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This paper examines organizational change programs across aviation, healthcare, and financial services sectors. Based on the analysis of three key programs, a theoretical model, which could be used to describe the state of any organizational change program, is presented. This model is called the STL Model and is represented by three mutually perpendicular axes: scalability, transferability, and longevity. In simplest terms, scalability refers to "volume;" greater the volume of users of, or participants in, a particular change program, the greater the scalability of that change program. Transferability refers to the number of user-groups, whether within a specific discipline or outside. Longevity is the measure of how long a particular change program is in operation or existence. Although longevity alone does not necessitate progress along the scalability and transferability axes, it does provide an opportunity for improved scalability and transferability. It is hypothesized that certain factors, called "influence vectors" could be managed to improve the overall sustainability of organizational change programs.

Background

Literature on organizational learning underscores the importance of systems thinking in designing and managing change efforts (cf. Senge, 1990; Senge, Kleiner, Roberts, Ross, and Smith, 1994; Senge, Kleiner, Roberts, Ross, Roth, & Smith, 1999). However, studies addressing the difficulties in scaling "n of 1" type innovations within an organization or across multiple organizations have been limited.

Three examples, one from aviation, one from health care, and one from financial services, are presented in the following section. These examples illustrate specific "n of 1" innovations that the research team has reported in previous research. Such innovations or success stories abound in several industry segments, but most of them never scale high enough for organization-wide adoption. In this paper, a theoretical model—called the STL Model—is presented as a means to characterize the progress of change programs in terms of scalability, transferability, and longevity and also to present the role of "influence vectors" in transforming a change program into a lasting, institutionalized cultural change.

Examples from Three Distinct Industries

Example 1: Application of the Concept Alignment Process in aviation maintenance

The Concept Alignment Process (CAP) was first adopted by the subject aviation department's flight crew in 1995 and subsequently customized by the maintenance department to suit their needs. CAP is different from most of the Maintenance Resource Management (MRM) programs because it focuses on a behavioral change rather than an attitudinal change. This program illustrates that an organization need not change everyone's safety attitude before expecting a change in anyone's behavior. CAP expects all employees to change their behavior and follow a prearranged process. Therefore, it does not suffer from the limitations of the first three generations of MRM programs: limited success in achieving behavioral changes, changes lasted for six to twelve months after the training, and participants' attitudes toward the program declined over time (cf. Taylor & Christensen, 1998; Taylor & Patankar, 2001).

Patankar and Taylor (1999) reported that not all of the technicians in this organization practiced CAP to the same extent. For example, some of them understood the basic protocol, but hesitated to challenge another person's concept or to seek validation. Only a few individuals were observed to be practicing CAP consistently and to its full potential (challenging concepts, seeking validation, identifying causes for ambiguity in information, and implementing appropriate structural/procedural changes so that the ambiguities are minimized). Patankar and Taylor also observed that as the skeptics used the process, they understood it more clearly; and as their success in effecting organizational changes grew, their trust in the process grew. Gradually, they were becoming believers. Hence, this company was able to cause an attitudinal change through a behavioral change, rather than the other way around (as attempted in the previous three generations of MRM programs).

Example 2: Collaborative Rounds—An Interdisciplinary Innovation in the Post-surgical Care of Open-heart Surgery Patients.

Caring for open-heart surgery patients is a socially and technically complex endeavor. Surgeons, therapists, nurses, pharmacists, social workers, and many other disciplines must coordinate their assessments and actions with one another, and with patients and their families. Depending on treatment needs, up to fifteen different disciplines may independently gather information from the patient on any given day (much of it is redundant), develop a care plan, and enter the plan into the patient's medical chart. The medical chart is typically the primary means of coordinating the thoughts and actions of all care providers working with the patient. Yet, the written record is an imperfect means of coordinating activity; informational gaps, ambiguous data entry, changes in patient status and other issues routinely compel care providers to seek or provide clarifying information in order to fit together the patient's total care plan. This approach is inefficient and prone to oversights and conflicting actions based on misunderstandings of the patient's situation and uncertainty about the overall plan of care.

In 1999, clinicians concerned with these problems at an acute care hospital began re-thinking the post-surgical care processes for open-heart surgery patients. These care providers, eventually known as the cardiac surgery team, decided that altering the patterns of interaction and communication would be integral to improving the processes of care for their patients. They decided to collaborate, to bring all disciplines together at the same time each morning, and to partner with patients and their families in assessment and care planning (cf. Uhlig, Nason, Camelio, Kendall, & Brown, 2002).

