that the reporting and querying capabilities of existing information systems provide very little input into strategic decision-making. In the model proposed below, coping with the pace of change is addressed conceptually, technologically and organizationally.

RETHINKING STRATEGIC ALIGNMENT FOR INFORMATION SYSTEMS

In this conceptual model the following points are addressed:

- (i) How to turn accelerating technological change into an advantage;
- (ii) Maintaining timeliness of information for decision making;
- (iii) Dealing with micro-time both technologically and socially;
- (iv) Extending human potential to keep pace with accelerating technological change;
- (v) Using the guiding principles of ecological and human protection and sustainability;
- (vi) Using general systems thinking principles to underpin the conceptual model; and

- (vii) Situating the conceptual model within the principles of complexity theory;

The following basic premises should underpin information systems development:

- (i) The importance of initial conditions for the IS development needs to be recognized. If social, political, technological and organizational conditions are not explored any one or any combination of factors from any point of view will stall a project. Once a project diverges from the correct path it is very difficult to get it back on track. No amount of money, political, professional or external consultancy can arrest an out-of-control IS project. The process of information systems work is complex, requiring a multiplicity of skills for successful implementation.
- (ii) Data should be stored as close as possible to the point of origin with respect to time, requirement and location. Direct accessibility is more likely to occur with locally available data. This availability may be virtual as well as physical.
- (iii) Reports should be produced on an “as needed” basis. If the principle of “good enough vision” (Plsek, Lindberg, & Zimmerman, 1997) is adopted then far-sight with local, pragmatic and immediate action serves best. Many hours of long-term strategic planning are not the right direction to take for dynamic times.
- (iv) Cognizance should be given to both formal and informal organizational information flows and structures. While we have fixed mindsets in rigid organizational structures there will always be “shadow systems” Stacey(1996). Rumors, rest room conversations, corridor conversations and lunchtime alliances will always happen. Those in the organization who are outside the fixed roles and who do not have access to organizational power still have ideas that can benefit. Without expressing these ideas or feeling that their ideas will not be received, human resources within an organization are not used adequately. Information systems developers require free access to the information flows in the informal system as well as the formal system within an organization if development is to keep pace of rapidly changing business needs.
- (v) Multiple strategies are often required to solve organizational information requirements. The days of the central information repository are gone. We are in the era of widely dispersed and distributed knowledge networks. In order to make the best use of the technological advantages of knowledge distribution, we must move from requiring simple solutions to organizational information requirements. Problem solving in the knowledge domain becomes initially a navigation task through a rich, intricately connected space. Expanded human potential is required to reflect and think critically in an integrated rational-intuitive mindset.
- (vi) The quantity of information stored, required and reported should always be minimized. Minimizing the size of information repositories minimizes the navigation task in the first instance and the integration task in the second instance. We also need to extend our human capacity to be at ease with uncertainty. No matter how much information we have at hand we will never know all the facts, certainly in the rational, logical domain. If we train ourselves to use and integrate our intuitive, emotional and spiritual selves we have a much richer source of information upon which to draw and one which is much more likely to set us upon an informed path of action.
- (vii) Multiple points of view onto and about information systems solutions should always be considered. There are many points of view in any decision making process. All stakeholders within an organization need to be considered. Unexpected emerging phenomena in organizations can be minimized even in uncertain times if multiple points of view are considered. There are existing tools and techniques within information systems development with which to achieve this (Checkland & Scholes, 1991).
- (viii) General systems thinking principles at the core of any conceptual model. General systems thinking principles guide, inform and underpin information systems development in complex spaces in a way that is not possible for scientific thought, engineering and managerialism. In being able to consider whole systems implications, emergence, the importance of structure and control, the importance of feedback at all stages moves us into modeling in complex spaces that is outside of the scope of previous modeling.
- (ix) All information systems should be designed and aligned to protect and sustain a fragile global environment. If we do not adopt this as a basic principle, everything else we do becomes pointless. There will be no earth planet in which all the very clever things we think we do will be.
- (x) All information systems should be designed and aligned to support social needs before profit and competition. Organizations are but collections of people after all. People not machines are an organization's most valuable resource. In a supportive environment in which open communication occurs at all levels and one in which an atmosphere of trust is nurtured, greater productivity will emerge.
- (xi) All information systems should support organizations that are self-organizing and adopt self-responsibility within all sectors of the organization. A balanced approach to directed leadership and self-organized teams

rather than an adherence to hierarchical managerialism may improve productivity and success in information systems development.

