SEQUENCING ORGANIZATIONAL CHANGE FOR POST-SHOCK ADAPTATION

A SIMULATION MODEL

PETER JACK GALLO • RICHARD M. BURTON

Abstract: What should an organization do after an environmental shock? What is the best sequence for changing organizational features or activities in response to a shock? In this study, a simulation methodology is used to examine how different sequences in changes to strategy, structure, and resource allocation affect the success of the adaptation process. Results show that the choice of change sequence leads to varying outcomes in organizational maneuverability, competence, and effectiveness. However, no one sequence is optimal for all scenarios; the best sequence choice depends on the goals of the change process as well as the content and direction of change. After an environmental shock, an organization should analyze and determine which sequence of change to follow. However, if there is little time for analysis, a reasonable heuristic is to implement a change in strategy first.

Keywords: Simulation; organizational change; change sequencing; implementation; organizational adaptation

"Would you tell me, please, which way I ought to go from here?" asked Alice.

"That depends a good deal on where you want to get to," said the Cat.

"I don't much care where," said Alice.

"Then it doesn't matter which way you go," said the Cat.

Lewis Carroll, *Alice's Adventures in Wonderland*

Do organizations have Alice's problem of deciding which way to go after experiencing an environmental shock? The trauma of deteriorating corporate performance could lead a firm to be equally ambivalent when deciding how to proceed. The Cheshire Cat's wisdom is logical but not particularly helpful unless a firm does know where it wants to go. This simple goal-oriented wisdom may prove useful to firms hit by an environmental shock. Ford Motor Company, for example, faced recurring shocks of extreme growth and contraction before undergoing a comprehensive adaptation process starting in 2006. Standard & Poor's Stock Report on Ford Motor Company, Inc. shows that annual net income grew rapidly from USD 284 million in 2002 to USD 3.6 billion in 2004. In 2005 and 2006, annual net income dropped, first, to USD 2.2 billion and then to a net loss of USD 12.6 billion. Ford sources attribute the performance declines to a rapid shift in consumer demand from profitable sport utility vehicles to economy cars in the wake of gasoline price spikes following Hurricane Katrina in 2005 (Krisher, 2006). These performance shocks motivated the company to transform itself simply to survive. Alan Mulally was brought in as the new CEO in September 2006, and many organizational changes were made, including changes in organization structure, strategy, and resource allocation (Hoffman, 2012). For Ford, was the order of these changes important to its future success?

Journal of Organization Design
JOD, 1(3): 37-50 (2012)
DOI: 10.7146/jod.7009

This study examines how the sequence of an organizational change process (Barnett & Carroll, 1995) affects the outcomes of post-shock organizational adaptation. Shocks can provoke firms to undertake dramatic and rapid changes as described by the change model called "punctuated equilibrium" (Gersick, 1991; Romanelli & Tushman, 1994). Firms may make changes to several key organizational elements that will effectively transform the firm from one organizational archetype to another (Burton, Obel, & DeSanctis, 2011; Greenwood & Hinings, 1993). Because organizational changes cannot be made instantaneously, they are often made sequentially, temporarily creating "incoherent" organizational configurations along the path of adaptation (Greenwood & Hinings, 1993). The order or sequence in which organizational elements are changed is not predetermined or inevitable (Pettigrew, 1990), and different sequences of change can impact the adaptation process (Abbott, 1988; Van de Ven & Poole, 1990). Pursuing one sequence may lead a firm through a pattern of configurations with greater performance than an alternative sequence. Ford chose to start by changing its CEO, followed by selling its ownership in foreign luxury brands and then lowering the firm's manufacturing capacity, but Ford management could have chosen a different sequence of adaptation.

In our study, we compare sequences that lead to the same final organizational configuration; however, the question is whether different sequences yield different performances along the way. We analyze three performance criteria: (1) maneuverability (Nissen & Burton, 2011), the quickness with which an organization changes from an initial organizational configuration to a planned final configuration; (2) competence, a firm's skills built from learning and the experience gained from repeated activities (Levitt & March, 1988); and (3) effectiveness, the ratio of competence to maneuverability. All three outcomes are desirable, but there are tradeoffs between them. Moving quickly to a new configuration can destroy competence while moving slowly maintains competence but at the price of getting there slowly. For Ford, would a different sequence have led to a faster turnaround or allowed for greater productivity during the period of adaptation? Competence is studied because it is an important determinant of firm performance (Tushman & Romanelli, 1985) and because transformations may destroy competence (Nelson & Winter, 1982; Sastry, 1997). Maneuverability is examined to highlight speed and the importance of getting to where you want to be quickly and efficiently. The final performance criterion, effectiveness, is intended to provide a measure that accounts for the inherent tradeoffs between maneuverability and competence.

The process of organizational change and the role of maneuverability, competence, and effectiveness can be examined using a simulation methodology. The agent-based platform SimVision™ (Levitt, 2012) allows us to experiment with a variety of change sequences and measure maneuverability and competence outcomes. Determining the best sequence depends on the particular organizational goals of the adaptation process. Sequences that begin with a change in structure result in faster adaptation and would be the best choice when maximizing maneuverability. Adaptation sequences that start with a change in strategy result in firms emerging from the period of change with greater experience, suggesting this is the better sequence if the goal is to maximize competence.

We begin with a theoretical discussion of the organizational change literature. Here we discuss the different motivations that encourage firms to focus on maneuverability or competence as well as the evidence that sequence plays a role in determining organizational change outcomes. Next, we discuss the simulation model and present our results. In the discussion and future research sections, we relate our results to previous studies of organizational adaptation, and we discuss the implications of our findings for researchers and managers. We conclude by highlighting the importance of the change sequence in steering successful post-shock adaptation.

