

# Dynamics of Innovation Implementation and Organizational Performance in Mental Health Services<sup>1</sup>

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## **Abstract**

*While organizational variables play an important role in the adoption and implementation of evidence based practices in mental health, most researchers have assumed that successful implementation leads to improving organizational performance. Yet existing organizational theory suggests that implementation differs by organizational characteristics, and certain configurations can lower organizational performance. This study shows how implementation of evidence based practice impacts organizational performance. Specifically, we present a system dynamics simulation model of implementation and organizational performance based on existing theory, system dynamics research, and key informant interviews. By varying organizational characteristics we learn how implementation affects organizational performance, and then explain these effects through subsequent behavioral analysis. These analyses led to a simplification of the theory and model for understanding performance following the implementation of evidence based practice. The theory implies that benefits from evidence-based practice depend on how fast managers can implement the innovation relative to the quality improvement process.*

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<sup>1</sup> The research and preparation of this paper was supported in part by the Center for Mental Health Services Research, George Warren Brown School of Social Work, Washington University; through an award from the National Institute of Mental Health (P30 MH068579). Paper presented at the International System Dynamics Conference July 29-August 2, 2007 in Boston, MA.

**Keywords:** innovation implementation, mental health services, evidence-based practice

## 1. Introduction

How does evidence-based practice help mental health agencies improve performance? Mental health agencies have long fought a battle to defend the legitimacy of mental health treatment and recovery through an appeal to empirical research and evaluation of outcomes. The current version of this struggle for legitimacy is the evidence-based practice (EBP) movement, based on evidence-based medicine, defined as “the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients” (Sackett et al. 1996). The term has now spread to nursing, teaching, management, and mental health, where it is claimed that EBP has the potential to improve the quality of care, contain costs, and shape better policies (Gonzales, Ringeisen, and Chambers 2002).

Despite the EBP potential, gaps persist and researchers continue pushing for more studies to understand the implementation processes of EBP (Sliverman, Kurtines, and Hoagwood 2004; Proctor 2004; Gonzales, Ringeisen, and Chambers 2002). This research has recognized the importance of organizational barriers to implementing EBP (Bartels et al. 2002; Gonzales, Ringeisen, and Chambers 2002; Rosen 1994; Hoagwood et al. 2001; Newman, Papadopoulous, and Sigsworth 1998; Rosenheck 2001; Schoenwald and Hoagwood 2001). However, most researchers have assumed that once implemented, these innovations will benefit the agency and thereby improve organizational performance.

Developing a theoretical understanding of how implementing EBP improves performance is critical to helping mental health organizations plan and manage innovation and organizational change. It also helps us understand when it is better to focus on building the capacity of organizations as opposed to implementing evidence-based practices. In this paper, we address this gap by presenting results from a simulation model of implementation and organizational performance. The model is based on previous system dynamics models of organizational change, organizational theory, and key informant interviews with administrators of mental health services. We then use the model of implementation and organizational performance to answer the following two questions:

1. Under what initial conditions does organizational performance improve as a consequence of implementing evidence based practice innovations?
2. Which mechanisms account for the organizational performance trajectories within each region of performance change?

In addressing these questions we develop insights into the dynamics confronting managers and policy makers on an important problem in mental health services research. We also demonstrate the feasibility and benefits of integrating and extending existing system dynamics models to develop and test social theories.

## 2. Background

Innovations with the potential to improve both service outcomes and legitimacy are especially appealing to mental health and other social service organizations. Mental health service organizations, relative to other industries such as health care or manufacturing, generally

have difficulties demonstrating outcomes and benefits of their services. These difficulties make mental health service organizations seek to protect their funding by ensuring legitimacy with stakeholders. Traditionally, this legitimacy was values-based and defended ideologically. Innovations that help demonstrate the scientific merits of mental health interventions will enhance the organization's legitimacy with stakeholders and reduce the likelihood of organizational failure. Innovations such as EBP, therefore, hold the promise of maintaining organizational survival in increasingly competitive sectors and improving organizational performance. Accordingly, mental health organizations have strong incentives to adopt and implement EBP.

At the same time, adopting and implementing EBP can set in motion a new set of internal and external organizational demands that can threaten performance. For example, the epitome of successful implementation of EBP might be when the organizational culture is oriented toward ensuring the highest quality of evidence-based services. Yet, this very commitment to a way of doing things, as well as its demonstrated success, will make it more difficult for the organization to adapt to new demands—an example of organizational inertia. Externally, increased quality of services from successful implementation of EBP is likely to increase the demand for services. This can push the agency past its capacity and force staff to restrict access to services or sacrifice quality, either of which will undermine subsequent organizational performance. The special appeal of EBP combined with delayed effects creates a situation in which a service organization could enter a vicious cycle of increasing implementation and declining performance, eventually terminating with organizational failure.

While barriers to implementing EBP are well-recognized (Bartels et al. 2002; Gonzales, Ringeisen, and Chambers 2002; Rosen 1994; Hoagwood et al. 2001; Newman, Papadopoulous, and Sigsworth 1998; Rosenheck 2001; Schoenwald and Hoagwood 2001), no studies have considered the impact of implementing EBP on organizational performance. That is, scholars have largely assumed that implementing EBP will lead to improved organizational performance. Yet, for some organizations, EBP may be a “poison fruit” for organizational performance. Developing a theoretical understanding of how this can happen is critical to helping organizations plan and manage the innovation associated with implementing EBP. In this paper, we present a dynamic theory of adopting and implementing EBP, and evaluate conditions under which implementation of EBP leads to higher and lower levels of organizational performance as well as conditions resulting in no change.

### *2.1 Innovation Implementation*

Organizational scholars have long known about the difficulty organizations face with implementing new ideas (Zaltman, Duncan, and Holbek 1973). The difficulty of getting empirically supported treatments into practice has drawn attention to four different social processes: diffusion, dissemination, adoption, and implementation. Diffusion refers to the sharing of information through ad-hoc mechanisms (e.g., word of mouth) and is contrasted with dissemination, which is a deliberate strategy to transmit information from one group to another (Sliverman, Kurtines, and Hoagwood 2004). Adoption refers to the decision to use an innovation, while implementation refers to the process of its actual use (Klein and Knight 2005; Rogers 1995). Less attention has been paid to re-examination of adoption decisions and the process of discontinuing a practice, which has led to a pro-innovation bias in diffusion of innovation research (Rogers 1995). In this study, our focus is on implementation and its impact on organizational performance.

## 2.2 *Organizational Efficiency, Effectiveness, and Performance*

We are concerned with the situation in which an organization adopts and implements evidence-based practices because it wants to improve some aspect of performance; for example, to increase legitimacy with stakeholders, improve client outcomes, or provide services at a lower cost. To capture this, we draw on Pfeffer and Salancik's (1978) distinction between organizational efficiency and organizational effectiveness.

Organizational efficiency refers to how well the organization pursues its activities. Efficiency is internal to the organization and determined by how much the organization produces. For mental health agencies, efficiency includes finances, services, and utilization (Ozcan, Shukla, and Tyler 1997). It can also include client outcomes, which may vary from client satisfaction to changes in severity of symptoms or behavior. Many questions about quality of services are, in fact, questions about efficiency in delivering services. For example, the emphasis in Total Quality Management (TQM) is on reducing the number of defects per unit of output, not on changing what is produced (Deming 1986).

