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EXPLORING THE ANTECEDENTS TO INFORMATION SYSTEMS DISCONTINUITIES: A COMPARISON OF THREE CASE STUDIES

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Abstract

An unanswered question in information systems (IS) research is: What triggers organizations to undertake reengineering or replacement of a mission-critical information system? While the benefits of reengineering efforts and new system implementations are well-documented, these large scale discontinuous system-changes are costly and known to be risky. IS projects frequently fail. A great deal of research has focused on understanding how new system implementations can be successful, once the decision to move forward is made. Alternatively, this research examines the antecedents of undertaking that costly and risky discontinuous change, as well as the role of inertia that precipitates the undertaking. We conducted 37 semi-structured interviews in three organizations. We explored the reasons for replacing or re-engineering their mission-critical information systems. We employ three theoretical explanations of change as derived from the organization theory and strategy literatures to conduct a cross-case analysis. While in some case studies external environmental forces and internal strategy changes reveal themselves as antecedents, we found that across all three cases, inherent constraints in the system slowed and even stifled the adaptation and design of these systems. We draw on structural inertia organizational change theories to explain these antecedents and how the systems evolved into their current states.

***Key words**: structural inertia, incremental and discontinuous change, punctuated equilibrium*

1. Introduction

Increasingly, many organizations are frustrated by information systems designs that fail in meeting business demands. As a result, rather than trying to incrementally improve them, organizations sometimes choose to completely redesign or replace their information systems (IS) with the intention of gaining efficiencies, redesigning them to make their processes more efficient, or enhancing their business agility. Ultimately, organizations are looking to improve their organization's performance, but what precipitates the need for such significant changes?

While the benefits of reengineering efforts and new system implementations are well documented, these large scale or discontinuous system changes are also risky, given the frequency of IS project failures. As a result, a great deal of research on IS change has focused on understanding how new systems can be successfully implemented, once the decision is made to move forward with reengineering. Alternatively, our research examines the antecedents of discontinuous change: how and why an organization reaches that point where they decide their systems have become a critical impediment to an organization's performance--to the point that the organization chooses to reengineer or replace them. Like history, such failures are destined to

be repeated if we do not learn from them. Hence, the theoretical questions that this research asks are as follows: are the systems changes a response to external environmental forces, initiated by internal organizational motivations, or due to the systems themselves becoming maladaptive? Ultimately, what is influencing the need for a radical changes intended to bring about renewal?

This research employs three theoretical perspectives on change in organizations. The sections that follow discusses these relevant organizational change theories, which inform the phenomenon found in the case studies to follow. Three case studies of incremental and radical change are presented using cross-case analysis. The analysis is developed by exploring the patterns of change that precede a significant discontinuous change. A discussion follows to explain the importance of this research and the implications it has for future work in this area.

1.1. Theoretical Background

Modern organizations increasingly benefit from and are subsequently reliant on information systems to support organizational functions. For those organizations whose products and services are now digitized (embedded in information systems), the design, delivery and support of these products and services is increasingly enabled and constrained by the design of the information system (Sebastian, Ross, Beath, et al., 2017). As the pace of change in today's technical and business environments quickens, one criteria of success for an information system is its utility as a long-term sustainable resource for enacting and supporting products and services. This necessitates an organization having the ability to change (Lawrence, 2018). This includes the ability to alter the design of the systems as dictated by the needs of the business—i.e. enact changes to systems and related business processes. Specifically, changes are defined here as efforts undertaken for developing, delivering and supporting alterations to an organization's products and services, which are embedded and supported by information technology.

To inform this capability and increase the likelihood of success, this research examines an extended timeframe in which to study a system's utility as an organizational resource. To do so, this research examines change from a retrospective historical perspective (Glick, Huber, Miller, et al., 1990), a method which has informed past studies of IS (Newman & Sabherwal, 1996) and contributed to IS and organizational theory of change and punctuated equilibrium (Sabherwal, Hirschheim, & Goles, 2001; Schilling, Beese, Haki, et al., 2017).

