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An Historical Analysis of Continual Change

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Abstract
We use a systemic process model of continual change to examine patterns of continuity and discontinuity in the policy processing systems of four auto insurance companies. The model draws on theories of deep structure, inertia and punctuated equilibrium. It demonstrates how variation across the units of an organization resulting from diversity in local competitive environments, coupled with continual changes, creates emergent and dynamic patterns of influence at the unit and organizational system level that complicate the innovation diffusion process. Field research using historical methods for data collection enabled us to trace the development of each organizationâ s primary processing system back to its beginnings and provided substantive support for the oscillations that organizations face as they struggle with the tension between the need to innovate and the complexity that results. The model provides a sensitizing lens that reveals the tensions between the need to differentiate products to address local competitive needs and the role of standards, which enable units to more easily share existing processes and to adopt wholesale system changes en mass.

Keywords: Implementation, Change, System Thinking, Historical Analysis

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Introduction

To date, most implementation studies have examined the success of an information system by its acceptance and use at its completion. But if systems are to be utilized as sustainable resources that support the development and delivery of future products and services, then researchers must extend their research to include capabilities for future enhancements.

We develop a process model to describe change as it unfolds in systems over time. We view change as a continual occurrence in systems, planned by organizations or improvised by individuals and sometimes resulting from the unexpected consequences of one or both. Cumulative changes define current conditions and the requirements for and constraints inhibiting future change.

We begin by describing the theoretical underpinnings of our model. Then we describe the model itself and the historical field study. Next, we describe our findings and finally, we discuss their implications for researchers and managers.

Theoretical Background

Inertia results when adaptation and refinement of processes and procedures, used to further the exploitation of current strategy, reduce an organization's ability to change in non-continuous ways. Deep structures (Gersick 1991) arise from the interrelationship of components of a system[1] and the way they work together to maintain organization consistency (Tushman and Romanelli 1985). Over time, a system will move toward stability for two reasons. First, each choice made during a system's implementation and evolution will limit the realm of possible choices for its future. Second, the patterns of activity that take place within the system's deep structures reinforce that course. Occasionally, organizations will be forced to make discontinuous changes as the buildup of inertia reduces their ability to execute incrementally.

The theory of punctuated equilibrium (Tushman and Romanelli 1985) combines inertia and discontinuous change. It rejects the notion that systems of the same type must follow the same patterns or stages of development[2]. Rather, conflicting theories of adaptation and rigidity might both be applicable to the same system at different times. The organizing principles of a system change during its life cycle, so no one universal motivating driver can be used to explain its evolutionary progress. Punctuated equilibrium enables the identification of common categories of choices and the identification of a system's state, but it also allows for infinite variety in the way that events occur in individual systems.

Variation also plays a role in the evolution of systems that support multiple business units. It is conceptualized as a systemic attribute of systems, resulting from the differing responses of business units to their individual environments. As units seek to enhance their

[1] System refers to the relations among the attributes of entities that achieve a particular output. It is not limited to information technology.

[2] E.g., Lewin's (1951) freeze, change and refreeze Ginzberg's (1981) adaptation of the Kolb and Frohman (1970) model and Rogers (1995) evaluation, adoption and implementation.

degree of fit with their environments, their products, services, processes and routines come to vary widely in design and execution. These variations contribute to the performance of individual units and therefore, to the organization's performance overall.

To accommodate punctuated equilibrium and variation and to understand the nature of continual change, we need a model that is neither linear nor rigid. We need to represent how an organization would change as a system is implemented across multiple units. We also need to show what would happen when a major revision is carried out, and a second, and a third.

Cause and effect relationships are often disguised by the passage of time and the continual nature of change. By using a cause map to illustrate change, we uncover those relationships and demonstrate the development and destruction of deep structure during periods of evolutionary and revolutionary change in organizations. Cause maps reveal the results of repeated patterns of interaction through feedback loops. They show the iterative and cyclical relationships that affect system components, even when they are separated by the passage of time and intervening events, and even if some of the effects do not become apparent until multiple iterations occur. Analysis of systemic structures reveals the root causes for their behavior (Senge, 1990).

