Alignment Between Crisis Management and IS Strategies: Performance Implication for Crisis Response

Peter Otto
Management Information Systems
Dowling College, Okadale, New York 11769
ottop@dowling.edu

Salvatore Belardo
Management Information Systems
University at Albany, New York 12222
s.belardo@albany.edu

ABSTRACT

The objective of this paper is to develop a means of examining the performance implications of alignment between IS strategy and crisis management strategy. Even with crisis management plans in place, organizations face numerous challenges in their effort to ensure that an initiating event, does not become a disaster, and if it does that response and recovery efforts will be conducted in ways that ameliorate its impact. We contend that by aligning IS strategy with crisis management strategy an organization can improve considerably its ability to plan for and mitigate the affects of a crisis. In this paper we present a system dynamics model in an effort to help us better understand the relationships among factors shown to be important in crisis decision making (i.e., stress, information overload and decision quality).

Le but de ce dossier est de concevoir un moyen d'analyser les implications sur le fonctionnement de l'alignement de la stratégie IS et de celle de gestion des crises. Même lorsqu'il existe des plans de gestion des crises, les entreprises sont confrontées à de nombreux défis dans leurs efforts visant à éviter qu'un simple événement ne se transforme en désastre. Et si c'est le cas, elles doivent assurer que la réaction et les efforts de rétablissement soient menés de sorte à améliorer leurs effets. Nous affirmons qu'en alignant la stratégie IS sur la stratégie de gestion des crises, une entreprise peut considérablement améliorer sa capacité à planifier et à atténuer les conséquences d'une crise. Dans ce dossier, nous présentons un modèle de système dynamique visant à vous aider à mieux appréhender les relations entre les facteurs indiqués comme étant importants lors de la prise de décisions en cas de crise (le stress, l'excès d'informations et la qualité des décisions).

INTRODUCTION

In today's complex, fast paced business environment, crises can occur at any time. These events invariably cause major problems (i.e. losing control over operations, increased stress levels for management, fears of job losses, etc.) for those organizations affected. In order to prevent or at least control crises, organizations need to develop and have in place effective crisis management plans. While the process of developing crisis management plans can help us gain a better understanding of how crises might impact the organization as well as a better understanding of how to respond to crises most plans do not capture the dynamic interactions among factors that affect crisis recovery. Nor do the plans take into consideration the potential performance improvements that might result from aligning IS strategy with crisis management strategy.

Just as aligning IS strategy with business strategy has been shown to improve organizational performance, (cf. Camillus and Lederer 1985; Chan et al. 1997; King and Teo 1997; Reich and Benbasat 1996; Segars and Grove 1989) we contend that aligning IS strategy with crisis management strategy should improve considerably our ability to better plan for and mitigate the affects of a crisis. In order to test whether alignment improves performance and also to help us better understand the impact of the interrelationships among certain factors (e.g., information overload, stress, etc.) we have developed a system dynamics model.

Crisis Management

A crisis is characterized by extreme threats to important assets, intense time pressure, high stress, and the need for rapid, yet careful decision making (Billings 1980). Business crises are broadly defined as turning points in which a situation of impending danger to the organization runs the risk of escalating in intensity, inferring with the normal operations of the business, jeopardizing the organization’s public image, and damaging the organization’s financial performance (Mitroff 1984; Fink 1986; Lerbinger 1986).

Unfortunately, crises do not resolve themselves. They can only be resolved when appropriate policies and plans are in place and when these plans are properly implemented. Key to an organization’s successful management of a crisis is a framework that can help the organization deal with problems that accompany all crises—problems that include, for example, information overload and stress. Brynjolfsson (2002) defines information overload as a function of the processing capabilities of individuals, the procedures designed to address a problem and the supporting network configuration of the organization. Stress, it has been shown, can lead to a narrowing of cognitive processes that in turn can result in adaptive behavior which along with information overload can adversely affect decision making quality (Belardo, Karwan and Wallace 1984).