THEORETICAL BACKGROUND

Although post-shock adaptation is required for organizational survival, change also increases the failure rate of organizations (Armenakis & Bedeian, 1999) by disrupting existing organizational routines that promote competence (Amburgey, Kelly, & Barnett, 1993; Nelson & Winter, 1982). Firms must balance the need for adaptation with the benefits of stability

(Leana & Barry, 2000), and the sequence of change and its effect on the maneuverability, competence, and effectiveness of the adaptation process could provide a means for striking this balance.

Sequencing has been addressed in the strategic management literature, where contingency theory research found that changes in organization structure follow changes in growth strategy (Chandler, 1962). Later empirical work on a sample of 262 firms found that strategy was a more important driver of structure than vice versa (Amburgey & Dacin, 1994). The sequence of changes to organizational structure and strategy has been a fundamental area of investigation, and we include them in our study. However, we choose to investigate more than the binary choice between these two organizational elements. Researchers have called for the examination of the sequence of change caused by environmental jolts (Meyer, 1982) and their effects on organizational performance (Pettigrew, Woodman, & Cameron, 2001). A study of radical organizational transformation at Canadian Olympic Non-Profits found that organizations completing radical transitions tend to make changes to high-impact organizational elements, such as the authority system, early in the transformation process (Amis, Slack, & Hinings, 2004). Our study includes changes in structure, strategy, and resource allocation to best approximate the radical adaptation processes often required after a significant environmental shock.

In addition to studies of the propensity for one change sequence over another, some research has explored the effect of sequence on performance. Siggelkow and Levinthal (2003) used a simulation methodology to study the effectiveness of three different organization structures in searching for high-performing configurations post-environmental shock. They found that a structure of temporary decentralization, where a firm starts with a decentralized structure for the period of exploration and learning and follows with a change to a centralized structure for the purpose of exploitation, leads to higher long-term performance. Their results show that sequencing changes in structure can lead to higher performance. We build on Siggelkow and Levinthal (2003) by modeling sequencing changes in strategy and resource allocation as well as structure.

Reorientations and transformations include changes to strategy, structure, and resource allocation (Tushman & Romanelli, 1985). The sequence of changes to these elements can introduce different “incoherent” organizational configurations (Greenwood and Hinings, 1993) with varying degrees of organization-environment fit (Donaldson, 1995; Lawrence & Lorsch, 1967; Miles & Snow, 1994). Conditions of misfit suggest that there is an opportunity for certain change sequences to outperform others.

The literature on configurations supports the idea that sequence should matter, but the question of firm performance during the adaptation process has received limited attention in the literature. The premise of the theory of punctuated equilibrium is that adaptations are large and brief, followed by periods of equilibrium. The total time of transformation, called “maneuverability” by Nissen and Burton (2011), is an important measure of adaptation success. However, maneuverability is not the only means to determine the success of a post-shock adaptation. In a system dynamics model of punctuated equilibrium, Sastry (1997) found that post-shock adaptations could lead to failure – if firms respond too quickly to pressures for change or if they respond too slowly. When firms are slow to respond to the signals for change, they suffer large declines in performance before acting to implement change. Such firms may focus their change goals on maneuverability hoping to achieve a state of fit as quickly as possible. The formalized model also demonstrated that transformations were accompanied by significant drops in competence (Sastry, 1997). If different sequences result in different levels of competence at the conclusion of adaptation, might it be possible to choose a sequence that maximizes firm competence? For example, firms that respond quickly to signals for change have not experienced severe performance loss; they can focus on recovering competence during the transformation rather than maneuverability. Maneuverability and competence represent two different goals for adaptation, and different change sequences may better accomplish one over the other. We extend Siggelkow and Levinthal’s (2003) study of organization structure and Sastry’s (1997) study of competence by examining the effects on performance of both maneuverability and competence during different sequences of adaptation.

SIMULATION MODEL

We used a simulation experiment to study the maneuverability and competence outcomes of all six possible sequence patterns for changes in organizational strategy, structure, and resource allocation. Simulation is a valuable tool for experimentation and examination of possibilities (Burton, 2003; Davis, Eisenhardt, & Bingham, 2007); we use it to gain insight into how sequence affects a firm's performance while undergoing adaptation. In our experiments, we utilize SimVision™, an agent-based simulation developed for the design of work processes and the organization of project teams (Levitt, 2012). SimVision™ utilizes an information-processing model of the information routines and micro behaviors of boundedly rational agents (March & Simon, 1958). Agents send information to each other and make decisions on what to do (Jin, Levitt, Kunz, & Christiansen, 1995; Levitt et al., 1999). The firm is represented entirely by these agents, their tasks, and communication links. SimVision™ has been validated in field settings ranging from chip fabrication to product launches (Jin & Levitt, 1996; Levitt et al., 1999). In addition, SimVision™ (and its precursor, VDT) has been used to study topics in organization theory, including studies of alternative control strategies (Long, Burton, & Cardinal, 2002) and communication strategies (Carroll & Burton, 2000). (See the appendix for a detailed description of the SimVision™ simulation and how it is used to model the sequence of adaptation.)