The Continual Change Model

The process of implementing an information system across an organization results in its adaptation to meet the needs of the business units that use it (Barley 1986). Even after implementation is complete, people will continue to refine their practices as they learn to solve problems with the new technology and processes (Orlikowski 1996). Implementations in individual units differ because of unique interpretations of requirements (Cooper and Zmud 1990), varying environmental factors (George and King 1991), and the idiosyncrasies of the units themselves. Variation is the accumulated result of different units adapting the fit of their system to the requirements of their regulatory or competitive environments. Hence, the greater the number of units, the more variation across the organization. Increased levels of variation resulting from the adaptation of an innovation across units of an organization yield better performance, at least in the short term.

Over time, however, variation has inertial affects. As a new system becomes the resource into which future innovations must be incorporated, adaptations made to a system's design during one implementation will influence the degree of change necessary to implement subsequent innovations. Therefore, increased levels of variation across units decrease the ease with which future change can be carried out. Reciprocally, reduction in variation facilitates an increase in the magnitude of the next change. An oscillation between easier and more difficult changes is the inevitable result.

Figure 1 portrays how the relationships among performance, perceived need for change and the ease with which change can occur are all influenced by the level of variation across the units in a system. The magnitude of any future change will be dependent on the level of influence of both the perceived need for change and the ease with which changes can be made. The level of variation in the system as measured across the units of the organization will be influenced by the magnitude of the change, since it will determine the number and breadth of opportunities the units have for variation. Opportunities for variation will emerge during implementation of an innovation into a unit of the organization, so the greater the number of

units, the greater the potential for variation. Since the magnitude of each change implemented in the system will vary, the occurrence of any single evolutionary iteration may or may not result in a significant level of influence over other components of the system. However, the systemic causal relations between evolutionary change and subsequent variation will eventually influence decisions to adopt new products and services through the perception of need and the ability to change. Eventually, the need for change to accommodate internal or external forces may require a revolutionary change to alter the organization's deep structures in a way that will reduce variation in the short term and facilitate future change.