The literature is replete with crisis management approaches that provide ways of helping organizations resolve crises. While some of the existing conceptual crises frameworks (cf. Martin 1977; Smart and Vertinsky 1997; Rudolp and Repenning 2002) capture the effect of information overload and stress on decision-making, other models (cf. Pearson and Mitroff 1993) are less explicit. Nunamaker at al. (1989) provides a framework for a crisis management environment, in which they identify essential activities and integrate them with computer- and communications-based processes. Hale (1997) extended this framework by adding a prescriptive architecture for crisis response systems.

It is suggested that IS strategy is directly concerned with business applications, and that therefore IS strategy should be aligned with the business strategy (cf. King 1978; Das et al. 1991; Zviran 1990). Thus, it is implicitly believed that alignment between business and IS strategies helps enhance performance (Sabherwal and Chan 2001). This echoes an earlier argument from Henderson and Venkatraman (1992) that effective management of IS strategy requires alignment of a complex set of choices reflecting both strategic and functional perspectives. The key issue which this study addresses is whether alignment between IS strategy and crisis management strategy can facilitate more effective responses to organizational crises.

FRAMEWORK

Crisis management is a complex and challenging field and unfortunately most of the associated research lacks statistical rigor. As Horlick-Jones et al. (1991) conclude:

> *"Evidence for the significance of disaster clusters is difficult to find. This problem stems from the high consequence – low probability nature of disasters. As a result limited amounts of data exist such that interpretation of data is by nature incomplete, prone to error and influenced by subjective factors".*

Faced with such a problem simulation offers a way to examine more data and more scenarios and more readily test various policy decisions. Pearson and Mitroff (1993) provide a comprehensive framework for crisis management that explains how organizations may actually contribute to their own crises. Their framework provides recommendations concerning what can be done to avert human-induced disasters, and it provides guidance to manage those that still occur. As shown in the top portion of Figure 1, we use Pearson and Mitroff's well established framework to capture the attributes in crisis management.

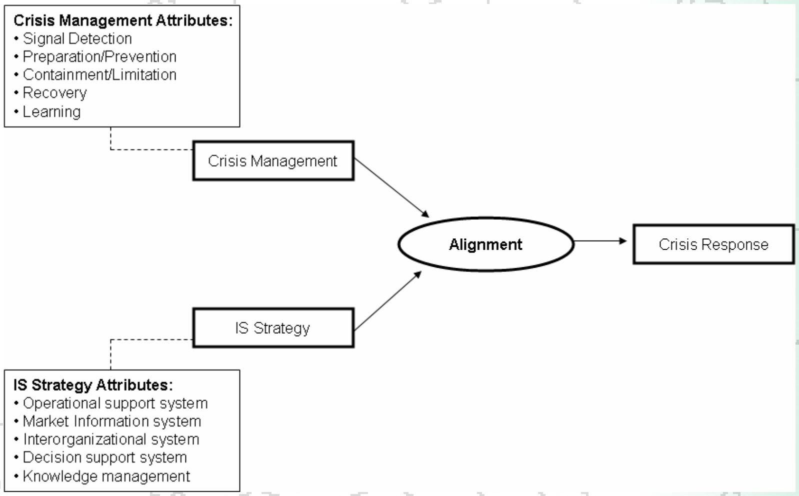


Figure 1: Alignment Framework, adapted from Sabherwal and Chan (2001)

The IS Strategy attributes in the lower portion of Figure 1 reflect the traditional classification of information systems as described in the original model of Sabherwal and Chan. However, in addition to Sabherwal and Chan's IS strategy attribute classification we add the dimension of knowledge management, which we contend is an important attribute that needs to be considered because of our increased awareness of the role of knowledge in decision making and especially because it helps address the learning dimension contained in Pearson and Mitroff's framework.

Alignment can have a substantial impact of an organization's performance; Johnston et al. (1988) and Wiesman (1988) suggest that organizations with greater alignment between business strategy and IS strategy are also more likely to utilize IS for a competitive advantage. However, with the best systems in place, even those aligned with a crisis management strategy, some crises will inevitably occur. Thus, the intent of alignment between IS strategy and crisis management strategy is to limit the effect of a crisis.