Modeling the Organization and Alternative Change Sequences

The organization is modeled as a set of both well-defined project tasks and agents assigned to complete the tasks. The relations among the agents and the assignment of tasks are experimentally manipulated to correspond with different settings for strategy, structure, and resource allocation. All experiments begin with the organizational model in its original configuration and run to complete one project cycle. At the conclusion of the first project cycle, a change in strategy, structure, or resource allocation is implemented, and a second project cycle is initiated. At the conclusion of the second project, the next change is made, and the final change is made after completing the third project cycle. After the third project, all simulations will have achieved the final configuration, and a fourth project is run in the final configuration mode.

Experimental Manipulations

Our study simulates the reorientation of a project organization from one configuration of strategy, structure, and resource allocation to a final configuration. The simulation starts with an M-form (multidivisional) structure, two product lines, and equal distribution of resources, then reorients to an organization with a U-form (functional) structure and four product lines which use twice as many resources in the later tasks of each product line. The organization changes one of the three elements at a time to transform from the starting configuration to the final configuration, creating six possible sequences of post-shock adaptation (see Table 1). Each change sequence is simulated in SimVision™ by changing the elements as described in the appendix; all other elements of the simulation remain constant throughout.

Changes in Organization Structure

The change of structure modeled is a shift from the multidivisional form to a functional structure – that is, from M-form to U-form. Chandler (1962) chronicled the benefits for modern firms in changing from the U-form to the M-form. However, the U form persists and has cost advantages over the M-form when coordinating components across divisions (Qian, Roland, & Xu, 2006). Therefore, a move from M-form to U-form is a viable option for firms in resource-constrained environments.

Changes in Strategy

Changes in strategy capture the level of product diversification in which a company is engaged. Our simulated organization starts with only two product lines and eventually diversifies to four distinct product lines. In the simulation, the original configuration consists of eight tasks (four per product line). Then the change in strategy is introduced, doubling the product lines and leading to an organization with sixteen tasks. Romanelli and Tushman (1994) captured changes in strategy by the introduction or abandonment of product lines.

Changes in Resource Allocation

Our model allows for the direct manipulation of how resources – in this case, human resources – are allocated. The starting configuration consists of an equal number of full-time employees (FTEs) assigned to all the tasks in the model organization. The change shifts human resources until twice as many FTEs are assigned to later tasks than to earlier tasks in the project; this could, for example, simulate a shift in focus from R&D to sales and marketing.

Table 1. Simulation Results

Sequence	Maneuverability (weeks)	Competence (work hours)	Effectiveness (work hours/week)
Strategy→Resource Allocation→Structure	37.5	2800	74.7
Strategy→Structure→Resource Allocation	36.4	2800	76.9
Resource Allocation→Strategy→Structure	34.7	2400	69.2
Resource Allocation→Structure→Strategy	28.8	2000	69.4
Structure→Strategy→Resource Allocation	31.8	2400	75.5
Structure→Resource Allocation→Strategy	26.9	2000	74.3

RESULTS

Table 1 presents the simulation results for the six different sequences of post-shock adaptation and the performance outcomes of maneuverability, competence, and effectiveness. Maneuverability is the time required to complete the adaptation process. Competence is the amount of production accomplished during the adaptation process. Effectiveness is the ratio of competence to maneuverability. These results reflect the mean value for a sample of 25 simulations and are significantly different at the $p < .01$ level.

Maneuverability

If the firm's goal is maneuverability, or to align the firm with the external environment as quickly as possible, then the sequence Structure→Resource Allocation→Strategy is the best choice as shown in Table 1. Maneuverability, however, does not necessarily represent all desirable outcomes.

Competence

Competence is measured as the production accomplished during the period of adaptation. We chose to represent a change in strategy with a doubling of product lines. Therefore, the amount of production accomplished is different depending on when the change in strategy is introduced. Competence (work volume) varies between 2000, 2400, and 2800 hours of production as shown in Table 1. The two sequences in which strategy is the first organizational element that is changed accomplish the greatest amount of production (2800 hours) during the period of adaptation.

Effectiveness

A third metric could be useful for firms whose goals are not maneuverability or competence alone. We introduce the ratio of competence to maneuverability as an effectiveness measure. This ratio identifies which change sequence accomplishes the greatest amount of work per unit of adaptation time. In our experiments, the sequence Strategy→Structure→Resource Allocation has the greatest value on effectiveness. The ratio of competence/maneuverability, while providing a useful effectiveness measure, does not supplant the importance of the individual measures. Firms set their own adaptation goals and decide which performance measure – maneuverability, competence, or effectiveness – is most relevant.

In summary, the sequence Strategy→Structure→Resource Allocation has the highest value for the effectiveness measure. However, this does not coincide with the quickest sequence to reorientation (maneuverability), which is the sequence Structure→Resource Allocation→Strategy. Both Strategy→Structure→Resource Allocation and Strategy→Resource Allocation→Structure have the highest work volume and are optimal when considering the goal of competence.

Post Hoc Interpretation of Results

In our model and analysis, we changed the firm from an M-form configuration to a U-form. However, the experimental design can be easily reversed – from U-form to M-form. The results in Table 1 would be identical were we to run our model in the opposite direction, starting with a firm in the final configuration and adapting towards the initial configuration. What then, are the best sequences for an organization changing from U-form to M-form, while downsizing from four product lines to two, and moving to an equal distribution of human resources across the firm? The results also appear in Table 1, with the exception that the sequences are reversed. The greatest maneuverability or quickest time is Strategy→Resource Allocation→Structure. The greatest competence is either Structure→Resource Allocation→Strategy or Resource Allocation→Structure→Strategy. And the sequence with the greatest effectiveness is Resource Allocation→Structure→Strategy. The change in strategy consists of downsizing from four product lines to two, so it seems reasonable that maneuverability is greatest if the change process starts by changing strategy. Competence is measured as the total work accomplished during the change process; this seems to explain why competence is greatest for the sequences that end with a change in strategy. Reversing the direction of our experiment in this manner highlights another interesting finding regarding sequence. The direction in which organizational elements are changed will also influence the choice of optimum change sequence. The best sequence depends not only on where you want to go but where you start from as well.