Organizational effectiveness refers to whether or not the activities are seen as appropriate by stakeholders. The basis of the criteria for evaluating effectiveness is *external* to the organization and depends on the environment. Institutional environments can be characterized along two dimensions: technical and institutional (Scott and Meyer 1991). In technical environments, organizations are rewarded for their outputs. In institutional environments, organizations are rewarded for their conformity to rules, regulations, or organizational form. Organizations can face demands from technical environments, institutional environments, or both. Public utilities, banks, and hospitals face strong demands from both technical and institutional environments, whereas manufacturing companies experience strong demands from technical environments, but weaker demands from institutional environments (Scott and Meyer 1991).

Mental health organizations are often characterized as facing strong demands from institutional environments, but weak demands from technical environments (Scott and Meyer 1991; Powell 1991; Ozcan, Shukla, and Tyler 1997). That is, mental health organizations have historically been judged more by the organization's credibility and therapists' conformity to expectations about how mental health services should be organized than by measurable clinical outcomes. Interventions are tolerated and even promoted in spite of weak, lacking, or even harmful scientific evidence.

Within this framework, organizations can have any combination of efficiency and effectiveness (Ostroff and Schmitt 1993; Ozcan, Shukla, and Tyler 1997). There are organizations efficient at producing unwanted goods or services, just as there are organizations inefficient at producing highly valued goods or services. The best organizations do both; that is, they are known for both producing services that are effective and for doing so with great efficiency. Likewise, there are organizations that do neither, and yet they continue to survive as permanently failing organizations (Meyer and Zucker 1989). Following Sastry (1997), we consider organizational performance as the product of organizational efficiency and effectiveness.

Figure 1 illustrates this framework by carving the phase space of organizational efficiency and effectiveness into four quadrants: organizational excellence, organizational inefficiency, organizational ineffectiveness, and organizational failure. Organizational excellence involves the efficient production of highly valued goods or services. Organizational inefficiency involves organizations inefficiently producing highly valued goods or services. Organizational

ineffectiveness is the efficient production of unnecessary or inappropriate goods or services; for example, a court mandated counseling program that delivers low cost services and makes a profit, but only provides its clients with an increased awareness of their problem, as opposed to treatment, which is what the courts, probation officers, and community would expect. Organizations are failing to the extent that they are inefficient at producing unnecessary or inappropriate goods and services.

Figure 1 Organizational type by effectiveness and efficiency

<i>Effectiveness</i>	High	Organizational inefficiency	Organizational excellence
	Low	Organizational failure	Organizational ineffectiveness
		Low	High

*Efficiency*

2.3 *Adopting and Implementing Evidence-based Practice*

Evidence-based practice changes the basis for evaluating performance by changing the environmental demands placed on organizations, from primarily institutional to both institutional and technical. Specifically, instead of judging interventions based on practitioners’ beliefs or intuition or scientifically unsupportable theories of human behavior, interventions are only considered acceptable if they meet the “gold standard” of demonstrating clinical benefits to clients that are equal to or exceed the benefits of other interventions. What is radical in this shift is not the use of science to inform practice decisions; rather, it is what happens to the organization that must now face technical demands in addition to institutional demands about how to conduct business. For the mental health organization adopting EBP for treatment decisions, it means that external and changing scientific standards now determine what kinds of services should be provided and how. Organizational performance can decline if agencies are unable to adapt to these changing demands.

2.4 *Organizational Inertia*

Organizational inertia represents existing monetary and psychological investments by the organization—a sunk cost in the status quo (Hannan and Freeman 1984). These investments include existing policies and procedures, technology, personal relationships and loyalties, political structures within the organization, organizational culture, and ties to other organizations and networks. The ability of an organization to produce outputs reliably depends on institutionalization and enactment of standardized routines; that is, inertia (Hannan and Freeman

1984). This has important implications for mental health organizations and their organizational ecology.

A central question from evolutionary-ecological organizational theories is whether or not organizations can learn and adapt to their environments as fast as the environment is changing (Hannan and Freeman 1984). The answer depends on understanding the relationship between the nature of the change in the environment and its impact on organizations. Organizational inertia is a relative concept that emphasizes how quickly an organization can change to address emerging needs and secure new resources (Larsen and Lomi 1999). Organizations with high inertia are slower to adapt to changes in their environment than organizations with low inertia. Organizations build inertia in stable environments and lose inertia when routines are not continually practiced (Hannan and Freeman 1984). Changes that affect the structural core of the organization—mission, authority structure, technology, and marketing—are more likely to decrease structural inertia, which can lead to declining organizational performance and thus increase the likelihood of organizational failure, whereas changes that are peripheral to the organizational core are less of a threat and might even enhance the organization (Carroll and Hannan 2000; Hannan and Freeman 1984). EBP can potentially affect all four levels of the structural core and hence impact inertia and performance.

Thus, it is plausible that large, established mental health organizations will find it more difficult to adapt to the shifting environmental demands associated with adopting evidence-based practice than newer, smaller, and less stable mental health organizations. While organizations with less inertia will be less reliable in their service outputs initially, their ability to adapt to the changing environment gives them an advantage over more established agencies. This means that the adoption and implementation of evidence-based practice can lower the performance of stable and more established organizations, relative to the less stable and smaller organizations.

If funding agencies and state policies reward organizations implementing evidence-based practice, then these newer organizations could displace the established and stable organization. This, in turn, could destabilize the organizational ecology of mental health agencies in a community, potentially to the point of undermining the overall quality of services. However, the transition could also dampen the quality of services only temporarily and then raise the quality of services to a higher level. It is, therefore, vital for us to have a better understanding of how the adoption and implementation of evidence-based practice impacts organizational performance within mental health services.

### **3. Method**

In this section, we describe the methods used to develop and test the model, along with the procedures used to answer the two main questions in this study. We review literature, summarize earlier work on replicating system dynamics models, and report on key informant interviews. Our goal is to advance a kind of understanding that progresses and cuts across many different situations, for example, from transforming a state mental health system in the United States to building a service system in a developing country or responding to acute mental health needs after an environmental disaster. To do this, we need to demonstrate how we take existing conceptual and empirical work and build models to answer specific questions.

#### *3.1 Systematic Review of Literature*

The initial conceptualization of the Implementation and Organizational Performance (IOP) Model was based on a systematic review of the literature on diffusion and implementation

of EBP in mental health agencies. This included reviewing existing literature on diffusion and implementation of EBP in mental health organizations, system dynamics models, and organizational theory. We used content analysis to identify key constructs and causal relationships in relevant articles, and then coded each fragment into a set of cause and effect concept pairs (Wrightson 1976). These were combined to form an initial conceptual model of the problem of adopting and implementing EBP in community mental health organizations.

In addition to the existing mental health services literature, we also reviewed system dynamics models related to the diffusion and implementation of innovation, and planned organizational change. Because we were interested in understanding the impact of implementation on organizational performance, we excluded models that focused primarily on diffusion of innovation. The models reviewed had to be published in journals or books, and list equation or provide the models on the web. When we rebuilt models from equation listings, we replicated the simulations in published studies to ensure the accuracy of our model reconstruction.