Research Proposition

As described in the prior sections, the objective of this paper is to evaluate crisis response performance implications when the IS strategy of an organization is aligned with its crisis management strategy. To test our thesis that better alignment will lead to better performance we have established the following two propositions which address two important process measures of performance critical to successful crisis management — time to respond to a crisis and improvement in information processing capabilities

Proposition 1. The degree of alignment between IS strategy and crisis management strategy determines the response time to single event crisis.

Proposition 2. To adequately support crisis response, organizations must be able to acquire information and process that information with appropriate computer and communication technology.

These propositions will be examined using a system dynamics approach. Substantive interpretation of testing the alignment policies with the simulation model will be discussed. In the next section we provide a more detailed description of the methodological approach.

CAUSAL FEEDBACK VIEW

The causal loop diagram, shown in figure 2, builds upon Pearson and Mitroff's five phase crisis management framework and links the functional dimensions of an IS strategy. In our model we add "stress" as an important variable that determines the quality of decision making as well as the capacity to collect information sources.

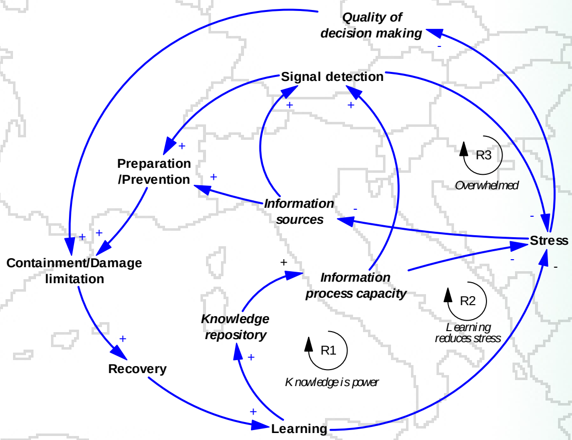


Figure 2: Causal Loop Diagram of a Crisis-Management Environment

We operationalize the variable "stress level" following Milburn's (1972) suggestion that stress has a curvilinear effect on individual performance. While a moderate stress level may be conductive to good decision making, high stress levels lead to a breakdown in perceptual accuracy and reduced ability to focus on relevant information from the environment. The feedback loops are easily discerned. For example, "R1" (a reinforcing loop) suggests that adding tacit or explicit knowledge to the repository increases the information process capacity, which improves the signal detection rate and subsequently the level of preparation, damage limitation and recovery rate.

The variables in *italics* capture the major functional IS strategy dimensions. For example, knowledge repository represents knowledge management capacity, and information sources represents, in aggregate, a system that collects and analyzes information cues (e.g. market information systems, inter-organizational- and decision support systems). While the functional dimension of IS strategy attributes is highly aggregated, we contend that aligning those dimensions with crisis management attributes will facilitate learning and as a result continuous improvement that allows an organization to achieve better response to the effects of a crisis event when one does occur. The causal feedback loop diagram shown in figure 2 is the basis for the simulation model, which we present in the next section.

MODEL STRUCTURE

One of the structural elements in our model is based upon the theory of interruptions described by Rudolph and Repenning (2002). Their theory is based upon Mandler's (1982) notion of a crisis as the result of interruptions to ongoing activities caused by any unanticipated event, external to the individual that temporarily or permanently prevents completion of some organized action, thought sequences, or plan.

Our model is based on a number of assumptions. We assume that during a crisis people in organizations are faced with a continual stream of information or signals that they are able to process until the arrival rate of signals reaches a certain level. At this point the decision maker is confronted with a situation of information overload that often results in stress. To capture the idea of information processing capabilities, we define an individual's normal processing rate as the number of information units per day.

Figure 3 captures the process of signal arrival (inflow), accumulation (signals to be processed) and dissipation (signal process rate). The diagram represents a stock and flow structure in which flow variables are signified as "pipes" with "valves" (Sterman 2000). Incoming signals, is represented as a flow variable (signal arrival rate) that is not processed instantaneously but, instead accumulates in the stock of signals to be processed. Thus the stock represents the number or amount of signal units that arrived but have not been processed.

$$\text{Signals to be processed } (t) = \int_{t}^{0} [\text{Signal arrival rate (s)} - \text{Signal process rate (s)}]\, ds + \text{Signals to be processed } (t_0)$$

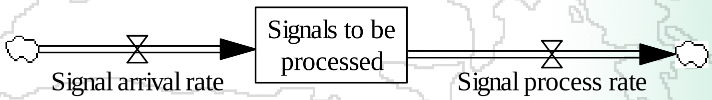


Figure 3: Stock and flow structure of signals to be processed

The stock of signals to be processed is then reduced by the outflow process rate, which is determined by the maximum processing rate. To define the signal arrival rate, we use an arbitrarily value, representing the incoming signal units per day. Because this variable cannot be constant, we account for variance in the number of incoming signal units in the form of a random uniform distribution (minimum value: 9; maximum value: 11; seed: 0.2).