DISCUSSION

Our study utilized a computational experiment to investigate the impact of change sequence on post-shock organizational adaptation. Results demonstrated significant differences in the maneuverability, competence, and effectiveness of the adaptation process for all six experimental sequences. By demonstrating that sequence can have significant and varying impacts on these three performance metrics, our simulation study provides initial insight into adaptation sequence and its role in organizational performance in dynamic environments with shocks. Sastry's (1997) results in prior simulation research demonstrated significant drops in competence after a reorientation, as had been stated in the original theory of organizational evolution (Tushman & Romanelli, 1985). Because different sequences of change result in different volumes of work accomplished by the time the full reorientation is complete, and organizations learn from experience (Levitt & March, 1988), sequence has a direct impact on the recovery of competence during post-shock adaptation. The earlier a change in strategy is introduced, the greater is the production accomplished during the adaptation process. An organization may struggle while waiting for the structure and resource allocation to align with the new strategy, but this period of struggle provides useful experience in which organizational competence begins to recover. We do not test the effect of increased experience on organizational competence directly; however, our experiment suggests that sequence impacts competence through the total amount of work accomplished. Our results show that the optimal sequence for firms with a goal of competence recovery would be either sequence that begins with a change in strategy.

Beyond our findings on maneuverability, competence, and effectiveness, reversing the simulated experiments highlights the importance of the direction of change in determining optimal sequence. If the firm is an M-form with balanced resources across two product lines, then the best sequence can be read directly from the rows in Table 1. If the firm is U-form with unbalanced resources across four product lines, then the sequences presented in Table 1 need to be interpreted in reverse. Therefore, the optimal sequences for firms changing in opposite directions are in fact mirrored. This demonstrates that the best sequence depends upon two contingencies: the direction in which organizational elements are being changed and which goal is the most important.

The implications of our study for management are straightforward: assess where you are and where you want to be. This is a truism for every organizational change and not surprising to managers. However, it is not obvious that the order or sequence of change is crucial as well. Here, we demonstrate that the choice of the sequence of change and the intermediate stages of change have significant effects. The challenge of environmental shock will generate managerial attention on the question of exactly which organizational elements to change. Our study indicates that managements' work is not done when they have determined the appropriate changes. Management should devote effort to determining the best sequence for the various changes that comprise the adaptation.

Periods of post-shock adaptation can be quite challenging and present significant time constraints. So our implication that the sequence of change needs to be analyzed and determined carefully may not be welcome. However, our study does suggest some opportunities for simplifying the determination of good change sequences. Sequences that start with a change in strategy perform well against all three goals. For firms in the initial configuration (balanced undiversified M-form), changing strategy first works best on competence and effectiveness but less well on maneuverability. If the experiment is reversed, changing strategy first works best on maneuverability and reasonably well on effectiveness. For change in both directions, a good heuristic is to implement a change in strategy first. When time to make a management decision is short, this heuristic is quick and robust as the chances of making a large mistake are small. However, if time permits it might be beneficial for a firm to use a simulation to model the change process and determine exactly which sequence benefits the firm the most.

Let us return to Ford Motor Company in 2006. Studying the timeline of changes implemented by Mr. Mulally, it is evident that strategy changes were tackled first during the adaptation process. Luxury brands were divested, truck factories were closed, and a compact fuel-efficient Ford sold in Europe was fast-tracked for release in the U.S. market (Hoffman, 2012). All of these changes were implemented before the change to a matrix organization structure and even before the full team of executives was in place. Certainly, many of the problems at Ford were endogenous. However, the steep rise in gasoline prices after Hurricane Katrina and a subsequent shift in demand away from sport utility vehicles was the exogenous shock that overcame the firm's inertia (Krisher, 2006). The content of the adaptation required at Ford was far-reaching and complex. But what can we say of the sequence of adaptation that was needed? In interviews with Ford executives, Hoffman (2012) found evidence of the organizational inertia that prevented the company from implementing necessary changes sooner. Therefore, by the time the firm chose to align with its external environment, it had suffered extensive drops in performance. Maneuverability, aligning with the external environment as quickly as possible, should have been the primary goal of its adaptation process. Ford had missed the shift in consumer sentiment towards greater fuel efficiency. The company's fuel-efficient product offerings paled in comparison to Japanese and European competitors, suggesting low coherence between the firm's routines for gas-guzzler production and growing demand for fuel efficiency. Was "strategy first" the right choice for a firm focused on maneuverability? Our simulation focused on a more limited set of changes than what Ford experienced; however, our results do show that, for downsizing firms, starting with a change in strategy leads to the quickest adaptation.

As of close of fiscal year 2011, the turnaround at Ford had been an unqualified success, with the firm posting net income of approximately USD 20 billion – despite the additional environmental shock of the global financial crisis in 2008. How much of that can be attributed to the sequence of implementation versus the content of change itself is not entirely clear. But the focus on strategy first did have quantifiable benefits in terms of product quality ratings and customer satisfaction surveys (Hoffman, 2012). Ford also benefited from increased goodwill for rejecting federal bailout money in 2009, but while this goodwill drove customers to dealerships, the company had to have cars that people actually wanted to buy to make a sale. The Ford example provides an understanding of the complex interplay between context and adaptation goals, content, and process.