- (xii) IS projects are unique in that they require the intense collaboration of three groups (Ewusi-Mensah, 1997) of stakeholders: IS staff, users and management. Hence IS projects are group-oriented activities organized and executed in teams and therefore subject to all the vagaries of group dynamics, interactions, coordination and communication. The diverse backgrounds of team members make the ability to communicate and coordinate the activities of the group an extremely important issue if the team is to work successfully.
- (xiii) All information systems should be congruent with the dynamic nature of an organization. They should provide local solutions within a congruent fitness landscape while holding to global vision for the organization. In most organizations the information required to make major decisions does not exist within any organizational database or knowledge repository (Gurteen, 1998). Therefore there is a misalignment between the organizational IS and the business. While the information systems may have supported the business in previous times for a small part of the requirement for the organization, it does not serve the organization over the whole of the organizational landscape. There needs to be a closer fit of the information systems and business fitness landscapes.
- (xiv) Education for change, multiple mindsets and multiple points of view is required for this change in direction in aligning information systems to dynamic business requirements. While current information systems education emphasizes and attracts those who regard technical skills in the rational domain as most important, a wider view on the domain of knowledge and skills required needs to be considered. Providing information systems students with the opportunity to work in self-organizing teams in live situations in the business world provides a multiplicity of social, political and organizational situations when developing an information system. A diverse and rich domain thus enriches the learning experience.
- (xv) Organizational structures will change and the change process needs to be addressed and managed (Bridges, 1991). Instead of over-reacting to unexpected change, or to the rate of change, it is essential that all employees develop flexible mindsets to change. This is a gradual rather than a sudden process. Bridges suggests that there is a neutral zone between letting go of the old and experiencing the new and that there is always a need to celebrate endings and beginnings. In today's dynamic world endings and beginnings merge into a blur of continual and discontinuous change.
- (xvi) The importance of sophisticated navigation aids through complex knowledge spaces on distributed networks needs to be recognized, designed and implemented. The technical aspect of knowledge management becomes the ability to provide more effective search engines in distributed information spaces. There is great potential here for future directions for information technology research. It is here that technology can help the most and it is here that we can develop expertise to help in decision making in uncertain times.
- (xvii) Relaxing controls within traditional organizational structures in the face of rising self-responsibility. Without relaxing controls we will continue to struggle in chaotic times. This mind shift is paramount. If the major stakeholders in decision-making positions cannot make this shift then they need to be replaced.
- (xviii) Information systems projects tend to be conceptual in nature. Software is a product of the mind. Tacit knowledge within the team tends to be technical in IS professionals, political in users and management, organizational in management. Tacit knowledge takes on different flavors depending on organizational role. Tapping tacit knowledge is not a mechanical task nor can it be activated by throwing even more software tools at it. Tacit knowledge exists within people's heads. Tacit knowledge forms a major part of a person's skill, experience, power and role within an organization. Relinquishing this into a shared knowledge base is vastly threatening in today's tightly controlled organizational structures. Managerial control is exerted over all tasks completed and managers usually are not the technical experts. The only way information technology professionals can hold onto their power base is to protect their own tacit knowledge. Without changing the global organizational environment to one of open sharing and trust rather than protection, privacy and propriety products, tapping tacit knowledge will not happen.

FUTURE DIRECTIONS

In order for this conceptual model to be adopted by the business community the following changes will need to take place:

- (i) Long term strategic planning replaced by global flexible visions and local implementation of evolving information systems aligned with the global vision;

- (ii) Organisations will need to review internal structures and controls. For local solutions, distributed networks, widely available knowledge to provide appropriate information support, shared resources available to everyone within the organisation regardless of position is required;
- (iii) Organisational structures evolving into self-managed self-organising teams to solve local problems will require a shift in organisational culture from fixed roles within a hierarchy to flexible self-managed teams; and
- (iv) Organisational cultures encompassing shared knowledge repositories, creative teams.

CONCLUSION

In this paper an alternate theoretical model is proposed for strategically aligning information systems to the dynamic nature of business in times of accelerating change. Enough failed information systems projects are documented to realize that it is imperative to reconsider the theoretical underpinnings upon which information systems are modeled. An alternate theoretical model based on ideas arising from complexity theory, chaos theory, self-organizing systems, knowledge management and systems thinking is considered. The current information systems development trend to re-engineer existing systems using an object-oriented approach is challenged, as are most of the traditional structured systems development life cycle methodologies. The dilemma of modeling a static information system picture of dynamically changing business requirements is also considered. The following basic premises are used in developing this alternate model: data should be stored as close to the point of origin with respect to time, requirement and location; reports should be produced on an "as needed" basis; cognizance is given to both formal and informal organizational information flows and structures; multiple strategies are often required to solve organizational information requirements; the quantity of information stored, required and reported should always be minimized; multiple points of view onto and about information systems solutions should always be considered; and general systems thinking principles are at the core of this alternate theoretical model. Future research is required into flexible development of information systems aligned with dynamic business.

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