Under normal conditions, the signal process rate is equal to the arrival rate of incoming signals. Under these conditions an individual is capable of resolving the accumulation of signal units to be processed. When the number of incoming signal units is higher than the maximum signal processing capacity we have a backlog of unprocessed signals, causing information signal overload, which, as suggested in our causal loop diagram (see figure 2) increases the level of stress.

If the inflow of signals is higher than the processing ability, the stress level begins to rise and the quality of signal detection declines, which results in a time lag to resolve a crisis. To simulate the effect of stress on the quality of signal detection, we use Rudolph and Repenning's (2002) conceptual linkage between the stress created by a large stock of unprocessed information and the process rate. Yerkes-Dodson's law, which posits an inverted U-shaped relationship, between stress and performance on moderate to difficult tasks (Miller 1978; Mandler 1984; Fisher 1986) is used to identify the tipping point.

Reference Mode

Because we have no empirical data to calibrate our model, we use a reference mode to replicate the expected behavior of a single event crisis. The graph in figure 5 depicts the potential behavior of a single crisis event resulting from active response, based on Ren's (2000) observation.

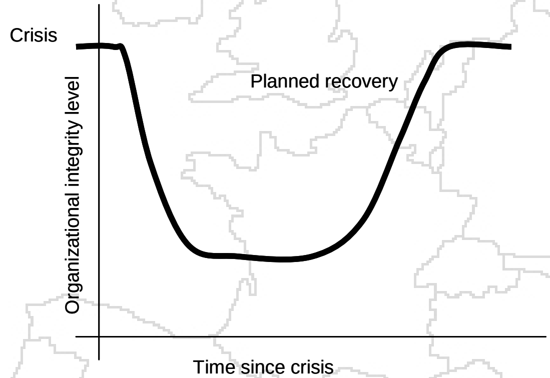
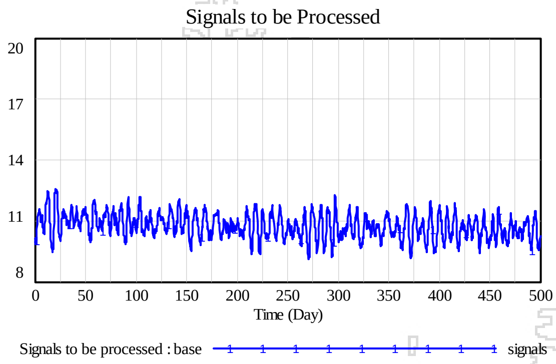


Figure 5: Reference Mode for Crisis Recovery Adapted from Ren (2000)

The parameter "organizational integrity level" is used as a multidimensional attribute to capture the disruptive character of a crisis for an organization. When a crisis hits an organization, it typically creates widespread fear threatening financial losses, loss of jobs, and disrupts daily societal activities (Ren 2000). Thus, an organization goes through a cycle of losing its organizational integrity level when a crisis occurs and over time bounces back to a new equilibrium level. The time for recovery is based on the organization's ability to respond and the nature of a crisis.

SIMULATION OF ORGANIZATIONAL RECOVERY

The graph in figure 6a shows the stock of incoming signals in our simulation model. As previously stated, the number of incoming signal units is simulated with a random uniform distribution value (minimum value: 9; maximum value: 11; seed: 0.2), which results in the oscillations as shown in figure 6a. We assume in our model that the strengths of the signal units do not change, only by adding randomness do we change the number of incoming signals per day. In the real world, signal strength would also be an influential factor that determines the signal process rate.