Our study results confirm that sequence is an important factor in the appropriate implementation of adaptation. We cannot provide a one-size-fits-all sequence for organizational change (Pettigrew, 1990), but strategy first is a good heuristic. Firms may choose one sequence over another depending on the context of the shock and the goals of adaptation. Our results hold for firms whose context requires the specific archetypal shift we modeled. The appropriate sequence may be quite different if the firm's context requires different shifts in organizational configuration. So, unlike Alice, who doesn't care where she goes, organizations need to understand exactly where they are and where they want to go before they know which sequence of changes to undertake.

FUTURE RESEARCH

The canvas for future research for the proper sequence of organizational changes is broad. Here, environmental shock was the stimulus for change. Less dramatic reasons for organizational change include market shifts, new product or technology initiatives, and new regulatory regimes. Environments and organizations are changing continually. We examined the combination of strategy, structure, and resource allocation as the adaptive response. But organizational changes can also involve leadership, routines or capabilities, IT systems, coordination and control mechanisms, and incentives. With possible changes being both separate and in combination, the number of organizational configurations becomes quite large. Burton et al. (2011) discuss the complexity of change and argue that the competency loss due to misfits is substantial. Many other important research questions regarding the goals, sequencing, and outcomes of change need to be explored.

One next step is to begin with field studies of organizational change that go into greater depth than the illustrative Ford case used here. We did not investigate either alternative sequences of change at Ford or the full scope of the changes themselves. Field studies of organizational change with an emphasis on the choice of sequence and its efficacy are called for. Further, such studies could be analyzed at the micro level using agent-based simulation models such as SimVision™. A SimVision™ model could be constructed by using real-world data to investigate alternative change sequences in much the same way as we did in the present study.

Another approach is a multi-firm field study of organizational change using the methodology pioneered by Eisenhardt (1989). The independent variable could be the sequence of organizational change, moderators could be contextual variables or other controls, and the dependent variables could be the maneuverability, competence, and effectiveness performance measures that we have used here. Such studies would provide detailed micro data on the change process and its outcomes.

CONCLUSION

Our study results indicate that the sequence of organizational changes is an important determinant of the success of the post-shock adaptation process. There is not one optimal sequence of change; the choice of sequence is context dependent. An organization's goals for the adaptation process, as well as the content and direction of the desired change, determine what the best sequence option will be. Some goals may emphasize maneuverability or accomplishing a change as quickly as possible, others may focus on maintaining the greatest competence during the change process, and others may emphasize effectiveness. Our simulation experiments show that different implementation sequences create significant differences in the maneuverability, competence, and effectiveness of a firm's adaptive response to a shock in the external environment. The varying impact of implementation sequence on these three metrics highlights the importance of understanding the goals of the adaptation process before initiating the sequence of changes that comprise the transformation.

Our experiments modeled the reorientation from one organizational archetype to another. Our methodology, however, also allowed us to reverse our experiments yielding different results for the optimal sequence on our three measures. These results demonstrated the importance of the content and direction of change. For example, the best sequence is different for firms in the M-form from those in the U-form – an asymmetry. While our results do not allow us to prescribe a one-size-fits-all best sequence for the process of post-shock adaptation, the significant differences across sequences establish that this should be an important concern to management. Determining strategy first has long been an important principle in organization design (Chandler, 1962), and we find some evidence that this principle may be extended to implementation. If the time for analysis after an environmental shock is very short and management needs to make a quick decision, then initiating a change in strategy first appears to be a safe heuristic.

REFERENCES

Abbott A. 1988. Transcending general linear reality. *Sociological Theory* 6(2): 169-186.

Amburgey TL, Dacin T. 1994. As the left foot follows the right? The dynamics of strategic and structural change. *Academy of Management Journal* 37(6): 1427–1452.

Amburgey TL, Kelly D, Barnett WP. 1993. Resetting the clock: The dynamics of organizational change and failure. *Administrative Science Quarterly* 38: 51–73.

Amis J, Slack T, Hinings CR. 2004. The pace, sequence, and linearity of radical change. *Academy of Management Journal* 47(1): 15–39.

Armenakis AA, Bedeian AG. 1999. Organizational change: A review of theory and research in the 1990s. *Journal of Management* 25(3): 293–315.

Barnett WP, Carroll GR. 1995. Modeling internal organizational change. *Annual Review of Sociology* 21: 217–236.

Burton RM. 2003. Computational laboratories for organization science: Questions, validity and docking. *Computational and Mathematical Organization Theory* 9(1): 91-108.

Burton RM, Obel B, DeSanctis G. 2011. *Organizational Design: A Step-by-Step Approach*. Cambridge University Press, Cambridge, UK.

Carroll T, Burton R. 2000. Organizations and complexity: Searching for the edge of chaos. *Computational & Mathematical Organization Theory* 6(4): 319–337.

Chandler AD. 1962. *Strategy and Structure: Chapters in the History of the Industrial Enterprise*. Doubleday, New York, New York.

Davis JP, Eisenhardt KM, Bingham CB. 2007. Developing theory through simulation methods. *Academy of Management Review* 32(2): 480–499.

Donaldson L. 1995. *American Anti-Management Theories of Organization*. Cambridge University Press, Cambridge, UK.

Eisenhardt KM. 1989. Building theories from case study research. *Academy of Management Review* 14(4): 532–550.