IS researchers have employed punctuated equilibrium as a model of longitudinal and evolutionary change (Sabherwal et al., 2001). The focus of research in IS pertaining to punctuated equilibrium, however, has primarily examined events occurring during and after these punctuations, or discontinuities. Researchers have also discussed subsequent incremental changes that account for the system's stabilization, which ultimately helps in refining the system's design (Tyre & Orlikowski, 1994). There is, however, a scarcity of research that examines theoretical explanations for events that led up to and influenced these discontinuities. Swanson and Dans (2000) offer one of the few empirical studies to develop an explanation for a system's retirement. There are, however, theoretical works in the area structural inertia and punctuated equilibrium, which can inform these events.

1.2. Explaining the Occurrence of Discontinuities

Discontinuous changes in organizations are often explained by events, which fall into one of three categories (Tushman & Romanelli, 1985). First, from an external-organizational perspective, adaptation is often undertaken as a response to changes in environmental factors—e.g., technology, competition or regulation (Schumpeter, 1983). Hence, the faster the rates of change in the competitive environment, the greater the need to develop agile capabilities**.** Furthermore, in both turbulent and stable environments, sudden and significant changes in the competitive environment may necessitate large changes in strategy, structure and systems. This environmental shift can come as a shock to the organization's capabilities (Christensen, 2013).

Second, from an organizational choice perspective, an organization may determine that a change in strategy is needed. In doing so, the organization may choose to target new customers, develop new products or undertake geographic expansion (Tushman & Romanelli, 1985; Huff, Huff & Thomas, 1992). Thus, an organization may undertake changes intended to take advantage of opportunities in its competitive environment that could benefit from a new system or design. A third explanation for large scale change is that inertia, which forms in systems such as an organization's processes and routines. Over time, inertia constrains an organization's ability to adapt as it pursues its current strategy. That is, without a significant shift in the external environment or internal strategy, the organization finds itself unable to enact the changes required to continue along a normal evolutionary course given new business demands.

The concept of structural inertia is central to understanding continuity and discontinuity in a systems evolution. Drawing on theories of structural inertia (Huff et al., 1992), small incremental changes are viewed as organizational adjustments intended to increase performance. Over time, these adjustments become less effective, however, as existing structures no longer yield the degree of improvement that is required (Huff et al., 1992; Tushman & Romanelli, 1985; Hannan & Freeman, 1984). Inertia is a stabilizing characteristic of a system. Over time, a system will move toward a high degree of stability. Inevitably, an inert system confronted with an increasing need for change has an increased probability of experiencing a radical change.

A radical change in an organization can act as a means for renewal (Agarwal & Helfat, 2009). Strategic renewal is the process whereby organizations can alter their path dependence by transforming their capabilities (Schmitt, Raisch, & Volberda, 2018). The discontinuity becomes necessary because the buildup of inertia has reduced their ability to execute incrementally. Such change reconciles the gap between a system's structure and performance requirements (Huff et al., 1992; Tushman & Romanelli, 1985). The change also facilitates the capacity for larger and more frequent changes (Amburgey, Kelly & Barnett, 1993) in the near future, prior to the new system's stabilization.

1.3. Conceptualizing Patterns of Change in Information Systems

Inertia is conceptualized in this research as a systemic variable, which promotes greater performance, but also constrains the ability to change. As an IS system is implemented, the choices that are made during design and implementation determine the form of the system and the patterns of its basic activities. An organization with an inert system, confronting a changing environment or strategy, may undertake a discontinuous change to their information system in order to facilitate an increase in the capacity for larger and more frequent changes (Ross, Beath,

& Goodhue, 1996). Tracing the patterns of evolution of a system, it is during initial implementation that the greatest opportunity is presented for adaptation of the new technology (Tyre & Orlikowski, 1994). Then, as a system stabilizes, subsequent patterns of activity and choice of modifications decline. The incremental changes that do occur will tend to reinforce the current design through adaptation and reinforcement of its structure, informed by feedback (Gersick, 1991). Over time, the continual tweaking and fine-tuning of a system's processes, procedures and technologies that support them will result in structures whose refinements increase performance and reward the current trajectory and organizational behaviors.