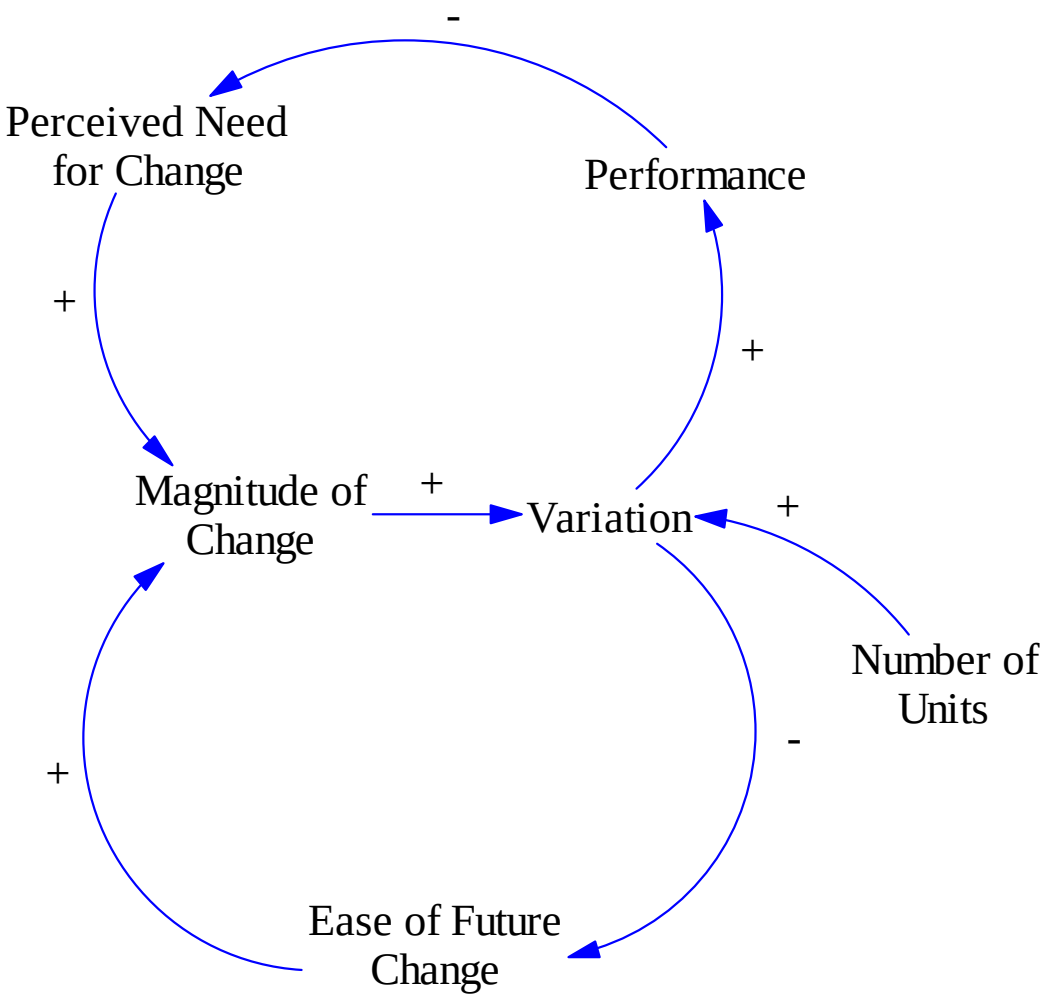

Figure 1. Model of Continual Change.

The model contains competing loops that oscillate according to the strength of opposing influences. For instance, if a significant new product were diffused across many units within an organization, a great degree of variation in the systems that support that product would be expected. The variation would positively influence performance and negatively influence the

ability to make changes in the future. With increased performance, there is less perceived need for change. This, coupled with a decreased ability to change, should reduce the magnitude of future change. Over time, however, the lack of innovation within the organization will result in poorer performance and an increase in the perceived need for innovation. Because of the inertia resulting from previous variation and change, eventually a discontinuous change will be required. This discontinuity will create a large correction that reduces variation and increases the organization's subsequent ability to change (Gallagher and Vandenbosch 2000).

Research Methods

We employed interpretive field research (Klein and Myers 1999) using historical methods for data collection (Mason, et al 1997) to examine the evolution of systems in four multi-unit organizations. To do so, we traced the development of each organization's primary processing system back to its beginnings, thereby allowing for a sufficient passage of time to establish the origin of path dependencies (Mason, et al, 1997). Historical methods provide a rich backdrop for the circumstances in which organizations operate and decisions are made. As an idiographic research methodology, history stresses the uniqueness of an organizational setting. Historical analysis also lends itself to the application of nomothetic methods as a way to frame and compare the causal nature of events. These methods offer the ability to evaluate evolutionary models by observing patterns of events (Kieser 1994).

We followed the seven-step process for historical analysis outlined by Mason, et al (1997) for gathering and evaluating the evidence. First we developed a timeline. Primary sources included forty-nine interviews with current and past employees and archival documentation. All interviews were taped and transcribed for subsequent analysis. Secondary sources included industry news, annual reports and published case studies of the organizations. All data were collected in the first half of 2001. Next, events were verified through further interviews and document collection. Finally, patterns were analyzed to evaluate how events produced effects leading to subsequent events.

The study examined a single industry to ensure environmental control. Auto insurance provided ideal industry characteristics. Because it is regulated at the state level in the U.S., it offers an industry whose products are sold across multiple units with a variety of information requirements and product design limitations. Companies can pick and choose states in which to compete, altering the complexity of the regulatory issues and mix of competitors.

Cases were selected to demonstrate predictability with similar or contrary results (Yin 1988). Since the model theorizes that the number of business units contributes to variation, companies with national and regional presence were both selected. Companies were also chosen according to the historical origin of their product: standard or non-standard. Standard underwriting uses information about an insured as a gate-keeping method, allowing for the remaining risks to be priced using a simplified and standardized set of variables. Non-standard companies choose to accept customers regardless of risk, but price them appropriately in order to insure profitability. Such differences have implications for data collection, underwriting, pricing and perceptions regarding the need for change. Four organizations enabled us to examine each situation (Table 1) and are generally considered adequate for achieving theoretical saturation (Eisenhardt 1989).