Gersick CJ. 1991. Revolutionary change theories: A multilevel exploration of the punctuated equilibrium paradigm. *Academy of Management Review* 16(1): 10–36.

Greenwood R, Hinings CR. 1993. Understanding strategic change: The contribution of archetypes. *Academy of Management Journal* 36(5): 1052-1081.

Hoffman BG. 2012. *American Icon: Alan Mulally and the Fight to Save Ford Motor Company*. Crown Business, New York, New York.

Jin Y, Levitt RE, Kunz JC, Christiansen TR. 1995. The virtual design team: A computer simulation framework for studying organizational aspects of concurrent design. *Simulation* 64(3): 42–57.

Jin Y, Levitt RE. 1996. The virtual design team: A computational model of project organizations. *Computational & Mathematical Organization Theory* 2(3): 171–195.

Krisher T. 2006. Official says Ford caught off guard by rapid shift from trucks. *Pittsburgh Post-Gazette* 80(10): C-2.

Lawrence PR, Lorsch JW. 1967. *Organization and Environment*. Graduate School of Business Administration, Harvard University, Cambridge, MA.

Leana CR, Barry B. 2000. Stability and change as simultaneous experiences in organizational life. *Academy of Management Review* 25(4): 753–759.

Levitt B, March JG. 1988. Organizational learning. *Annual Review of Sociology* 14: 319–340.

Levitt RE. 2012. The Virtual Design Team: Designing project organizations as engineers design bridges. *Journal of Organization Design* 1(2): 14-41.

Levitt RE, Thomsen J, Christiansen TR, Kunz JC, Jin Y, Nass C. 1999. Simulating project work processes and organizations: Toward a micro-contingency theory of organizational design. *Management Science* 45(11): 1479–1495.

Long CP, Burton RM, Cardinal LB. 2002. Three controls are better than one: A computational model of complex control systems. *Computational & Mathematical Organization Theory* 8(3): 197–220.

March JG, Simon HA. 1958. Organizations. John Wiley & Sons, New York, New York.

Meyer AD. 1982. Adapting to environmental jolts. *Administrative Science Quarterly* 27(4): 515-537.

Miles RE, Snow CC. 1994. *Fit, Failure and the Hall of Fame*. Free Press, New York, New York.

Nelson RR, Winter SG. 1982. *An Evolutionary Theory of Economic Change*. Belknap, Cambridge, MA.

Nissen ME, Burton RM. 2011. Designing organizations for dynamic fit: System stability, maneuverability, and opportunity loss. *IEEE Transactions on Systems, Man, and Cybernetics–Part A: Systems and Humans* 41(3): 418–433.

Pettigrew AM. 1990. Longitudinal field research on change: Theory and practice. *Organization Science* 1(3): 267-292.

Pettigrew AM, Woodman RW, Cameron KS. 2001. Studying organizational change and development: Challenges for future research. *Academy of Management Journal* 44(4): 697–713.

Qian Y, Roland G, Xu C. 2006. Coordination and experimentation in M-Form and U-Form organizations. *Journal of Political Economy* 114(2): 366–402.

Romanelli E, Tushman ML. 1994. Organizational transformation as punctuated equilibrium: An empirical test. *Academy of Management Journal* 37(5): 1141–1166.

Sastry MA. 1997. Problems and paradoxes in a model of punctuated organizational change. *Administrative Science Quarterly* 42(2): 237–275.

Siggelkow N, Levinthal DA. 2003. Temporarily divide to conquer: Centralized, decentralized, and reintegrated organizational approaches to exploration and adaptation. *Organization Science* 14(6): 650–669.

Tushman ML, Romanelli E. 1985. Organizational evolution: A metamorphosis model of convergence and reallocation. *Research in Organizational Behavior* 7: 171–222.

Van de Ven AH, Poole MS. 1990. Methods for studying innovation development in the Minnesota Innovation Research Program. *Organization Science* 1(3): 313-335.

PETER JACK GALLO

Assistant Professor of Strategy and Entrepreneurship
College of Business, Creighton University
petergallo@creighton.edu

RICHARD M. BURTON

Professor of Strategy and Organization
Duke University
rmb2@duke.edu

APPENDIX

We use the SimVision™ project organization model to investigate the impact of different sequences of change. The order of post-shock adaptation is modeled by sequentially changing each of three key organizational elements. SimVision™ defines an organization by its various tasks and the aggregate characteristics of the workers assigned to those tasks. SimVision™ is a laboratory to simulate the information-processing demands on time-constrained individuals and is well suited to test the impact of changes in organizational activity on the adaptation process. By manipulating the workflow design, task variables, and worker parameter values, it is possible to create alternatives in strategy, structure, and resource allocation within the project organization. In our research design, two archetypal organizational configurations are modeled, and the variety of sequences an organization can follow when transforming from one archetype to another are simulated.

The model in this study consists of an organization of agents (employees or managers), project tasks, and successor links. Project tasks define the work done by the organization, while the successor links dictate the order in which the tasks are accomplished. In the graphical interpretations of the simulation model, tasks are designated as rectangular boxes, while successor links are designated with solid arrows. Agents are assigned to individual or multiple tasks; an agent assigned to other agents represents a manager. Agents are represented graphically with a human icon, and assignments are designated using solid arrows. By manipulating the design of these three elements, we create a simple virtual organization and model how it transforms from one archetypal configuration of organizational activities to another. In our study, the focus is the actual dynamics of implementing the change. SimVision™ is chosen as the modeling software because it allows for the direct manipulation of structure, strategy, and resource allocation.