### 3.2 *Formulation*

We started model formulation by working with Sastry's (1997) model of Tushman and Romanelli's (1986; 1985; 1985) theory of punctuated organizational change, and then added structure to reflect the processes identified through our systematic review of the mental health literature and structures from other models of organizational change (Levin and Roberts 1976; Repenning 2002; Samuel and Jacobsen 1997; Sastry 1997). This approach revealed equivalent mechanisms and differences in the meaning of similar terms. For example, the models we considered had some reinforcing mechanism that increased commitment through experience. Functionally, these mechanisms drove the implementation of innovations, although they tended to represent the same phenomena using different mechanisms.

Simulation testing revealed that apparently similar concepts such as resistance to change, commitment, and organizational inertia were functionally distinct. For example, commitment is sometimes used to mean worker commitment to change, but at other times refers to managers' commitment to implement change. Resistance is sometimes included as an element or indicator of organizational inertia, and other times thought of as the result of change. Where we discovered this type of ambiguity, we drew on organizational theories such as resource dependence theory (Pfeffer and Salancik 1978), organizational ecology (Hannan and Freeman 1977, 1984), theories of punctuated change (Romanelli and Tushman 1994; Sastry 1997), and new intuitionism (Scott and Meyer 1991) to clarify and extend our model of implementation and organizational performance.

Initial conditions for each of the stocks were calculated to start the model in equilibrium for high inertia organizations. In some cases, this was a straightforward exercise of finding the roots for the net rate of change. Other situations proved more complicated and required derivation of expressions based in organizational theory. For example, an important assumption in our model is that only organizations with high inertia are in a dynamic equilibrium since inertia accumulates in stable environments. From these assumptions, we worked out a series of lemmas describing the initial conditions so that the model initialized in equilibrium independent of initial effectiveness, efficiency, and organizational performance.

### 3.3 *Model Testing*

We used a variety of tests throughout the modeling process to identify errors in formulation and theory. In addition to dimensional consistency tests, we ran the model through a

series of behavior reproduction tests comparing the behavior of the relevant organizational theory against model behavior. For example, implementing new ideas in an organization frequently leads to an initial decline in performance before any improvement can be seen. Since our model incorporated theories and structures that could produce this effect, we expected our model to replicate these behaviors as well.

### 3.4 *Key Informant Interviews*

We compared structures in the IOP Model against seven key informant interviews with administrators of mental health services. Key informants were asked questions about their experiences implementing evidence-based practice. Interviews were recorded, professionally transcribed, and independently coded by two members of the research team. Administrators identified barriers such as costs of training and supervision, high caseloads, resistance to change among experienced workers, shortage of master's level graduates ready to use EBP in clinical practice, and an urgent need for "evidence-based management" to inform the implementation process. These interviews shifted our focus from modeling tactical questions about implementation to addressing strategic questions. When we could not find excerpts in the interviews to corroborate the mechanism as specified in the model, we either modified the mechanism to reflect what key informants were saying or dropped the mechanism entirely.

### 3.5 *Representing Adoption and Implementation of EBP*

Our main focus in this study was on understanding what happens to a mental health agency that decides to adopt and then implement EBP with the expectation of improving organizational performance. This had two components: the strategic decision to adopt and implement EBP, and the goal of improving organizational performance. The decision to adopt and implement EBP means that the organization changes the basis of its legitimacy from one based on ideology to one based on evidence. The implication is that organizational effectiveness drops, and creates what will appear as an initial shortfall in the strategic direction. We represented this change as a 30% increase in the required strategic direction using step input at 12 months.

Equally important is the fact that the organization initiates this change in a strategic direction with the intention of improving organizational performance. That is, the issue here was not that the environmental demands changed and the organization sought to stay at the current level of organizational performance. Rather, the organization entered a change process with the goal of improvement, which we represented as a 30% increase in the desired level of organizational performance using a step input at 12 months.

### 3.6 *Sensitivity Analysis*

We answered the first question by conducting a simulation study of the implementation process for organizations with different initial conditions. Initial efficiency and initial effectiveness both varied from 0.1 to 0.9 in increments of 0.05 to cover the phase space of Figure 1. To capture the effect of organizational inertia on performance, we needed to vary initial organizational inertia for each combination of initial effectiveness and initial efficiency. The value of initial inertia for an organization to be in equilibrium in a stable environment is unique and varying inertia places organizations into disequilibrium.<sup>2</sup> Our approach was to vary the ratio

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<sup>2</sup> Note that in a changing environment as opposed to a stable environment, an organization can be in a dynamic equilibrium with multiple values of initial inertia.



of initial inertia to equilibrium inertia from 0.2 to 0.9 in increments of 0.1. This resulted in a total of 2,312 simulations.

There are a number of ways to quantify the impact of implementation on organizational performance. Perhaps the easiest measure is to compare post-implementation performance against pre-implementation performance. This is generally what managers do most of the time. We represent this by comparing performance at 120 months against the initial organizational performance at 0 months, calculated as the difference  $D_1$ :

$$D_1 = \frac{P_i(120) - P_i(0)}{P_i(0)}, \quad (1.1)$$

where  $P_i(t)$  is the performance at time  $t$  for the organization implementing evidence-based practice. In order to compare the size of change across different types of organizations, the difference is normalized by dividing by the initial performance.

A major disadvantage with this approach is that it attributes all changes in organizational performance to the implementation process. In fact, the organizational performance might already have been improving or declining without the intervention. What we want to know is not whether or not the organization changed in absolute terms, but whether or not the change in organizational performance was due to the intervention. That is, we want to compare the dynamic behavior of the factual (implementation case) with the counterfactual (no implementation case) to assess what the impact of implementation is on the organizational dynamics. The factual case is implemented as described in Section 3.5 above. The counterfactual case does not introduce the step inputs, and the organizational change that is observed is a result of organizational inertia building in a stable environment. We calculate  $D_2(t)$  as:

$$D_2(t) = \frac{P_i(t) - P_{\sim i}(t)}{P_{\sim i}(0)} \quad (1.2)$$

where  $P_i(t)$  is the performance of the organization at time  $t$  with implementation (factual), and  $P_{\sim i}(t)$  is the performance of the *same* organization but without implementation (counterfactual). The difference is then normalized by dividing by the initial performance at the start of the simulation for the case without implementation. This metric,  $D_2(t)$ , is continuous over time. While this is useful for the more detailed behavioral analysis discussed in the next section, it is difficult to use as a summary of what happened for each organization. Thus, we might consider three summary metrics of  $D_2(t)$  based on taking the average, maximum, and minimum of the difference over the simulation period:

$$D_{mean} = \overline{D_2(t)}, D_{max} = \max(D_2(t)), \text{ and } D_{min} = \min(D_2(t)). \quad (1.3)$$

We also want to know whether or not the organization eventually improved relative to what might otherwise have happened. This tells us whether or not the long-term expectations are met for improvements in organizational performance, which is a central concern to managers. For this, we can calculate  $D_3$  as the difference between the two scenarios (factual and counterfactual) at 120 months, normalized by the initial performance of the non-implementation case:

$$D_3 = \frac{P_i(120) - P_{\sim i}(120)}{P_{\sim i}(0)} \quad (1.4)$$

To answer the first question, we first determine whether or not organizational performance increased, remained the same, or declined using the normalized change metric  $D_1$  for each simulation. We use  $D_3$  to determine if that change can be attributed to implementation of EBP. To identify where changes in the strategic direction impacts performance, we identify regions in the phase plots of Figure 1 for both for  $D_1$  and  $D_3$ .