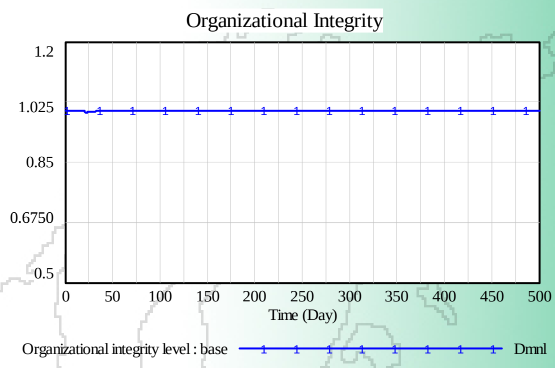


Figure 6a & b: Behavior of the System under Base Conditions

The base condition in our simulation shows that the organization is able to process the stock of signals to be processed with the available processing abilities (as shown in figure 6b). Thus, the organizational integrity remains in a stable equilibrium. The equilibrium level for the parameter "organizational integrity" in the simulation model is also an arbitrarily chosen value.

Dynamics in Single Event Crisis

Pearson and Mitroff (1993) as well as Cook (2003) emphasize learning as a mean to help reduce the risk of organizational breakdown in times of crises. In both models, learning feeds back into the signal detection stage, though Cook uses the term "quality of incident investigations", which we contend is synonymous with improving an organization's ability to analyze information when crises occur.

Using an appropriate IS strategy will facilitate learning by providing access to information in a timely manner. Thus, it is suggested that an effective incident learning system can help an organization to reduce the severity of incidents over time. In aligning a knowledge management system to the crisis management strategy, on top of an incident learning system, we contend that an organization can recover faster from a single event crisis. In the following experiment, we increase the number of incoming signals by 30 percent over a time of 30 days, simulating the effect of an organizational single event crisis.

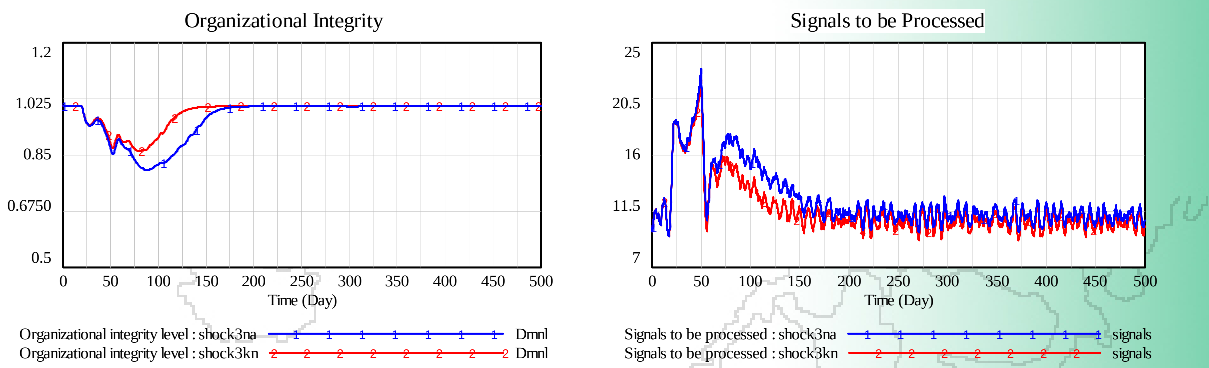


Figure 7 a & b: Comparing Recovery in Single Event Crisis

Figure 7a shows a comparison of recovery rates. Line 1 depicts the recovery rate or organizational integrity when computer- and communications-based processes designed to support crisis management are in place. Line 2 shows the recovery rate when knowledge management is aligned with a crisis management strategy. Aligning a knowledge management system with a crisis management strategy provides an organization with a repository of tacit and explicit knowledge.

As can be seen in figure 7b, the number of signals to be processed increases suddenly at t=20 and then stops at t=50. When we align a knowledge management system with a crisis management system (line 2 in figure 7b) we increase the signal detection rate.

Dynamics in Multiple Crises

In the second experiment, we simulate the effect from multiple crises under changing alignment policies.