Figures 1 and 2 are taken from two studies, one of incremental changes in a system after implementation, and the other from a study of structural inertia. The first is used by Tyre and Orlikowski (1994) to illustrate the decline in the number of changes over time. The second figure illustrates the declining ability of organizations to enact change due to constraints imposed by structural inertia (Kelly & Amburgey, 1991). Both Figures indicate that change increases following discontinuous, then slows over time, as a system stabilizes. Eventually, another discontinuity is expected to follow stabilization. The patterns of change these diagrams exhibit are also consistent with theories of punctuated equilibrium and structural inertia.

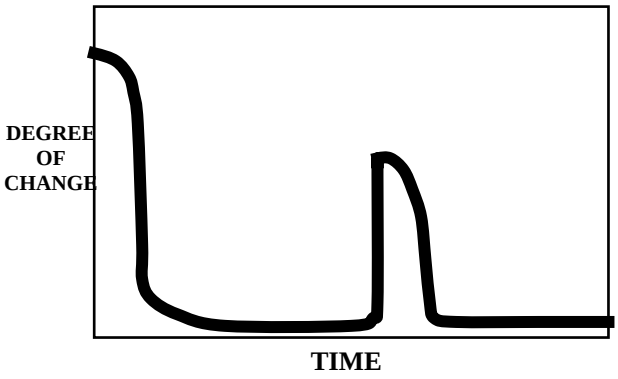

Figure 1. Tyre & Orlikowski (1994)

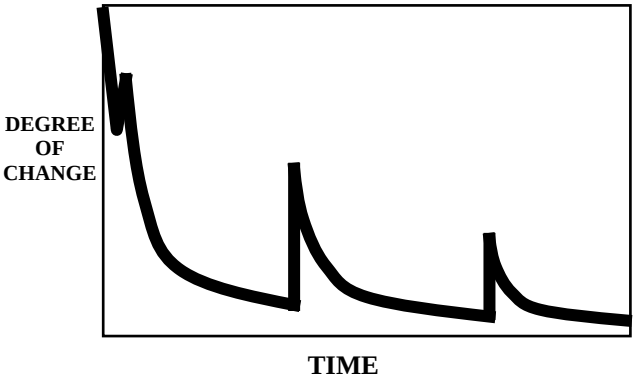

Figure 2. Kelly & Amburgey (1991)

As each cycles repeats, the incremental and discontinuous changes result in varying levels of inertia. Thus, inertia is explained by the occurrences of incremental evolutionary changes between discontinuities, as illustrated in figure 3 and 4 below.

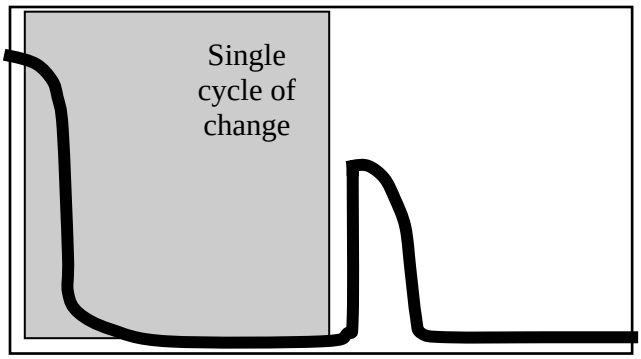

Figure 3. Derived from Tyre & Orlikowski (1994), the figure illustrates a declining occurrence of adaptive change that takes place after a system's implementation.

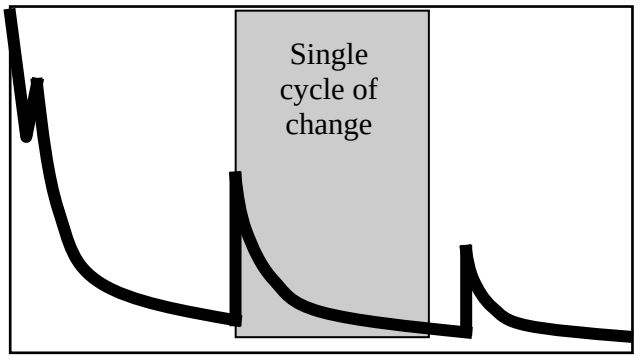

Figure 4. Derived from Kelly & Amburgey (1991), this figure also illustrates declining change, due to structural inertia, which is elevated when discontinuities occur.

In the current research, we examine the ongoing occurrences of incremental changes that precede and ultimately precipitate the occurrence of a discontinuity. This is consistent with Tushman and Romanelli's (1985) theoretical explanation of patterns of punctuated equilibrium and change.