	Regional reach	National reach
Standard insurance	Alpha	Omega
Non-standard insurance	Beta	Delta

Table 1. Case study organizations

The Companies

Alpha

Alpha is the most conservative of the four carriers and competes in the fewest number of states. Marketing its products only in Midwest states through a network of captive agents has helped Alpha carry out a product strategy based on consistency and an approach to system design that emphasizes uniformity and standards. To achieve adequate market share in these states, Alpha expanded its products to include non-standard auto in the 1980s. Just recently, the company broke with tradition by aggressively expand its geographic scope and updating its product designs. The company now finds that their ability to deliver new products and services as fast as it would like has become constrained by the current design of its processing systems, although it currently has no plans to replace it.

Beta

In contrast, Beta began as a non-standard company and quickly expanded its geographic scope. Initially the company expanded into twelve states, selling through independent agents. It then merged with another small non-standard carrier that had grown in a similar fashion, except this company also sold direct to customers through retail stores and call centers. In contrast to Alpha's focus on developing a strong market share in a few states, Beta, as a non-standard niche player, needed to expand across more states in order to grow in terms of total written premium.

Beta has attempted to keep pace with most of the new product innovations that have emerged in the last fifteen years. It has remained strictly in the non-standard market. The company has periodically had to replace parts of its computerized systems in order to restructure its design, thereby regaining some flexibility lost during the rapid succession of cumulative changes that accompanied its expansions. Today, the company is again facing serious constraints to its ability to accommodate change to its processing systems. It hopes to replicate past success, Beta is once again replacing major portions of its policy processing system.

Delta

Delta also began with a non-standard product. But, unlike Beta, Delta has long competed nationally and has recently expanded its offerings to include a standard product. For Delta, continual innovation has resulted in many product changes and much success, but it has also created the need to frequently reengineer and replace parts of its policy systems. The changes in product have also accompanied changes in marketing and service design as the company has expanded into different delivery channels, now selling direct through call centers and on-line, in addition to existing networks of independent agents and strategic partners.

Omega

Omega also competes nationally, but its mission until recently was primarily to support its captive life agents with a complimentary auto product. Omega has not expanded the scope of

its product design beyond standard underwriting until just last year. The product has changed very little, mostly due to Omega's indifference to product line and its inability to invest in information technology. In recent years, a change in management brought about a turnaround effort at Omega. The company rapidly expanded the number of channels used to distribute its products and moved quickly to develop a more competitive product. To date, the aging and increasingly inert processing systems have inhibited the organization's ability to implement its new products and services. Hence, Omega has begun the process of replacing its policy system.

Data Analysis

Table 2 and Figure 2 both show the timelines of change for each organization. The timelines in Table 2 document the change events. Figure 2 delineates periods of incremental and discontinuous movements in the trajectory of each system's evolution. Incremental events include expansion or enhancement of the system's functionality through more automation. Discontinuous events mark changes that replaced, reengineered or redesigned existing parts of a system. Both incremental and discontinuous changes accompany changes to the company's operations, but with few exceptions, discontinuities became necessary in order to support changes to products or services. In each case, the existing system had become too inflexible to accommodate the desired change.

These classifications of events differ significantly by the level of effort required both technologically and organizationally, as in discontinuous changes existing data and work processes must be transformed. They also differ in terms of cost and the degree of risk; therefore discontinuous change efforts are justifiably avoided by management. Figure 2 documents similar patterns of oscillation among the organizations, yet strikingly different degrees to which discontinuous changes were undertaken.

While each of these organizations must continually make changes to its product designs to accommodate the evolving nature of regulatory rules, industry competition and information technology, they experienced very different degrees of discontinuity over the last two decades. To analyze the patterns and test the ability of the model to explain the differing patterns of change and their trajectories, we first compare the evolution of the systems based on the nature of their products. Then we compare them based on the number of units they support.