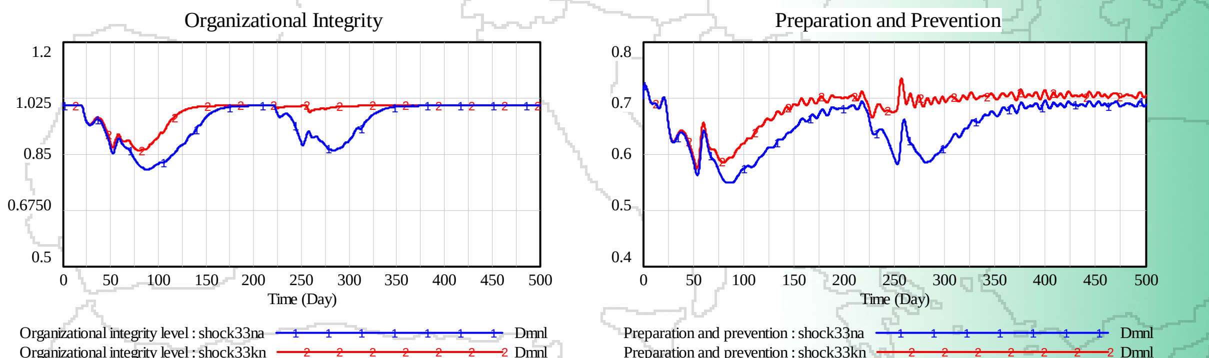


Figure 8 a & b: Comparing Effects in Multiple Crises

As can be seen in figures 8 a & b we have increased the number of incoming signals by 30 percent over a time of 30 days, but in this case over two cycles to simulate the effect of multiple crises. Line 1 in figures 8 a & b shows how organizational behavior changes when computer- and communications-based processes are in place. Line 2 on the other hand, shows the performance implications when a knowledge management system is added and aligned with the crisis management strategy. The results from this experiment suggest that an organization with an effective incident learning system is able to enhance its ability to recovery from a crisis over time. Line 2 suggests that when a knowledge management system is aligned with a crisis management strategy only a minor disruption of the organizational integrity level in a multiple crisis situation results.

Insights from Exercising the Model

The model was exercised to simulate the organizational recovery in the event of single and multiple crises when IS strategy is aligned with a crisis management strategy. Many factors, internal as well as external, may determine a crisis recovery. Given adequate resources and management skill, an organization can successfully respond to crises. While these responses and subsequently crisis recovery can vary across an organization, we focus on only a few performance implications of the alignment between crisis management strategies and IS strategy.

The results from the experiments suggest that the degree of alignment between IS strategy and crisis management strategy improves the organizational recovery after a crisis. First, if an IS strategy is in place to support learning as a process of continuous improvement, it allows an organization to recover faster, by reducing the stress levels and improving preparation and prevention. Second, if knowledge management is aligned, an organization is able to establish a knowledge repository of ‘lessons learned’ during organizational crisis, which will help to improve recovery in the future.

DISCUSSION

The model described in this paper is intended to help us evaluate performance implications of the alignment between crises and theory-based IS strategy. By aligning Pearson and Mitroff’s framework for crisis management with well established IS strategy attributes, we present a means of explaining the effect of alignment on the recovery rate for an organization during single and multiple event crises. Even though the model discussed in this paper is highly aggregated, the results suggest that alignment affects the recovery time in single event crises and the level of organizational integrity in multiple crises events. A faster recovery during a crisis event can have substantial financial implications for an organizations, thus the theory discussed in this paper is applicable to improve decision-making for crisis management.

REFERENCES

Belardo, S., Karwan, K.R., and Wallace, W.A. 1984. Managing the Responses to Disasters Using Computers, Interfaces, Volume 14, No. 2

Billings, R. S., Milburn, T.W., and Schaalman, M.L. 1980. A Model of Crisis Perception: A Theoretical and Empirical Analysis. Administrative Science Quarterly, Volume 25(June): pp. 300-316.

Brynjolfsson, E. (2002). Organizational Capital. MIT. Boston, MA.

Camillus, J. C., A.L. Lederer (1985). "Corporate Strategy and the design of computerized information systems." Sloan Management Review **26**(3): 35-42.