2. Research Methods

This research investigates how systems evolve when change to them occurs over time. The benefits brought about by the refinement of structures may negatively affect the ability of an organization to adapt. Three case studies in three different industries were analyzed to fully understand the phenomenon. Each case describes the occurrence of discontinuous changes, which occurred to mission-critical information systems. The central focus of the analysis, however, is the preceding events that instigated radical change. Thus, both the discontinuous changes that the organizations experienced and the events that preceded them are discussed.

The cases describe the organization's competitive strategy, their internal organizational management structure, the relevant products and services, and the role that information systems play in supporting their sales and service. These three organizations were selected because they are representative of the interplay of the three forces that influenced the need for discontinuous changes: (1) environmental shifts in competition, technological innovation or regulatory requirements, (2) internal shifts in strategy regarding product design, segmentation or geographic market, (3) evolution of inertia in structures and processes developed during previous incremental changes. Comparison of these issues allows for cross-case analysis of the factors affecting the organization's perceptions about the need for a discontinuous change.

2.1. Sample

We chose industries that rely heavily on information as a critical component of their product or service, given that this would provide greater opportunities to observe recurring cycles of changes made to the systems. The insurance, financial services, and health care industries are characterized by dynamic technical, regulatory and competitive environments, which frequent require adaptations to product and process designs. They are also characterized by diverse sets of requirements for organizations that work across various geographic regions and specializations.

Both the medical and insurance industries have undergone tremendous technological, regulatory and competitive changes in recent years, which have increased the frequency with which they need to reconsider the design of their product and service offerings. At the time of the study, each of these organizations was experiencing large-scale changes to their information systems.

The first case was a large metropolitan hospital providing both in- and out- patient care at a large campus site with several satellite locations. During the period examined, the organization adopted a new system to facilitate insurance authorization and billing. The second case was a financial services company that sold products both in the United States and abroad. During the period examined, the property and casualty insurance branch of the organization was undertaking efforts to replace its automobile policy issuance and maintenance systems. The third case was an automobile insurance company that sold its products and services across most of the United States. During the period examined, the insurance company undertook several large-scale efforts to reengineer its processes for sales and service. The company replaced its billing system as part of an overall effort toward developing a new innovative product design.

2.2. Data Collection

To explore these complex issues, information was collected about the history of the information systems in each organization, including the historical events that influenced its current design, its beneficial capabilities, and limitations. The primary data collection was semi-structured interviews, which detailed the current change and the historical development of the systems. This method of retrospective event histories (Glick et al., 1990) offered the ability to gather the data that could inform both an understanding of the need for change and the forces that constrained it.

Data collection included unstructured interviews (14 at the hospital, 13 at the financial services company and 10 at the insurance company). When possible, internal documentation and reports were acquired for analysis. Published articles and published teaching cases were also available for each organization. For two of the organizations, historical reports about IS development efforts, written by senior employees, were made available. Interviews included three groups of participants from each organization. First, IS professionals (IS executives, managers, programmers, designers and testers). Second, those representative of the business interests (actuaries, underwriters, product managers and those who managed the finance and operations), plus the chief and associate chief of staff at the hospital. Third, users of the system and their managers, including customer service personnel, business analysts and hospital clinicians.

All interviews were conducted either on site at the organizations or by phone. Each interview lasted one to two hours. At the insurance company and the financial services organization, the interviews were recorded and then transcribed. At the hospital, notes were taken during in-person interviews and then a more detailed account was documented immediately afterwards. Follow-up interviews were used in several instances to confirm or expand on the evidence collected. Senior managers at each site then reviewed the initial case findings, either as a write-up or as a presentation by the researcher, to ensure the accuracy of events.

The three cases afford cross-case analysis, allowing for comparison of events that the informants offered as explanation for the evolution of the organization's information systems, the events they attributed to its current state, and the explanation for why its replacement was necessary. Holding with tradition in IS case study research, the alternative explanations are analyzed and evaluated through the process of deductive logic (Lee, 1989). This approach offers a scientific, if not quantitative approach, for comparative analysis.