Year	Alpha	Beta	Delta	Omega
1980	Original policy systems		Original policy system	Original policy system
1981				
1982			*System reconfigured into four virtual regions – enables growth*	
1983				*Agent reporting system – provides activity analysis*
1984				
1985	*New policy system – supports growth*	Original policy system		
1986	**Agent system - provides remote sales processing**		**System reconfigured into 12 divisions - supports variation**	*New print and mail systems*
1987	*Document system –print automation*			
1988	**Rewrite policy system – add non-standard**		*Agent rating disk*	
1989				
1990				*Agent system - provides automated rating*
1991	*Automate billing system*			
1992	*New agent system – move to PC technology*	*Initial agents system – support rating*	*Pilot system –standard product*	New policy system cancelled - limited resources
1993		**Replace database – enables state expansion**	**Rewrite policy system – standard product**	*New rating engine –more efficient rating*
1994			*New direct sales system*	
1995		**Replace policy system – enables state expansion**	*New internet sales system*	*Automated renewals processing*
1996	*Integration of customer billing across products*		**Rewrite agent disk – support new rating model**	
1997	New policy system cancelled – too complex		**Replace policy db – support new data requirements**	
1998	*Update rating engine*		**Rewrite direct system Rewrite internet system**	
1999		**Replace agent rating system – support sales across channels**	**Rewrite print system – standardize to enable change**	**Replace agent system – greater data capabilities for underwriting**
2000		**Rewrite policy system - expansion into new channels**		**Replace policy system – enables new products Replace database – enables new products**
2001			**Replace billing system – enable new products**	