Adapting team briefing and debriefing strategies from the air transportation industry, the team achieved significant reduction in operative morbidity and mortality, as well as substantial gains in staff and patient satisfaction. An important feature of the Concord Collaborative Rounds model was the deliberate capture, through debriefing, of "systemic glitches"—deviations from intention (errors) that could support identification, analysis and intervention in hazards and error-provoking conditions. Despite significant reduction in operative morbidity and mortality and national recognition of this change in practice as an important safety innovation, this innovation was not sustained by the organization following a change in physician leadership.

Example 3: A Change Program in Financial Services

In 1999, the COO and CIO of the fixed-income division of a major investment firm recognized that they were reaching the limits of their current model of operations. Along with the CEO and other senior executives, they had started a long-term organizational change process in the early 1990's. When they began, the division had just been embarrassed by a major error (and resulting loss of business) that occurred when an investment professional took "too much risk." A new CEO was brought in, and he decided to take significant steps to "clean up the mess." The "mess" involved radical decentralization of the professionals, to the point where (reportedly) the division had "120 professionals and 120 Information Technology (IT) systems." They also had that many approaches to investment decision-making.

The new CEO began by recruiting two key managers from the professional side to create more coherence across the unit. They created an approach called TAM ("Targeted Active Decision-Making") that placed boundaries, or limits, on the range of acceptable risks for investment decision-making. This template was vigorously enforced and reduced variations in professional practice. Next, the CEO chartered (and the COO led) a redesign of all workflows related to investment decision-making, using a reengineering approach. This led to improved productivity and efficiency, on the one hand, and to strengthening the lines of business (or "desks") on the other. By 1998, the CEO was promoting the third phase of the change—reconciling the IT systems, which had remained untouched throughout the preceding phases. The IT initiative was based on rationalizing the infrastructure; a key mechanism was the concept, and principle, of "reusable components." The concept was simple but hard to implement. IT project teams, as well as the overall IT management team, were tasked with transferring and re-using "good" components from one team, or line of business, to another. This was hard for several reasons: it was unfamiliar; it represented a significant cultural change for the IT managers, their teams, and the lines of business they supported; and it meant overcoming the idea that every line of business is unique—that is, one cannot (by definition) re-use a component built for the Bonds desk in a software tool for the Money Market desk.

The change effort began with an action science-based (cf. Argyris, Putman, & Smith, 1985; Argyris, 1992) approach called action learning (or "Active Learning" as it was called by the team), using After Action Reviews of situations and stories from projects. The research team, led by Dr. Bigda-Peyton, used an appreciative inquiry orientation, in which they began with successes, mapped out the actions and operating assumptions that led to the successes, and then (and only then) looked at "unintended consequence." (Even then, they began with unintended positive consequences). From this starting point, they constructed an "As Is" and a "To Be" that were, in effect, a picture of the current work culture and a more desirable (and effective) work culture that they could create together, and with their business counterparts. For instance, they agreed that a key driver of their current culture was the "hero model"—relying on individual experts to solve critical problems (Bigda-Peyton & Galor, 1999). They further agreed that they wanted to create a culture driven by "shared accountability with individual excellence." This and other, similar drivers became the metrics by which they evaluated the change program.

The second phase of the intervention used peer reviews, in-action problem-solving, and surfacing and using tacit knowledge of the business landscape and the software development process. The research team made a breakthrough on the re-usable component issue; the team got a major win and gained significant credibility with the business side as a result. The lead technology architect commented, "I didn't know you could solve a technology problem with a model like this—we didn't learn this in software engineering school!" The team also used the method to solve other key problems, such as the departure of the lead architect and how to facilitate a project to solve the problems of a desk that were notorious for "broken" processes and uneven results. The team used the approaches to make significant strides in all of these areas.

In the third phase of the effort, the team engaged the business side as well as their immediate allies and partners in the central IT organization. They also did a parallel project with the central Risk and Knowledge Management group. In each case, the work was well received; but after one "handshake" project, the effort declined. The initiative subsided in 2002, after measurable and significant gains in innovation, operations effectiveness, customer satisfaction, and culture shift. The specific reasons for the erosion of this change program were never formally investigated. (cf. Bigda-Peyton, 2002).

These examples illustrate the following: (a) change programs are heavily influenced by their specific champions and (b) the resistance to change among field personnel could go as far as a high degree of professional rejection of persons championing the change. However, it is not clear what specific strategies change agents need to employ in the design and implementation of their programs in order to increase the probability of institutionalization of those programs. Additionally, the specific "incubation time" should be identified for change programs before their effects are evaluated. Although similarities and differences in terms of professional, national, and organizational cultures among physicians, pilots, and aircraft mechanics have been reported in past studies (Helmreich & Merritt, 1998; Taylor & Patankar, 1999), the specific roles of such cultures in influencing the propagation of an organizational change program have not been examined.