3. Data: The Case Studies

3.1. Metropolitan Teaching Hospital - Billing System

At the metropolitan teaching hospital (MET-HOSP), the billing systems implemented just five years prior had allowed the organization to maximize revenue for both the hospital departments and the physicians. For example, departments were able to define their own fee schedules, allowing them a great deal of financial autonomy. They were then, through that autonomy and greater profitability, able to advance their individual areas of specialization by negotiating better salaries for their doctors. This enabled MET-HOSP to develop several advanced practices, including a level one trauma center and burn unit.

During this time, the health care environment that defined physician reimbursements was fee-for-service. The complex set of fee schedules used to charge insurance carriers worked well in

this fee-for-service environment. However, with changes in the economics of health care and movement in the industry toward managed care and networks of preferred providers, the hospital struggled to keep pace with the growing demands for changes to rules regarding regulations and insurance provider payment schedules. Overall, the hospital found it increasingly difficult to keep pace with system changes. This problem was further exacerbated by the growing number of insurance carriers the hospital worked with, and thus increased the number of carrier-specific rules and contingencies that MET-HOSP needed to make to its billing systems. Ultimately, maintaining and updating the system became increasingly difficult.

Ironically, the complex nature of MET-HOSP's existing systems (originally set up to allow autonomy to the various specialization areas), made the design more complex. Making changes across the organization became more daunting. A program manager reported that a six week backlog of changes demanded by insurance carriers was common place. As changes in the healthcare industry at large created financial strain, the hospital was adversely affected by the inability to keep pace with these changes. The delayed implementation of rules created reimbursement and cash flow problems. For example, until new rules were implemented, services were sometimes rendered and later found to be un-reimbursable by the patient's insurance. Delays in changes to the billing system also delayed legitimate reimbursements.

These financial pressures brought the limitations of the billing systems' design into relief. The complexity of the fee schedules, combined with the approval rules designed and implemented over time, constrained the ability to implement necessary changes. MET-HOSP's inability to implement change on a timely basis ultimately began to adversely affect performance. These constraints convinced MET-HOSP's administrators that the billing system had to be replaced.

3.2. Financial Services Company - Policy Issuance and Maintenance System

The financial services company (FIN-SERV) competed nationally with property and casualty insurance products, in addition to health insurance. Life insurance, however was always the primary focus of the FIN-SERV's captive sales agents. For the property and casualty lines, the mission was to support these agents with complimentary products, such as auto insurance. As a result, FIN-SERV had not aggressively priced or marketed its auto product and the auto product had a very conservative underwriting approach. The organization was also hesitant to offer new or innovative pricing and product features. Essentially, the product had changed very little in 30 years. The property and casualty line's management attributed this to the parent company's indifference to the auto product line, since management considered it a loss leader.

Furthermore, the product design and pricing decisions were made across three functional areas: underwriting, pricing and marketing. Decisions had to be negotiated across these departments; hence, changes to the product's design were reportedly few and far between. For example, any changes to underwriting rules would affect the overall price of the policy and vice-versa, so underwriting and pricing had to be in agreement on any change. Because pricing changes can directly affect customer retention (often negatively), and because agents were not concerned with growing the auto product's market share, marketing was seldom in favor of change.

As a result, FIN-SERV had little interest in innovation. There existed a severe lack of investment in new information technology and automation. For example, agents were still

mailing in customer applications, which were entered manually by customer service representatives. Complacency with the status quo became the norm, as the old system became more and more difficult to change, stifling any ability to adapt to changing market conditions. Not surprisingly, performance declined and FIN-SERV's demand for change in the auto product category was never great enough to bring about change.

However, a change in management brought about a turnaround effort. FIN-SERV began expanding the number of distribution channels it served and moved quickly to develop a more competitive product. The obstacle the organization now faced was that the systems which supported the new distribution channels were very complicated and constrained by the state of the current systems. While product changes were infrequent, the aging technology had, over the years, experienced many incremental enhancements to improve efficiency wherever possible. This, combined with many variations in their work processes and procedures, resulted in a complex labyrinth of technology and manual work structures that were repeatedly described in interviews as 'layered', 'difficult to maintain' and 'overly fragile', making maintenance and enhancement projects slow, expensive and unpredictable. The aging and increasingly complex design of the processing system inhibited FIN-SERV's ability to implement new products and services as quickly as desired. As a result, the ability to implement the new product design became the basis for replacing the *entire* policy system. In summary, in this case a new system is seen as a strategic necessity to introduce the new product and management's new strategy.