### 3.7 Behavioral Analysis

To answer the second question, we seek to explain changes in organizational performance in terms of the model's feedback mechanisms. In principle, one can do this for each of the 2,312 simulated cases. However, our main interest is in understanding what differentiates the cases where performance increases from implementation from those that decline in performance. So instead we purposefully select cases to develop a comparative understanding of the successful trajectories. For example, we compare cases 1, 2, and 3 to see the effect of increasing initial efficiency on improving organizational performance; compare case 3 with case 4 to see why two organizations with the same initial organizational performance have different outcomes; and compare case 3, 6, and 10 to see if our explanation for an improvement in performance varies with inertia.

For each case, we simulate and compare the trajectory of the factual case (adopted and implemented EBP) against its counterfactual case (did not adopt EBP). This generates 2 simulations for each hypothetical organization resulting in 28 simulations for the behavioral analysis. For each pair of trajectories, the factual and counterfactual are compared to identify time periods with similar and different behavior. A command file for replicating the simulations in Vensim and data files for each simulation is available from the first author.

## 4. Model

This section describes the Innovation and Organizational Performance (IOP) Model. The IOP Model represents a dynamic theory of how implementation of evidence-based practices impacts organizational performance. The focus of the IOP Model is on understanding the consequences of implementation at the organizational level. We therefore exclude diffusion mechanisms both within the organization and at the sector level. For example, we do not attempt to model how successful or unsuccessful experiences with an innovation by clinicians affect the likelihood that they will adopt the innovation. Instead, we simply represent implementation of an innovation among workers as a function of commitment, which is largely driven by managers. Likewise, we also do not attempt to model how positive or negative experiences with an innovation diffusion within a service sector between practitioners or organizations. Table 1 shows the boundary chart for the current IOP Model indicating the variables and mechanisms that are treated as endogenous, exogenous, and excluded from the model altogether.

A causal loop diagram of the main mechanisms in the Implementation and Organizational Performance Model is shown in Figure 2. Table 2 describes each of the main mechanisms and provides excerpts from key informant interviews showing the relevance for some or all of the mechanism. Mechanisms that did not have support from the key informant interview transcript

were either modified to reflect what key informants were saying, or dropped from the model. In the next sections, we briefly describe each of the major feedback mechanisms in the IOP Model.

Table 1 Boundary chart of IOP Model

<b>Endogenous</b>	<b>Exogenous</b>	<b>Excluded</b>
Effectiveness	Required strategic orientation to services	Diffusion of innovation among workers
Efficiency		
Performance	Managers' commitment to strategic direction	Diffusion of innovation among organizations within a sector
Resources needed	Desired performance	Cost of incentives
Demand for services	Treatment efficacy*	Pacing of implementation
Reliability or intervention fidelity		Interaction with service networks
Staff commitment to strategic direction		Staff and managers' commitment to structural change
Organizational inertia		Need for services or size of market

\* Calculated as a function of initial efficiency and reliability for initial conditions to set the initial conditions of the organization, but not modified during the simulation.

#### 4.1 Reorientation

The process of reorientation entails a balancing feedback mechanism (B1 in Figure 2) where an agency changes its strategic orientation to services to meet environmental demands. Examples of this happen when foundations begin to expect program evaluation outcomes from an organization or the legitimacy of services shifts to technical outcomes related to evidence based practice. What constitutes a large, moderate, or small change is relative.

The model presently represents *Required Strategic Direction* and *Strategic Direction* in a manner similar to Sastry (1997) with the environment impacting the organization through the absolute difference between the *Required Strategic Direction* and *Strategic Direction*. This shortfall lowers the *Effectiveness* of the organization, which decreases *Performance* and thus *Perceived Performance* following a delay. This increases the *Pressure to Change* and causes a *Change in Strategic Direction* that will reduce the shortfall. It is worth noting that in this representation of strategic orientation, agencies do not make mistakes in adjusting their strategic orientation. That is, they only experience delayed information and always move closer to the environmental demands.

#### 4.2 Funding

Levin and Roberts' (1976) theory of human service delivery systems includes a balancing mechanism where shortfalls in performance lead to increases in community resources. This is represented by the balancing mechanism where the agency changes direction to meet the demands of its environment to secure additional funding (B2 in Figure 2). Specifically, an increase in the *Strategic Direction Shortfall* lowers *Effectiveness*, which causes a decline in *Community Support* and reduction in the *Funds Allocated to Agency*. This leads to less *Resources for Services* and lowers the *Ratio of Available to Needed Resources*, which contributes to less time for providing services. Thus *Reliability* and *Efficiency* decline, which lowers organizational *Performance* and *Perceived Performance* with the result of increasing the *Performance Shortfall* and increasing the *Pressure to Change*, which causes *Change in Strategic Direction* and leads to an adjustment in *Strategic Direction* provided that the agency has the

ability to change. This describes how organizations change their strategic direction in response to changes in funding.

#### 4.3 *Caseload Pressures*

Caseload refers to the number of clients the agency is currently serving. It is generally assumed to be stable and managed through a number of feedback mechanisms as suggested by Levin and Roberts (1976). When caseloads increase, caseload pressures limit the quality and thereby the growth in demand for services. Conversely, agencies that experience declines in caseloads will initially have more time to provide higher quality services and this can lead to an increase in demand. This is balancing mechanism represented by B3 in Figure 2. Specifically, an increase in *Caseload* increases the *Resources Needed*. This lowers the *Ratio of Available to Needed Resources*, and decreases *Reliability*, which lowers *Efficiency* and leads to fewer *Referrals* and lowers *Caseload* relative to what it would have been if *Referrals* remained constant.

#### 4.4 *Commitment*

Both Samuel and Jacobsen (1997) and Repenning (2002) describe the process of managers setting goals for implementation. For example, Samuel and Jacobsen discuss how the pacing of change affects managers' use of incentives, and Repenning discusses managers' commitment to an innovation as the primary determinant of successful innovation implementation. In contrast, Sastry (1997) treats managers' commitment as endogenous to the organization and determined by an organization changing its strategic direction. In the IOP Model, commitment refers to staff members willing to put an innovation into practice. This is represented within a feedback mechanism whereby managers apply normative pressures to increase staff commitment to use evidence-based practice as shown by B4 in Figure 2. Specifically, an increase in the *Commitment Gap* leads to an *Increase in Commitment* that increases *Commitment*, and thereby reduces the *Commitment Gap*. It is important to note that in this process, managers' ability to motivate staff is essentially perfect, and that commitment only decreases when the strategic direction changes.