Chan, Y. E., S.L. Huff, D.G. Copeland, D.W. Barclay (1997). "Business strategy, information systems strategy, and strategic alignment." Information Systems Research **8**(2): 125-150.

Cooke, D. L. (2003). Learning from Incidents. 21st International Conference of the System Dynamics Society, New York, USA.

Das, S. R., S.A. Zahra, M.E. Warkentin (1991). "Integrating the content and process of strategic MIS planning with competitive strategy." Decision Science **22**: 953-984.

Fink, S. (1986). "Crisis Management: Planning for the Inevitable." American Management Association.

Fisher, S. (1986). Stress and Strategy. London, Lawrence Erlbaum.

Goodman, M. R. (1989). Study Notes in System Dynamics. New York, USA, Productive Press.

Hale, J. (1997). "A Layered Communication Architecture for the Support of Crisis Response." Journal of Management Information Systems **14**(1): 235-255.

Henderson, J. C., N. Venkatraman (1992). Strategic alignment: A model for organizational transformation through information technology. Transforming Organizations. T. A. K. a. M. Useem. Oxford, Oxford University Press.

Horlick-Jones, T., J. Fortune, G. Peters (1991). "Measuring Disaster Trends Part Two: Statistics and Underlying Processes." Disaster Management **Vol. 4**(No. 1): 41-4.

Johnston, H. R., S.R. Carrico (1988). "Developing capabilities to use information strategically." MIS Quarterly **12**(1): 37-48.

King, W. R. (1978). "Strategic planning for management information systems." MIS Quarterly **2**(1): 27-37.

King, W. R., T.S.H. Teo (1997). "Integration between business planning and information systems planning: Validating a stage hypothesis." Decision Science **28**(2): 279-308.

Lerbinger, O. (1986). Managing Corporate Crises: Strategies for Executives. Boston, Massachusetts, Barrington Press.

Mandler, G. (1982). Stress and the Thought Processes. New York, Free Press.

Martin, L., Ed. (1977). Decision Making under Stress. Ashgate, Aldershot.

Milburn, T. W. (1972). The management of crisis. New York, Free Press.

Miller, J. G. (1978). Living Systems. New York, McGraw-Hill.

Mitroff, I., R. Kilmann (1984). Corporate Tragedies: Product Tamperings, Sabotage, and Other Catastrophes. New York, Praeger Publishing.

Nunamaker, J. F., E.S. Weber, C. Minder (1989). "Organizational Crisis Management Systems: Planning for Intelligent Action." Journal of Management Information Systems **5**(4): 7-32.

Pearson, C. M., I.I. Mitroff (1993). "From crisis pron to crisis prepared: a framework for crisis management." Academy of Management Executive **Vol. 7**(No. 1): 48 - 59.

Ren, C. H. (2000). "Understanding and managing the dynamics of linked crisis events." Disaster and Prevention Management **Vol. 9**(No. 1).

Richardson, G. P. (1996). System Dynamics: Simulation for Policy Analysis from a Feedback Perspective. Modeling for Management 1: Simulation in Support of System Thinking. G. P. Richardson. Alderhot, UK, Dartmouth.

Rudolp, J. W., N.P. Repenning (2002). "Disaster Dynamics: Understanding the Role of Quantity in Organizational Collapse." Administrative Science Quarterly **47**(March): 1-30.

Sabherwal R., Y. E. C. (2001). "Alignment Between Business and IS Strategies: A Study of Prospectors, Analysers, and Defenders." Information Systems Research **12**(1): 11-33.

Segars, A., V. Grover (1998). "Strategic information systems planning success: An investigation of the construct and its measurement." MIS Quarterly **22**(2): 139-163.

Smart, C., I. Vertinsky (1997). "Designs for Crisis Decision Units." Administrative Science Quarterly **22**(December): pp 640-657.

Sterman, J. D. (2000). Business Dynamics: System Thinking and Modeling for a Complex World., Irwin McGraw-Hill.

Wiesman, C. (1988). Strategic Information Systems. Homewodd, IL, Irwin.

Zviran, M. (1990). "Relationships between organizational and information systems objectives: some empirical evidences." Journal of Management Information Systems **7**(1): 65-84.