3.3. Auto Insurance Carrier - Billing System

At the auto insurance carrier (AUTO-INS), the billing system, first implemented in 1985, was being replaced. AUTO-INS historically competed in the non-standard or high risk auto insurance market. This industry is highly competitive, since carriers compete primarily on price. Shifts in one carrier's pricing strategy can leave competitors in unwanted positions--selling more policies than prudent in undesirable territories to high-risk customers. Further complicating matters, the industry is highly regulated at the state level, creating great variations in rules governing underwriting, pricing, and the collection and use of information. Companies also face a variety of competitive situations in different parts of the country. All these factors influence product billing design decisions, which, in turn, affect the billing system.

Decisions at AUTO-INS were made by state product managers, who had complete control over the design and development of their product and pricing. AUTO-INS was known as an innovator in the way it segments customers and prices its policies. The product manager's control over product design spawned a great deal of innovation and increased overall performance—e.g., growth and profitability. Billing designs were continually developed and refined for specific markets, in ways that were often honed to fit the state's unique competitive or regulatory requirements. For instance, if the state mandated a specific driver discount, this would influence decisions regarding the billing calculations. Specific bill plans offered by competitors, especially those with large market shares, required AUTO-INS to offer bill plans identical to statewide competitors in order to provide accurate price comparisons to prospective customers. As a consequence, a great variety of bill plans were implemented across the organization.

Over time, the systems had also been refined in other ways that helped to increase individual business unit performance. However, these variations in design across state products (embedded

in the systems) created obstacles to change. For example, there were limits to the number of states which customer service representatives could proficiently learn to support. Furthermore, some billing changes and transactions could only be processed by certain senior customer service representatives, due to the complex and often idiosyncratic nature of their design. Nevertheless, as AUTO-INS remained very profitable, it continued to allow product managers to control the design of their bill plans, which further increased the complexity in the billing system.

In the past, AUTO-INS had experimented at the state level with several innovative product designs and billing innovations, such as electronic funds transfer from agents, direct payment from customer bank accounts, and flexible billing dates that customers could select and change. Each of these proved to be competitively important, but the complexity of the system became an obstacle to their introducing these innovations across all of the states serviced by the company.

The primary obstacle was the time and cost required to introduce a new product into each unit, given the heterogeneous and complex nature of the systems. Faced with an increasing number of requests for implementing new innovations and the pace of competitive change in the non-standard insurance market, AUTO-INS had to find a way to stabilize operations of the billing system, while continuing to introduce new billing innovations.

Ultimately, the system reached a level of complexity where, based on an internal analysis by the manager in charge, any general enhancement to the system would require in excess of 2000 hours of work. At this point, AUTO-INS decided to embark on a multi-million dollar project to purchase and customize a new billing system in order to introduce a more standardized, yet flexible system, to hopefully facilitate a more efficient introduction of innovations.

4. Analysis: The Case Studies

In all three cases, the organizations made a decision to replace the existing system, thus creating a discontinuity in its evolutionary trajectory. Despite the individual reasons that seemingly explain the need for discontinuous changes in each of the three organizations, the three forces at work (environmental change, shifts in internal strategy, and the cumulative effects of structural inertia) all present common threads in the three cases. In each case, subjects discussed competitive environmental considerations and internal organizational and strategic issues that affected the need for significant changes. Thus, despite the variant conditions and antecedents, inertia is a significant common thread in all three cases. Each case also highlighted the constraints to change imposed by the current state of the existing information system.

MET-HOSP faced increasing external demands for change as it increased the number of billing partners it needed to accommodate, thereby increasing the number of changes required to process billing approvals and reimbursements. This can be explained by institutional influences imposed by the insurance companies and governmental health agencies that the hospital relied on for billing reimbursements. The technical nature of the changes demanded by these institutions is also the result of the increased proliferation of information technology as a means for instituting controls in organizations.