#### 4.5 *Implementation*

Implementation as a process refers to situation where increasing commitment leads to greater implementation, which improves organizational performance, and feeds back to reinforce commitment. This is represented as R1 in Figure 2. Specifically, as *Implementation* increases, so does *Efficiency*, which leads to improved *Performance* and *Perceived Performance*. This reduces the *Performance Shortfall*, which decreases the *Pressure to Change*, and hence slows the *Change in Strategic Direction*. The result is that the *Decrease in Commitment* stemming from *Change in Strategic Direction* slows, which allows *Commitment* to build even more. Thus organizations that are improving performance through greater commitment and implementation will become more stable around the current strategic direction and "lock in" on a specific innovation. This has benefits until the environment changes.

Figure 2 Causal loop diagram of Implementation and Organizational Performance (IOP) Model. Boxes represent major stock or state variables. Arrows indicate causal relationships, with signs indicating direction of influence. Double lines across casual links denote lagged effects. 'R' denotes a reinforcing feedback loop. 'B' denotes a balancing feedback loop.

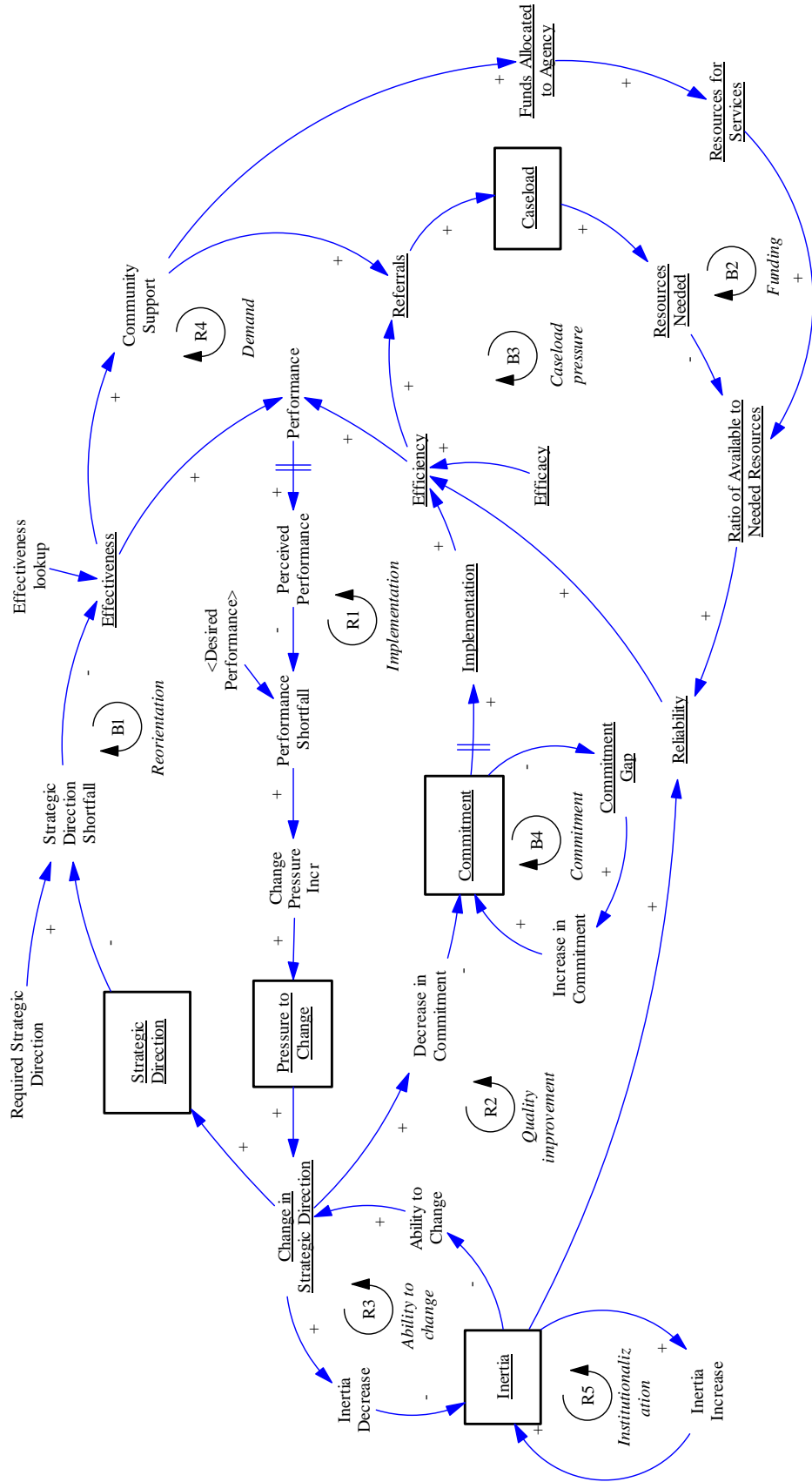


Table 2 Main feedback mechanisms in the IOP Model

Mechanism	Label <sup>1</sup>	Description	Support <sup>2</sup>
Reorientation	B1	Agency changing its strategic orientation to meet the demands of its environment.	“As you know, the evidence changes. That’s my challenge is to stay on top of that change and continue to involve the staff in looking at the change.”
Funding	B2	Providing external support to agency to meet the demands of its environment.	“We worked with the county in getting a tax passed, which will create a children’s services fund.”
Caseload pressures	B3	Caseload pressures limiting the quality and growth in demand for services.	“There needs to be some limits on caseload.” “We don’t have enough other staff to really do a lot of sort of talk therapy with patients.”
Commitment	B4	Supervisors applying normative pressures to increase staff commitment to use evidence-based practice.	“They get immediate feedback about what they’re doing, whether it’s effective or not effective.”
Implementation	R1	Increasing implementation by gaining commitment through improved organizational performance.	“So the medical center director, his bonus, in large part, is determined by how the medical center does on its performance measures.”
Quality improvement	R2	Improving the reliability of services through organizational learning and quality improvement.	“And so, if we have what we perceive to be an inordinate amount of runaways in our residential program, we will do a QI study for 18 months.”
Ability to change	R3	Changing strategic direction decreases organizational inertia, which increases the agency’s ability to change. Likewise, increasing stability increases inertia, which makes it harder to change.	“Some people appreciated the power of being trained a certain way, and once you leave school that it’s very difficult to take on new ideas and embrace them and move forward.”
Demand	R4	Increasing the effectiveness of services leads to more demand for services, reinforcing pressure to change and further increase effectiveness.	“And I think there is an appeal from the public for that kind of thing, and so we’ll increase the numbers of people, we’ll increase our profile in the community, we’ll increase our revenues through doing that because...they want to make sure they’re not just throwing their money away.”
Institutionalization	R5	Establishing a way of doing things in the agency, that is, organizational culture.	“People have to have some experience with it, they have to see it working, and they have to hear their peers talk to them about how it’s working.”

**Notes:** <sup>1</sup> ‘B’ prefixes denote balancing or negative feedback mechanisms, while ‘R’ prefixes denote reinforcing or positive feedback mechanisms. <sup>2</sup> The quotes are excerpts from key informant interview transcripts with administrators of mental services.