The STL Model: Characterization and Analysis of Organizational Change Programs

Although only three specific cases are described above, the underlying problems of scalability, transferability, and longevity seem to be consistent in many similar cases. These problems are robust—they seem to exist across sectors and methods of intervention. Thus, the researchers believe that there must be some fundamental issues that need to be addressed. Therefore, it appears that the problems of scalability (S), transferability (T), and longevity (L) could be framed in the form of a three-dimensional model—called the STL Model (see Figure 1)—that could then be used to assess the success of a previous intervention (retrospective analysis) or to develop specific strategies to ensure sustainability of future or planned change programs (prospective analysis).

The STL Model could allow—for the first time—researchers, practitioners, and policy makers to view change programs in terms of three interrelated dimensions. By bringing scalability, transferability, and longevity perspectives together, one could begin to formulate a fresh and integrated view of the assessment of change. Further, it is postulated that this view includes new micro-level (individual or small-group) dimensions that could promote the understanding of the dynamics of knowledge transfer/flow during the progression of a change program and the effect such flows, as well as people or "nodes in a network" that are responsible for knowledge transfer, might have on the overall success of the change program. Finally, the STL Model could enable tracking of the factors

contributing to the dissemination (or lack thereof) of local innovations on a wider scale. In turn, an enhanced perspective on the assessment of organizational change could enable the promotion of the spread of innovation and, in part, help address the fundamental problem of transfer of innovation.

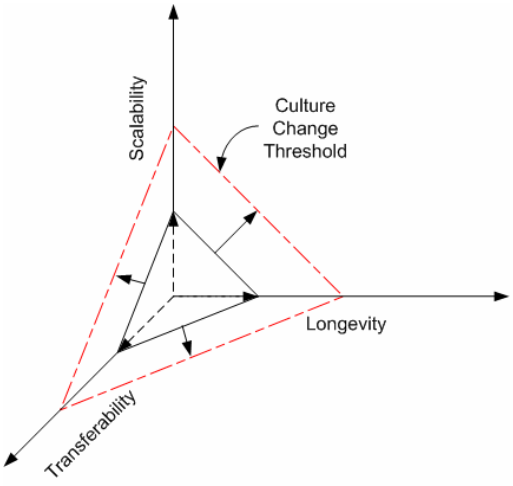

Figure 1. *The STL Model*

The Three Axes

Scalability, transferability, and longevity are three inter-related dimensions that could be expressed along three mutually perpendicular axes. Clearly, a change in one of the dimensions could affect the other two. However, it is important to note that a certain degree of progress along all three dimensions is necessary for a change program to achieve the desired level of sustainability. Therefore, one could argue that scalability, transferability, and longevity collectively define the sustainability of a change program.

In simplest terms, scalability refers to "volume." The greater the volume of users of, or participants in, a particular change program, the greater the scalability of that change program. For measurement, researchers could count the number of users and estimate the program's scalability.

Transferability refers to the number of different user-groups, whether within or between disciplines. For example, the transferability of a pre- and post-task briefing process could be measured in terms of the number of work groups using the process. As the number of work groups increases, the transferability increases. If the transferability goes beyond the traditional boundaries of an organizational unit, the change could be expressed in terms of orders of magnitude—when the briefing process that was first used in the flight operations department is adopted by the maintenance department, there is a jump in transferability by one order of magnitude. If the same process is adopted by another department, the transferability of that process will undergo a jump by another order of magnitude. A multi-order transferability is possible when that process is adopted by an entirely different industry such as healthcare. Obviously, as the transferability increases, so does the scalability; however, change along this dimension is most difficult.

Longevity is simply the measure of how long a particular change program has been in existence. Longevity alone does not necessitate progress along scalability and transferability because organizational silos could keep a certain change program alive and hidden for a long time. Nonetheless, longevity does provide an opportunity for improved scalability and transferability. From another perspective, a certain degree of longevity is essential for an innovation to be visible outside of a particular organizational unit. Furthermore, for a bi-directional transfer to take place, the innovation has to last in the originating organization long enough for the new organization to adopt it, demonstrate the advantages, and report unique, applicable findings back to the original organization.