Table 2. *Italics: incremental changes*; bold: discontinuous change

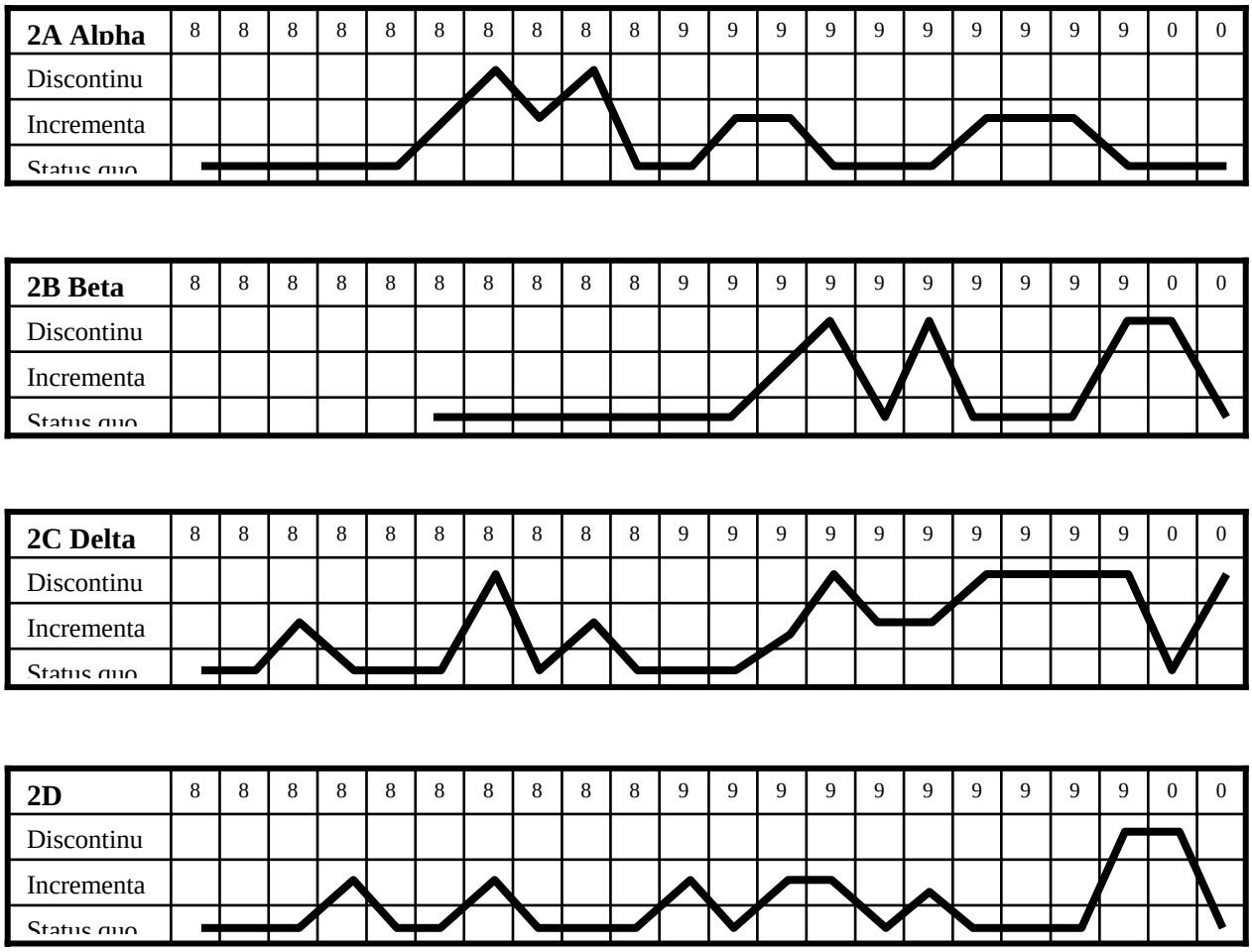

Figure 2. Continuity and discontinuity in each system's evolutionary trajectory

Product Segmentation

Standard Products

Alpha. Alpha's underwriting focus is risk avoidance, so it makes use of simple data models to price and process policies. Except for the addition of a non-standard auto product in 1988 (see Figure 2A), new product designs were unheard of until a tiered product was introduced last year. Yet, over time the systems have evolved as changes were made to refine existing products and processes. Today, the company finds that the structures of the systems are very difficult to change which is making it difficult to deploy new products.

The infrequency of significant change and the effect that has had on system structures and organizational performance is in part explained by the company's overall product strategy. As the organization remained singularly focused on in-state growth and conservatively followed the industry, Alpha concentrated on incremental refinements to existing products. There was

little energy in the organization to undertake discontinuous change, even though it might have offered an opportunity for renewal. Only in recent years, as performance has been adversely affected by regional concentration of risks and low policy retention due to increased competition form more innovative products have new products been developed. And only then did management realize how inert the systems had become. To date, Alpha has introduced its new products only in states in which it has not previously competed because constraints within its policy processing systems required the segregation of new products from existing ones.

Omega. Originally, Omega was first and foremost a life insurance company; the purpose of the auto product was to provide a compliment or loss leader for life products. Management was concerned only with maintaining the existing products and systems and had little interest in innovation. This became increasingly the case as the old system became more and more difficult to change, which further stifled adaptation to changing market conditions. Not surprisingly, performance declined. The auto organization's demand for change was never great enough to alter this trajectory.

In the model, the absence of change is explained by the relationship between performance and the perceived need for change. In this case, poorly aligned measures of performance coupled with inadequate resources to update the system prevented a discontinuous response. The poor performance was tolerated and the system was allowed to continue deteriorating. In recent years, perceptions have changed. New management has led the pursuit of innovative new product designs and new systems to support them (see Figure 2D 1999, 2000). The obstacles the organization now faces are explained by the buildup of inert structures over time which have reduced the ability to change. As a result, the development of the new product has prompted the replacement of the entire existing policy system.

Non-standard Products

Beta. In terms of innovation, Beta is a fast follower in the non-standard auto market. Beta frequently examines competitor products as well as its own in order to make adjustments, enhancements and quite often completely redesign them. Each time a major competitor introduces an innovation, Beta follows, creating systems that are complex and often difficult to manage. To keep pace with competitors, Beta has had to periodically reprogram and even replace significant parts of its systems. This has allowed them to re-organize their system to increase the flexibility in design options they offer to the product managers.