#### 4.6 Quality Improvement

Quality improvement refers to the process where reliability of services increases through organizational learning as shown in R2 in Figure 2. Sastry (1997) represents this process as a function of growth of inertia where organizations develop routines based on previous experience and performance that lead to additional improvements. It is important to note that in a quality improvement process, it is usually not just that the quality of the outputs have improved, but that the effects of these improvements help the organization and reinforce the initial investments in

the change. This is represented as the reinforcing mechanism R2 in Figure 2 where an increase in *Reliability* improves *Efficiency* which increases *Performance* and *Perceived Performance*. This reduces the *Performance Shortfall* and *Pressure to Change*, which slows the *Change in Strategic Direction* and decreases inertia. This allows *Inertia* to grow faster than it would have otherwise, and reinforces the initial increase in *Reliability*.

#### 4.7 Ability to Change

An organization's ability to change is limited by its organizational inertia (Carroll and Hannan 2000; Hannan and Freeman 1984), which decreases when organizations undergo a change process that affects organizational structure (Sastry 1997; Tushman, Newman, and Romanelli 1986; Tushman and Romanelli 1985; Tushman, Virany, and Romanelli 1985). This forms the reinforcing mechanism R3 in Figure 2. Specifically, high *Inertia* lowers the organization's *Ability to Change*, which limits the *Change in Strategic Direction*. This slows the decrease of inertia and allows *Inertia* to grow.

#### 4.8 Demand

In Levin and Roberts' (1976) theory, demand for services increases as the community becomes aware of new services or improvements in quality. All other things being equal, increasing demand leads to more clients receiving service and to further increases in demand. This process is represented in the current IOP Model by the reinforcing mechanism R4 in Figure 2. Specifically, an increase in *Referrals* leads to a higher *Caseload*, which increases the *Resources Needed* and reduces *Ratio of Available to Needed Resources*. This lowers *Reliability* and *Efficiency*, leading to a decrease in *Performance* and *Perceived Performance*, and thus increases the *Performance Shortfall*. This creates a *Pressure to Change* and change in *Strategic Direction* to reduce the shortfall in performance, which contributes to an increase in *Effectiveness*, more *Community Support*, and an additional increase in *Referrals*.

It is important to note that this representation in the IOP Model is problematic. While R4 does capture the effect that demands for services depends on effectiveness and community support, it is primarily a resource allocation mechanism. Specifically, it reflects a mechanism where organizational growth in the form of increased caseloads and funding is fueled through improving the fit between the organization and environmental expectations. This is a different mechanism than the word of mouth or marketing effects more commonly discussed.

#### 4.9 Institutionalization

Institutionalization refers to the process where organizational inertia accumulates through the natural development and transmission of rules, procedures, and routines within an organization, often discussed as organizational culture. Institutionalization is sometimes described as organizational learning (Sastry 1997). This is a simple reinforcing mechanism (R5 in Figure 2) where more *Inertia* leads to a further increase in *Inertia*.

## 5. Results

In this section, we present the results from the simulation analysis of the IOP Model. We begin with the sensitivity analysis used to answer the first question about how the initial conditions of the organizations and implementation impact organizational performance. From this, we identify specific regions of change that we consider in behavioral analysis.

5.1 Sensitivity Analysis

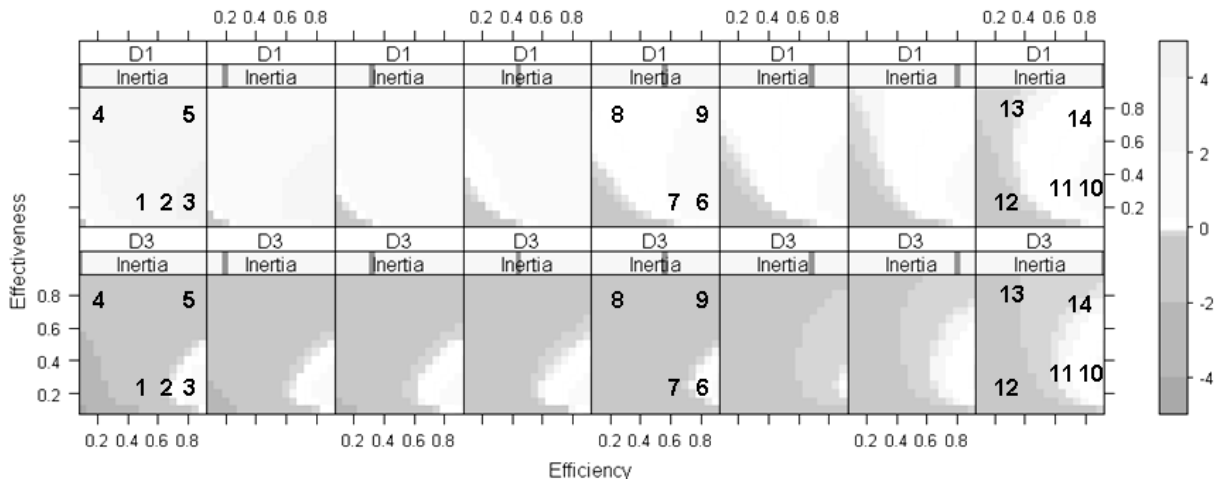
Under what initial conditions does organizational performance improve as a consequence of implementing evidence based practice innovations? Figure 3 shows plots for  $D_1$  and  $D_3$  by initial efficiency and effectiveness with one pair of plots for each condition of initial inertia. Inertia increases going from left to right in the panels of Figure 3. The top row of panels has  $D_1$ , as the dependent variable while the bottom row of panels shows  $D_3$ . White regions are neutral, dark gray represent declining performance, while light gray regions indicate improving performance. The numbers identify cases used for the behavioral analysis to understand the structure-behavior relationship.

Most organizations will experience improving performance when initial inertia is low (top-left panels in Figure 3). As initial inertia increases (top-middle panels in Figure 3), improvements in organizational performance begin to vary, and depend on initial conditions of efficiency and effectiveness of the organization. For example, failing organizations will see a decline in performance, whereas organizations with high efficiency or high effectiveness will see improvements. As initial inertia increases further, only organizations with high efficiency will see improvements in performance (top-right panels in Figure 3).

However, the results look different when we compare change in performance between the factual (implementation) and counterfactual (no implementation) using  $D_3$ . The bottom row of panels in Figure 3 shows that only a small portion of organizations will improve in organizational performance relative to what would have happened if they had not adopted and implemented EBP. First, for organizations with low to moderate inertia at the start of the simulation, only those with high efficiency but low effectiveness see improvements in organizational performance relative to the counterfactual case (e.g., regions 3 and 6 in Figure 3). Moreover, the region where  $D_3$  is positive shrinks and then expands with increasing initial inertia.

In no cases do organizations with high initial effectiveness see increasing organizational performance from implementation when compared with the counterfactual case of not implementing EBP. In particular, agencies demonstrating organizational excellence are likely to *decline* in performance, whereas organizations seen as efficient but ineffective are likely to improve in organizational performance from implementing EBP when they have 1) low to moderate initial inertia, or 2) high initial inertia. The next question is, why?

Figure 3  $D_1$  and  $D_3$  by initial efficiency, effectiveness, and inertia.





## 5.2 Behavioral Analysis

In our behavioral analysis, we first seek to understand why cases improve in organizational performance from implementation relative to the no implementation counterfactual. Next, we seek to understand why this effect seems to vary by initial organizational inertia. Lastly, we seek to understand the interaction between high initial efficiency and high initial effectiveness that makes organizational performance decline for cases starting out in the region of organizational excellence.