Alternatively, FIN-SERV competed in a stable environment characterized by captive sales agents that had little interest in changing the design of the current products or the processing services

supported by information technology. And, at AUTO-INS, the competitive nature of their non-standard insurance market had long demanded constant changes in bill plans and innovations in information technology, which the company always supported. For these organizations, there was no sudden increase in institutional pressures or innovative shift in technology that explains the discontinuities in these organizations, although there is no denying that institutional and technological changes in these industries created competitive pressures over time.

The discontinuity at FIN-SERV is most easily explained by the shifts in strategy that accompanied the arrival of new management. The poor performance of the property and casualty division was long ignored by the organization. New management brought about opportunities to address some key issues and try to turn the organization around. The new management wanted to inspire a sense of innovation and renewal, developing new products and change capabilities.

It is more difficult to fully explain the discontinuity at MET-HOSP based on changes in the organization's internal structure and competitive strategy. A new Chief of Staff did manage MET-HOSP through the implementation of the billing system, but the application suite was purchased before her arrival. Furthermore, the management at AUTO-INS had been in place for a very long time. At AUTO-INS, standardization was driving the redesign of underwriting processes, but the bill plans and payment options available to product managers were not part of this effort. If anything, the movements in underwriting meant that the product managers wished to retain their ability to experiment with bill plan and payment innovations, as a way to adapt to the local environment and competitors. In essence, managerial and environmental forces cannot fully explain the discontinuity at all three organizations.

It is clear that AUTO-INS believed that continuing to adapt the current system was no longer an option. As the manager in charge of the system explained, it's 'because of what we did to it'. The organization allowed product managers to dictate the design of the bill plans and when and how certain innovations (like electronic fund transfer) were designed and implemented across the various business units. As a result, the system contained many variations. For example, there were 700 different bill plan options, where a bill plan defines the number of payments made over the life of the policy and the percent paid on the down payment. The organization arrived at this number of designs because managers adapted many different variations of these plans in order to match the offerings of different established and emerging competitors at the local and state level.

While the change at MET-HOSP can presumably be explained by a significant shift in the external environment, this explanation does not hold as well for FIN-SERV or AUTO-INS. And while the discontinuity at FIN-SERV is best explained by internal changes (such as those to the management team, overall strategy and product design), MET-HOSP and AUTO-INS maintained a great deal of internal stability over the time period under study. Alternatively, the explanation for undertaking significant change at the AUTO-INS (structural inertia) was also resonant in the explanations offered at all three organizations.

5. Discussion

All three organizations implemented numerous incremental changes over the years, resulting in finely tuned, yet increasingly constrained designs. The resulting constraints in the systems prevented these organizations from responding to or proactively executing changes deemed

necessary for maintaining or improving performance. Eventually, the organizations undertook very large scale, discontinuous changes to replace or redesign their systems. Thus, the constraints in the system were negatively related to the ease of future change. Therefore, increased levels of inertia decrease the ease with which future change can be carried out. Over time, adaptations to the design of the system and the processes surrounding its use will occur. The more significant, varied, and frequent these changes are, the larger and more complex the structures become and therefore the more difficult it is to undertake future changes.

The occurrence of any single evolutionary iteration may or may not significantly influence a system. However, repeated over time, the relations between incremental evolutionary change and subsequent levels of inertia eventually come to influence future capabilities to adapt. Eventually, the need for change to accommodate internal or external forces may require a revolutionary change to alter the system's structures in a way that will reduce the inertial state of the system and facilitate change, as these organizations indeed discovered.

In the cases, while the organizations performed well, systems were incrementally improved and refined in a way that reinforced their current evolutionary trajectory. When the organizations wished to adopt changes by implementing new billing rules, pricing structures or technical innovations, the existing systems were found to complicate and slow the pace of change. Ultimately, the systems required radical alterations. These changes were necessitated in part by the declining ability of change afforded by these systems.

These cases reflect the tension between the need for change (resulting from internal and external performance inadequacies) and the difficulty of change imposed by the information systems. The cases illustrate patterns of incremental evolutionary change in an information system. Over time, inertia slows the capacity for change so that a stabilizing effect takes place that eventually encourages a discontinuous change. This is consistent with the oscillating, but growing levels of change, inertia, and perceptions of change reported in prior theoretical and empirical studies.