This recurring pattern of change (see Figure 2B) is explained in the model by the organization's perceptions of change and the continual update of its products and systems. The large oscillations in the patterns of change are influenced by the perceived need to develop and implement new ideas. Ultimately, when change becomes constrained, the perceived need for change then supports and encourages even larger changes that are required to restructure or replace the current system, creating a large discontinuous change. These events improve the ability to change in the short run. But the unrelenting pace of change ultimately results in more variation across the products as subsequent enhancements are adopted.

Delta. Delta has always had a reputation as an innovator, which includes its use of data, its pricing methods and its technology. Many ideas have come from product managers who identify local opportunities for new products. Delta's product managers historically embarked on

independent paths of innovation and product development. Experimentation paid off and the company grew and prospered, but systems became increasingly incompatible. As the company recognized its inability to share innovations across units and to quickly diffuse new products across multiple states, uniformity of products became the objective.

Eventually the products were aligned, making innovation diffusion more efficient. However, the lack of new product ideas resulted in a return to a belief about the need for innovation. Today, Delta is again allowing product managers to make innovative changes unilaterally. The model explains these oscillations by examining the dynamic tension between the need for local innovation and the ability to implement change across a system. The strong drive for product innovation increases variation, boosting performance, but it also makes change more difficult.

Number of Units

The number of business units also played an important role in the evolution of each system. Each organization has faced challenges coordinating implementation efforts across and between units. When a company increases the number of states in which it competes, it must contend with a greater variety of regulatory rules and a greater number and variety of competitors. The difference in the products offered by these competitors often requires different competitive responses in the design of a product.

Regional Reach

Alpha. Alpha has less variation across its units than the other companies because it markets in fewer states and the states in which it does compete have less diversity of requirements. Alpha has also dictated standards across all states and has accommodated exceptions through manual processing. Over time, however, Alpha has continued to refine its products and processes, adding more underwriting rules and continually automating more policy processing. The result is an increasingly refined system based on the standard product designs and processes. The complementary result is variation in processing procedures. Alpha now finds it increasing difficulty to implement change because of a standardized system that cannot accommodate a deviation in product design and widely diverse work processes and procedures that make it very difficult to incorporate the requirements of new states.

Now that Alpha is implementing a new product design it finds it can only do so by introducing it in states where they have not competed in the past. This expedites implementation by avoiding existing structures, but increases variation, both in the automated and manual systems.

The model explains the inertial effects that Alpha is experiencing. Small changes are the norm, so when larger changes are requested, they result in implementation delays and manual workarounds. This contributes to variation in the system as different units employ different and distinct products and processes, which become an obstacle to changing the system in the future.

Beta. Beta's strategy for growth has focused on adding states and expanding its geographic reach. Early in its history, state expansion and product changes were constrained by limitations in the system. As the company expanded, it faced new and increasingly difficult challenges in designing its products to accommodate significant differences in the design requirements for new

states. As a result, variation increased with the addition of more states. As the system became increasingly inflexible, innovation and growth became stifled, which affected performance. The company replaced its database (see Figure 2B 1993), then its quoting system (see Figure 2B 1995) to provide greater flexibility. Since that time, the programmers at Beta have worked hard to build systems that will accommodate change.

The model explains that changes of a larger magnitude across more states combine to create increasing levels of variation in a system. As perceptions of need continued to fuel change, the IS department focused on building flexible designs and improving their ability to change. But again the system has restricted the organization's ability to respond to its changing needs. The current rewrite (see Figure 2B 2000) once again exemplifies a discontinuous change made in order to regain flexibility and support the variations needed to sustain performance.

National Reach

Delta. The strategy at Delta was to identify and capitalize on local knowledge of a state, resulting in a great deal of explicit variation. Later, systems were regionalized to make processing units more efficient and then divisionalized to allow programmers to acquire and leverage knowledge of specific states. The variation across products in the current system contributed to the performance of individual units and the company's overall aggregate performance, but it also created obstacles to change. That realization brought about efforts to reengineer the systems (see Figure 2C 1993) in conjunction with four successive rollouts of an increasingly standardized product.

Today, the products and systems at Delta are more standardized than ever and the organization has become very efficient at delivering changes, in part by reducing variation. But, now the organization feels a need to become more innovative, so it is allowing units to evolve independently.