In the first set of comparisons, we consider cases 3, 6, and 10 (see Figure 3). All six simulations show improvement in organizational performance relative to their initial performance (see Figure 4). Case 3 and 10 show marginally higher final performance for the implementation case relative to the no implementation case, while case 6 is more or less neutral (which has to do with the fact that case 6 is close to neutral on  $D_3$  in Figure 4).

In all three cases, performance drops sharply at the time of the initial adoption decision and change in the organizational environment. This drop in *Performance* is caused by a decline in *Effectiveness*, and indirectly by a decline in *Community Support*. The decline in *Community Support* affects *Referrals*, *Funds Allocated to the Agency*, and ultimately the availability of resources relative those needed to maintain quality services. The result is an immediate decline in the *Reliability* of services at 12 months<sup>3</sup> that lowers *Efficiency* and compounds the effects of the initial decline in *Effectiveness*.

The magnitude of this initial decline is proportional to the *Efficacy* of the service technology, which is assumed to be constant throughout the simulation.<sup>4</sup> *Efficiency* is formulated as the product of *Implementation*, *Reliability*, and *Efficacy*:

$$Efficiency(t) = Implementation(t) \times Reliability(t) \times Efficacy(t) \quad (1.5)$$

A drop in *Reliability* is therefore multiplied by the value of *Efficacy*. For organizations with low inertia and high efficiency, this means that high *Efficiency* is the result of using highly efficacious interventions as opposed to achieving high reliability through resources or high inertia. This explains why the drop is larger for organizations with high initial efficiency, and why this effect declines with inertia, but it does yet explain why this translates into the organizational performance being higher than the non-implementation case. Intuitively, one might expect a shallower drop to be more in line with higher performance as opposed to the other way around.

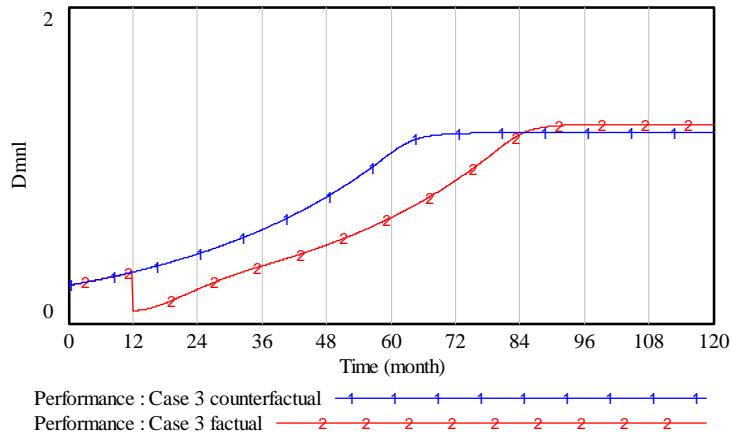
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<sup>3</sup> That this happens instantly is unrealistic. For example, agencies will have operating budgets that can sustain temporary losses in revenue and staff are likely to continue providing quality services with temporary shortfalls in time or increases in caseloads. Although not sustainable in the long-run, most agencies do have ways of making it through temporary short-term transitions, and we would expect such mechanisms to come into play and buffer the immediate shock in loss of community support. There would also be ways that organizations could slow the decline in community support by, for example, participating in sector-wide change efforts or educating supporters about the expected transition. This would introduce a delay between the initial change and the loss of community support.

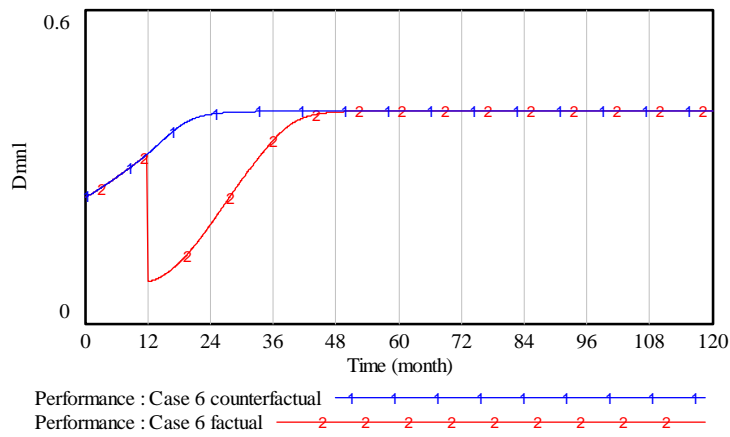
<sup>4</sup> This is also unrealistic since what we are saying is that the organization switches from one practice to another practice, and we would expect this to mean that the organization adopted and sought to implement interventions with higher treatment efficacy.

Figure 4 Implementation versus no-implementation performance trajectories for three cases where performance increased by initial levels of organizational inertia.