The Influence Vectors

The influence vectors are specific individual or organizational factors such as participant attitudes, management tenure, regulatory requirements, labor-management relationship, etc. that have a significant influence on the lifecycle of a particular change program. Such factors are called "vectors" because they have a magnitude and a direction: magnitude is quantified via opinion or attitude scales, or by quantitative archival evidence; direction is defined by the effect of that factor on the change program—if the effect is beneficial, the direction is positive. Also, it must be noted that a particular influence vector is likely to impact all three dimensions, and its influence may vary. For example, the tenure of a manager, measured in terms of years, may have a positive influence on the change program and thereby boost its longevity. The positive effects of such longevity (linear scale) might actually cause exponential changes on the transferability and scalability dimensions. Survey questionnaires and archival data analysis could be used to determine the key influence vectors in a particular industry segment. It is then plausible that influence vectors could be managed to drive specific change programs to their intended level of institutionalization.

The Culture Change Threshold

Differences in national, organizational, and professional cultures in aviation and health care have been reported (Helmreich & Merritt, 1998; Taylor & Patankar, 1999). Similarly, the role of organizational cultures in safety-critical industries has also been studied extensively (Reason, 1997; Westrum & Adamski, 1999). Largely, these studies have focused on describing the concept of culture or safety culture. Concurrently, many organizations have elected to implement system-wide changes; however, because the current state of knowledge mainly addresses the definition of culture, it is not clear when such organizational changes should be declared successful or when exactly one could declare that there has been a cultural change. By measuring a particular change program along three interrelated dimensions, the STL Model attempts to express the state of the change accomplished by the specific change program. Based on the literature that describes failures of various change programs, one could postulate that cultural change, as opposed to climatic change, is a long-term change in behaviors as well as attitudes of the individuals and it changes organizational structures, processes, and policies. Such a change eventually becomes independent of the initiating champion. Therefore, in all measures, a cultural change is not likely to relapse. If the state of a particular change program could be described in terms of scalability (the number of individuals using it), transferability (the number of organizational units using it), and longevity (the total years that it has been in existence), one may be able to define a three-dimensional threshold beyond which the change could be considered long-term enough to be commonly accepted as a cultural change.

Conclusion and Future Directions

In order to thoroughly test the STL Model, both retrospective as well as prospective analyses are essential. In the retrospective mode, the characteristics of previously implemented change programs—their scalability, transferability, and longevity need to be quantified. Also, it would be imperative to study the influence vectors as well as knowledge transfer nodes, both positive as well as negative, that affected the final status of the change program. It is important to conduct prospective analysis to determine what factors the industry partners believe would make a significant difference in the transfer of future innovations. Also, the prospective analysis allows for a critical window of opportunity to facilitate the transfer of innovations across organizational units or industry sectors.

The following hypotheses need to be tested:

- Hypothesis # 1: The state of a change program can be defined in terms of the three macro-level dimensions of the STL Model: scalability, transferability, and longevity.
  - Secondary Hypothesis: For each dimension of the STL Model, there are micro-level influence vectors that have either a positive or a negative effect on the development of the corresponding dimension.
- Hypothesis # 2: Transferability of innovation can be engineered across organizational units or disciplinary boundaries through appropriate control of the influence vectors.
  - Secondary Hypothesis: Transfer of innovation is influenced by nodes in organizational networks and the presence of a learning culture.

Both hypotheses, and their associated secondary hypotheses, could be tested in a cycle of data collection, analysis, and testing as the research progresses through three possible phases—single case in each sector, three-to-five cases in each sector, and seven or more cases in each sector.

Kramer and Sabin (2003) describe three conceptual phases of organizational learning (generating new knowledge, creating organizational memory, and embedding the learning) and present practical activities that professionals can use to promote learning to change organizations and influence key outcomes. Organizational learning techniques such as the After Action Review (AAR) could be employed to identify lessons learned from critical experiences (cf. Baird, Holland, & Deacon, 1999). Learning impediments described by research participants need be analyzed using a model developed by Shaw and Perkins (1992) that categorizes learning barriers in terms of insufficient capacities to reflect on experiences, disseminate knowledge, and/or take appropriate action. The Dimensions of the Learning Organization Questionnaire (DLOQ) by Marsick and Watkins (2003) could be used to assess the cultures of participating organizations. Empirical evidence demonstrates that the DLOQ measures seven dimensions (continuous learning, inquiry and dialog, team learning, empowerment, embedded system, system connection, strategic leadership) that impact learning, sustain change, and drive improved performance (Yang, Watkins, & Marsick, 2004).

In summary, the STL Model seems to offer a plausible means to characterize organizational change programs. Empirical research in multiple industries could be used to test the validity of this model.

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