These patterns are explained in the model. By reducing the level of variation in the system, Delta was able to execute changes more efficiently. Delta then recognized that high levels of standardization in a world of diverse regulations and competitors adversely affects performance. As explained in the model, performance requires the ability to accommodate local needs, which in aggregate yields increasing levels of variation.

Omega. As discussed above, the strategy at Omega focused on providing a complementary product. Over the course of time, however, the mix of business rules and aging code resulting from incremental changes made the systems increasingly complex and inert. Thereafter, variation became more prevalent as the inability to implement change led to diffusing new products and services selectively to states where changes met the least resistance or where the impact to performance was greatest. This method of prioritization contributed to increasing variation across the forty-seven states and to decreasing the ability to change.

Omega's situation exemplifies variation's dualistic role in a system. Omega was able to increase performance by delivering change to its states, and as change became more difficult, Omega became increasingly selective. Adding an enhancement to some states and not others introduced more variation. Now the perceived need for a new product is driving the implementation of a new system. Yet, practices of selective diffusion persist because of the short-term benefits to performance, despite any long-term cost to flexibility.

Discussion

The model explains the emergence of oscillating patterns of change in a system created by the need to alter the products and services it supports over time. An important component of the model is the degree to which variation emerges as a systemic variable, its ability to contribute to performance and the degree to which it may constrain the ability to change the system in the future. Since variation emerges across multiple units in a system, diversity in the number of units that an organization serves provides one way to examine the model's robustness and its ability to explain patterns of change.

Additionally, the model takes into account how change influences management's perceptions about the evaluation of performance and the need for future change. This component concerns the choices managers make about where and how to compete and influences how products are designed and marketed over time. Comparing companies that have chosen to compete differently based on their product designs provides a way to examine the theory's ability to explain the dynamics of change in the systems of these four organizations.

In the two standard companies, the way in which performance was measured and the way changes were perceived slowed the evolution of systems and thereby dampened the oscillating cycles of change. Yet, these organizations still experienced an inability to change because of the levels of variation across their state product designs. Changes accumulated over time to form increasingly complex structures both in the design of the products and the processes that supported them. Once perceptions about change were altered and the organizations moved to implement new products or to expand their presence to additional states, the inert state of their systems became noticeable. Large changes, such as replacing a policy processing system, are discontinuous changes, which break from the current trajectory of the system and reduce inertia, making future changes easier.

In contrast, the perceptions of performance in the non-standard companies promoted change. The dynamics of their industry promoted and rewarded innovation, which led to using more and different data. Together, the complexity of the systems, combined with the dynamics of constant change in products and services, brought about continual changes in the systems at both companies. These dynamics sped the environmental cycles of continuous and discontinuous change in the systems, making variation across the units a critical factor in the success of their products. But, in both organizations, variation in the system in combination with the dynamics and magnitude of change, created significant barriers to implementing change, which led to many discontinuous changes.

Conclusion

In this study, the size of the organizations and the nature of their product market strategies were used to evaluate the dynamics of change. The analysis demonstrates the value of the model, in explaining how the number of units in a system will influence the level of variation and the subsequent ability of an organization to implement change. It also explains how the orientation of the products and services supported by a system influences its development and the demand for changes to it. A niche market strategy and the perceived need to change product designs were shown to create larger oscillations in the patterns of inertia and change. Conversely, stability in a product and the perceptions regarding performance also influenced the patterns of

change, resulting in long periods of incremental change and adaptation that caused inertia over time.

This research expands our understanding of diffusion, implementation and information systems change research by modeling the dynamic interaction of events that set the stage for future change. For practitioners it provides a model of change that lends insight into the distributed and delayed effects of change. These effects manifest themselves by inhibiting change, but go unnoticed until change is most desired and least accessible.

IS researchers have examined resistance to change as an obstacle to successful implementations, but have not examined sources of structural inertia that are used to explain obstacles to organizational adaptation. An important question for future research is how organizations can manage the constraints that form in systems over time and across multiple units.

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