All of the simulation experiments start with the initial organizational configuration depicted in Figure A1. This initial configuration is described as the balanced undiversified M-form archetype. The simulation proceeds to model changes in strategy, structure, and resource allocation that result in the final organizational configuration seen in Figure A2. This configuration is described as the unbalanced diversified U-form archetype. The changes in the organization are accomplished by changing the elements of the SimVision™ model; a detailed description of those changes follows.

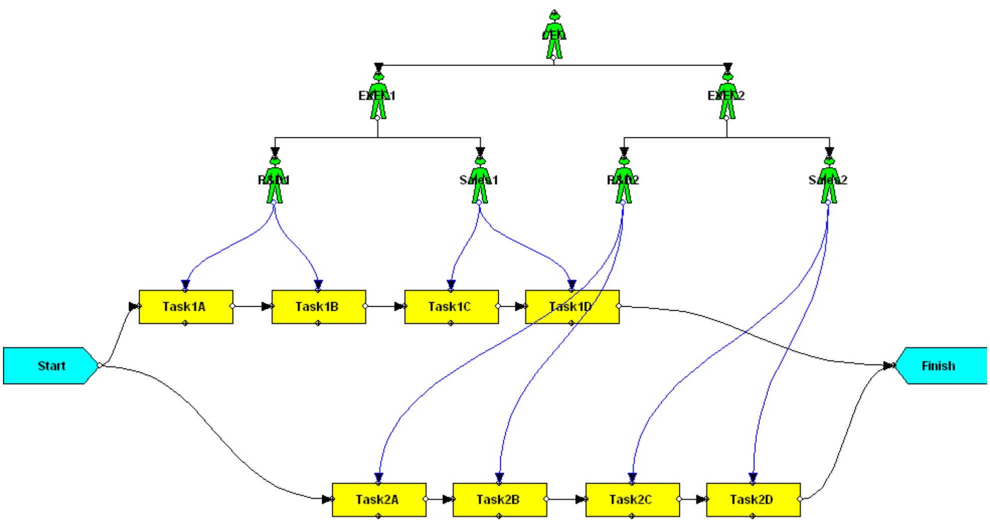

Fig. A1. Initial Organizational Configuration

Strategy: The initial configuration is described as undiversified even though Figure A1 shows two product lines. It might be better to describe the initial configuration as "under-diversified" in relation to the final configuration. The change in strategy being modeled in the experiments is a doubling of product lines from two to four. Each product line is made up of four tasks labeled A, B, C, and D. The property settings for each task are set to identical values and remain unchanged throughout the simulation experiments. For example, work volume sets the “work type” property for all tasks, and the value of work volume is set to 50 hours. Work volume represents the total quantity of work required to complete the task, but the duration of the task will vary depending on how many employees are assigned to a given task. The value of 50 hours remains unchanged throughout the experimental manipulations. The changes in strategy are introduced simply by the addition of tasks 3A-D and 4A-D shown in Figure A2. These tasks have the same property settings as tasks 1A-D and 2A-D.

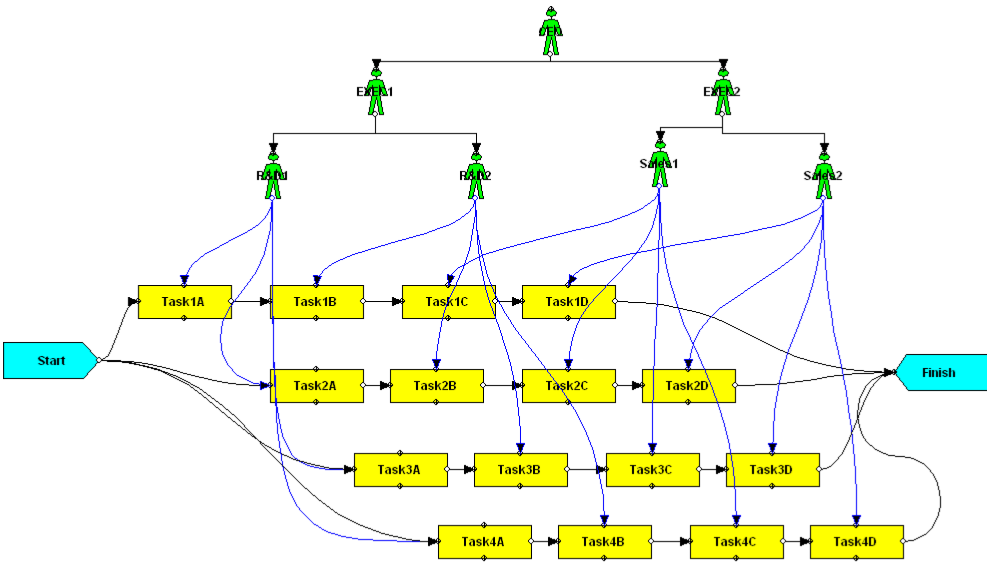

Fig. A2. Final Organizational Configuration

Structure: The change in structure modeled in our simulations is a change from the M-form to the U-form. Figure A1, depicting the initial organizational configuration, clearly represents a M-form structure. The structure of the firm is determined by the placement and positioning of the assignment links that assign positions to individual tasks, as well as by the supervision links that demonstrate the hierarchy of the organization. Figure A1 shows that only positions supervised by EXEC1 are assigned to tasks 1A-D; likewise, only positions supervised by EXEC2 are assigned to tasks 2A-D. Therefore, the product outputs of tasks 1A-D are the responsibility of one singular division, and a separate division is responsible for the products of tasks 2A-D. The change in structure is accomplished by reorganizing the assignment and supervision links to create a U-form organization structure. This U-form structure is present in Figure A2, but for the sake of visual clarity it is helpful to look at the change in structure before the change in strategy is introduced. Figure A3 is the resulting organizational configuration when the change sequence starts with a change in structure.