6. Conclusion

This paper integrates multiple case studies and past research in the areas of inertia and change in order to support the need for more work in IS field in the area of change. This work enhances our ability to understand how changes affect systems over time and contributes to a better understanding of the processes involved. By employing theories of structural inertia, this research also explains how conflicting theories about adaptability and rigidity may be applicable at different times depending on the state of the organization and the nature of the current changes taking place. The reduced ability to change also demonstrates the long-term implications of structural inertia that may eventually lead to large-scale discontinuous change, thereby exhibiting patterns of punctuated equilibrium over time.

References

Agarwal, R. and Helfat, C.E. (2009). Strategic renewal of organizations. *Organization Science, 20*(2), 281-293.

Amburgey, T.L., Kelly, D. & Barnett, W.P. (1993). Resetting the Clock: The Dynamics of Organizational Change and Failure. *Administrative Science Quarterly, 38,* 51-73.

Christensen, C. M. (2013). The innovator's dilemma: when new technologies cause great firms to fail. *Harvard Business Review Press.*

Gersick, C. (1991). Revolutionary Change Theories - A Multilevel Exploration of the Punctuated Equilibrium Paradigm. *Academy of Management Review, 16*(1), 10-36.

Glick, W.H., Huber, G.P., Miller, C.C., Doty, D.H., & Sutcliffe, K.M. (1990). Studying Changes in Organizational Design and Effectiveness: Retrospective Event Histories and Periodic Assessment. *Organization Science, 1(*3), 293-312.

Hannan, M.T. & Freeman, J. (1984). Structural Inertia and Organizational Change. *American Sociological Review, 49,* 149-164,

Huff, J.O., Huff, A.S., & Thomas, H. (1992). Strategic Renewal and the Interaction of Cumulative Stress and Inertia, *Strategic Management Journal, 13,* 55-75.

Kelly, D. & Amburgey, T.L. (1991). Organizational Inertia and Momentum: A Dynamic Model of Strategic Change. *Academy of Management Journal, 34*(3), 591-612.

Lee, A.S. (1989). A Scientific Methodology for MIS Case Studies, *MIS Quarterly, 13*(1), 33-51.

Lawrence, M. (2018). Taking Stock of the Ability to Change: The Effect of Prior Experience. *Organization Science, 29*(3), 489-506.

Newman, M. & Sabherwal, R. (1996). Determinants of Commitment to Information Systems Development: A Longitudinal Investigation. *MIS Quarterly, 20*(1), 23-54.

Ross, J.W., Beath, C.M. & Goodhue, D.L. (1996). Develop Long-Term Competitiveness through IT Assets, *Sloan Management Review, 38*(1), 31-42.

Sebastian, I. M., Ross, J. W., Beath, C., Mocker, M., Moloney, K. G., & Fonstad, N. O. (2017). How Big Old Companies Navigate Digital Transformation. *MIS Quarterly Executive, 16*(3), 197-213.

Sabherwal, R., Hirschheim, R. & Goles, T. (2001). The dynamics of alignment: Insights from a punctuated equilibrium model, *Organization Science, 21*(2), 179.

Schumpeter, J.A. (1983). *The Theory of Economic Development*. New Brunswick, N.J.: Transaction Publishers.

Schilling, R., Beese, J., Haki, K., Aier, S., & Winter, R. (2017). Revisiting the impact of information systems architecture complexity: a complex adaptive systems perspective. *Thirty Eighth International Conference on Information Systems,* South Korea.

Schmitt, A., Raisch, S., & Volberda, H. W. (2018). Strategic renewal: Past research, theoretical tensions and future challenges. *International Journal of Management Reviews, 20*(1), 81-98.

Swanson, E.B. & Dans, E. (2000). System Life Expectancy and the Maintenance Effort: Exploring Their Equilibration, *MIS Quarterly, 24(*2), 277-297.

Tushman, M.L. & Romanelli, E. (1985). Organizational Evolution: A Metamorphosis Model of Convergence and Reorientation. *Research in Organizational Behavior, 7,* 171-222.

Tyre, M.J. & Orlikowski, W.J. (1994). Windows of Opportunity: Temporal Patterns of Technological Adaptation in Organizations. *Organization Science, 5*(1), 98-118.