In Figure A3, note the change in supervisory links. EXEC1 now supervises both R&D 1 and R&D 2 positions, while EXEC2 supervises both sales positions. The assignment links have also changed to create the U-form structure. Each position is now responsible for a given task across all product lines. R&D 1 works on both task 1A and 2A, and R&D 2 works on tasks 1B and 2B. These changes create a functional orientation, where units work on identical functions across the various product lines. These changes in assignment and supervision links are the only manipulations used to change the organization from M-form to U-form. All task properties and person properties remain unchanged.

Resource Allocation: In Figure A1, seven person icons represent all of the human resources in the simulated firm. In SimVision™, the FTE (full-time employee) property setting allows for values both less than and greater than one. This helps in modeling part-time employees as well as modeling several similar employees with a single graphical icon. In the initial organizational configuration of Figure A1, the FTE property is set to six FTEs each for both

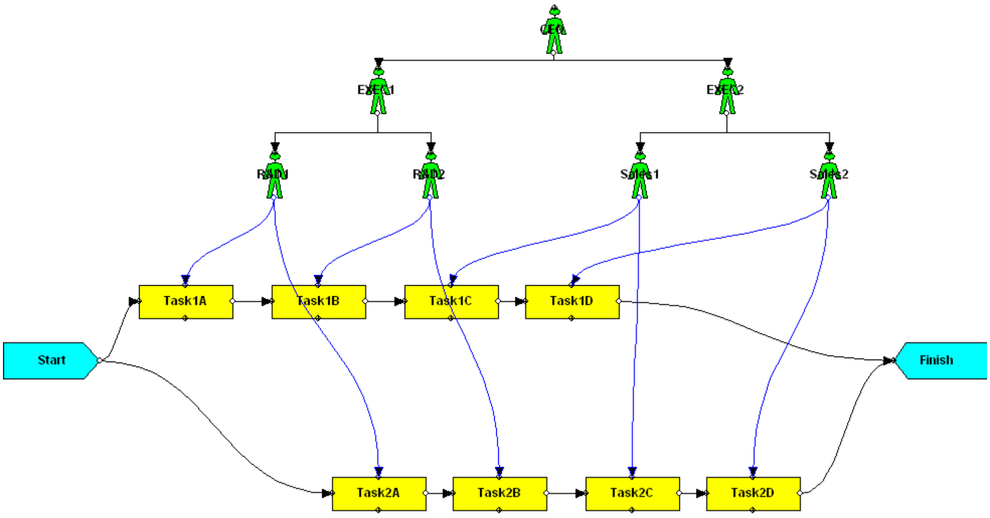

Fig. A3. U-Form Structure (Change Structure First)

R&D icons and both sales icons. Similarly, both EXEC1 and EXEC2's FTE property is set to a value of three. The CEO's FTE setting is set to a value of one. With these settings, the total human resources of the firm are allocated equally across the two business units. Each unit has three executives overseeing the work of twelve employees equally distributed between R&D and sales. All of the other properties assigned to persons remain unchanged throughout the simulation experiments.

Shifting the FTE settings of the person icons simulates the change in resource allocation; the CEO person property settings remain unchanged throughout. In Figure A2, the positions of the person icons have changed but so have the values of the FTE property. Unfortunately, the change in FTE settings is not represented graphically. The final organizational configuration is described as unbalanced and, in fact, the later stages of the process now have twice as many human resources assigned as the earlier stages. EXEC2's FTE is now set to a value of four, while EXEC1's FTE has been reduced to two. Likewise, both sales icons' FTE property is set to a value of eight while the FTE setting for both R&D persons is reduced to a value of four. Therefore, the final organizational configuration has two executives overseeing the work of eight employees on the eight A and B tasks of the four product lines. Four executives and sixteen employees oversee the C and D tasks of these same product lines. Twice as many human resources are dedicated to the later stages of the product line than to the earlier stages.

Sequencing

The changes to strategy, structure, and resource allocation can now be applied to the initial organizational configuration in different sequences to measure the effect of sequence on the adaptation process. As mentioned in the results section, there are a total of six possible sequences when only three organizational elements are being changed. Each sequence follows the organization as it transforms through four organizational configurations. To illustrate this point, let us use the Structure→Resource Allocation→Strategy sequence as an example. The simulation starts with the initial configuration depicted in Figure A1. The first element changed is the structure, and the organization is now in the configuration represented in Figure A3. The third configuration is created by the next change, in this case the introduction of an unbalanced resource allocation. Recall that this change is created by a change in FTE settings and cannot be seen graphically. Finally, the strategy is changed and the organization now enters its fourth and final configuration as seen in Figure A2.

Each sequence is modeled by simulating the organization as it runs through the four configurations that represent the sequence. The SimVision™ software allows for the creation of projects, and these projects can be linked together with successor links. Therefore, by creating all the organizational configurations represented by a sequence and then linking these configurations together in the appropriate order we can simulate the adaptation process. The simulation output gives us details on the total duration of the simulation – that is, how long it took the organization to cycle through all four of the organizational configurations that represent a given change sequence as well as the total work volume accomplished. These two outputs are the performance metrics presented in Table 1.