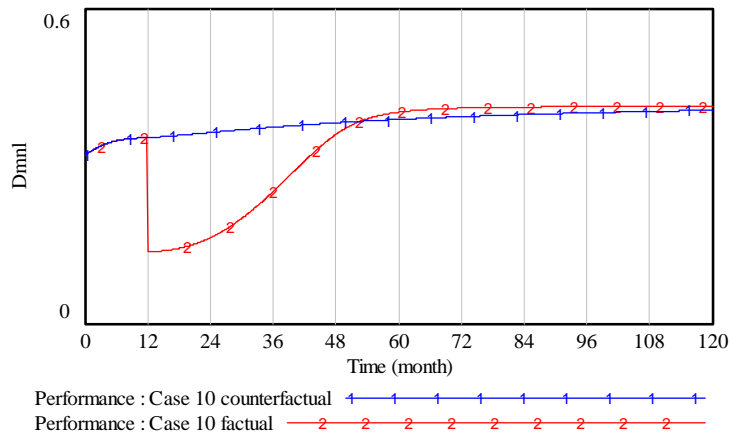
(a) Initial inertia = 0.2



(b) Initial inertia = 0.6



(b) Initial inertia = 0.9



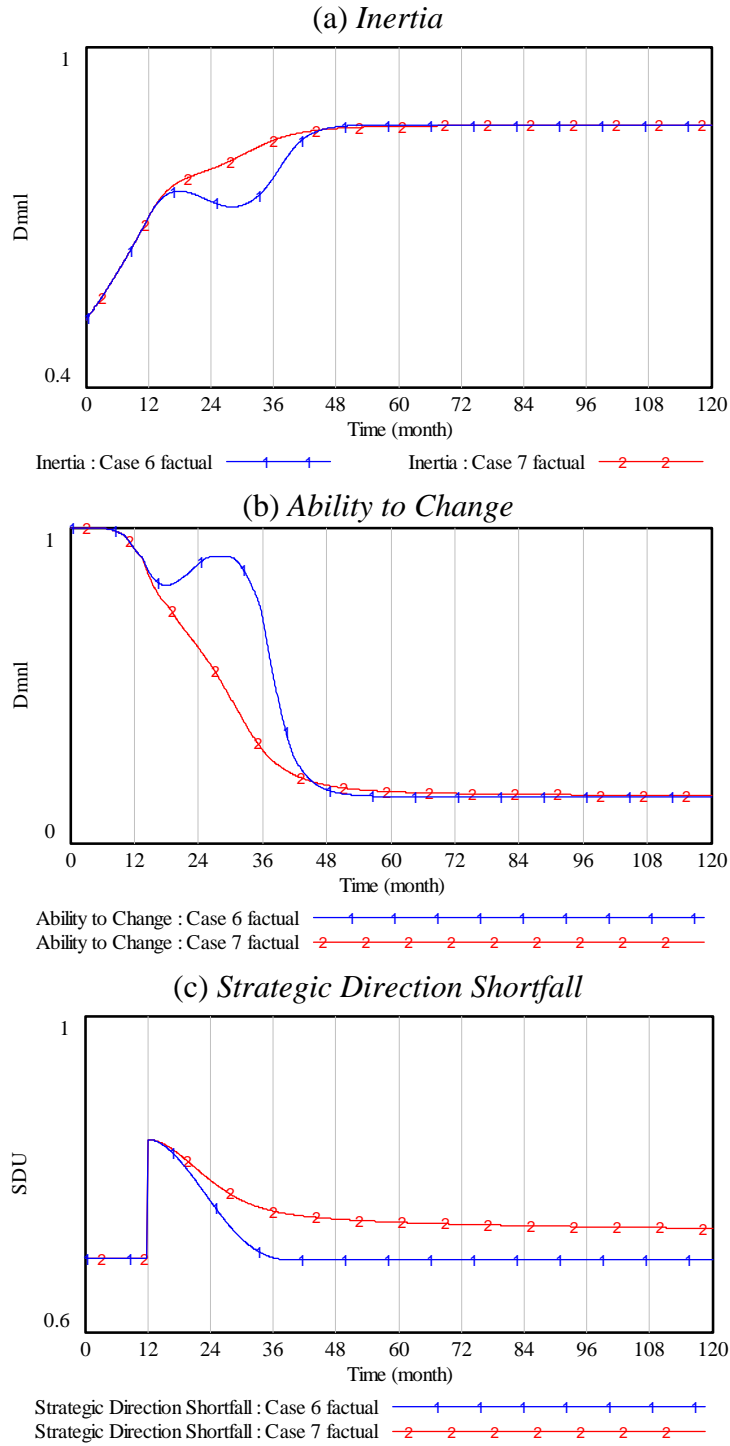
The key to why the larger initial drop contributes to a long-term performance gain is the role that *Pressure to Change* plays in driving improvements in organizational performance. *Pressure to Change* can influence organizational performance through changes in commitment via the implementation loop (R1); organizational inertia through the quality improvement loop (R2); and through strategic direction through the reorientation loop (B1). For most cases, long-term improvements in organizational performance will come from the quality improvement process as *Inertia* accumulates in a stable environment. However, the accumulation of *Inertia* is not goal directed around a specific outcome in performance or particular strategic direction. Moreover, *Inertia* has an upper-bound associated with employee turnover, the forgetting of routines, etc. So there is an inherent limit in how far an organization can improve performance via a quality improvement process, and it will not offset the problems associated with an organization moving in the wrong strategic direction. Thus, a critical question for an organization is whether or not it can complete its reorientation before the quality improvement loop (R2) takes hold.

When improvements from earlier changes in *Strategic Direction* combined with increases in *Inertia* and *Reliability* are sufficient to close the *Performance Shortfall*, then the incentives for the organization to continue the reorientation process disappear. This locks-in a *Strategic Direction Shortfall* and limits the potential long-term *Effectiveness* of the organization. Organizational performance continues to improve through the accumulation of inertia, but it will ultimately be less than the no-implementation case. However, the larger drop in *Performance* pushes the *Pressure to Change* past a critical point where growth in *Inertia* slows, causing a decline in *Inertia* (see Figure 5a). This leads to an increase in the organization's *Ability to Change* and reinforces change in strategic direction (see Figure 5b), allowing the organization to close the *Strategic Direction Shortfall* before month 36 and the quality improvement process takes hold (see Figure 5c).

To understand why this effect varies by initial inertia, we need to explain why it 1) declines with initial inertia, and then 2) reappears for organizations with high inertia. The first is easy in that we have already shown how for an organization to have high efficiency with low inertia, it must deploy an intervention that is highly efficacious. This translates into a larger initial drop, increasing the pressure to change, which allows for the gap in effectiveness to be closed. Since reliability increases with inertia, the treatment efficacy required for an organization to have high initial efficiency decreases. This lessens the initial drop and lowers the pressure to change until it no longer pushes the organization past the critical threshold of being able to complete the reorientation process before quality improvement sets in.

To understand the second case, it is important to note that the for higher inertia organizations, the *Ability to Change* is lower, making them less responsive, and allowing *Pressure to Change* to build. As initial inertia approaches the right side of Figure 4, *Pressure to Change* increases until *Inertia* and *Ability to Change* are low enough for significant *Changes in Strategic Direction*. This creates sufficient momentum in the system to allow the reorientation process to complete before the quality improvement process gets established.

Figure 5 Dynamics of *Inertia*, *Ability to Change*, and *Strategic Direction Shortfall* from simulation of implementation for cases 6 and 7

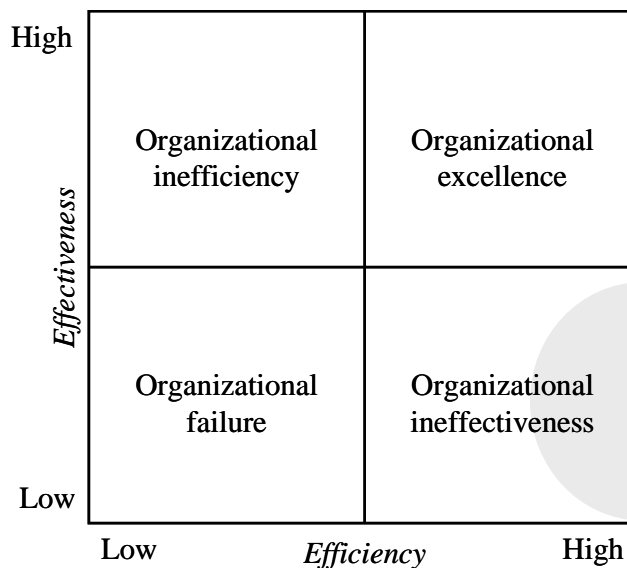


Finally, to understand why organizational excellence does not translate into improving organizational performance, consider that an organization with performance in the region of organizational excellence in Figure 1 has both high efficiency and high effectiveness, which means higher levels of community support. This translates into more client referrals and resources. One implication of this is that for two organizations with the same level of initial *Inertia*, *Reliability* will be higher for the organization with higher *Efficiency*. If the initial efficiency for both organizations is the same, higher *Reliability* means that the organization with higher effectiveness can achieve the same level of efficiency with less efficacious treatments according to equation (1.5). Consequently, *Efficacy* is lower for organizations with higher initial effectiveness; and, lower treatment efficacy means a lower drop in organizational performance, which lessens the *Pressure to Change* and decreases the likelihood that the reorientation process will finish before the quality improvement process takes over. This effect is independent of initial efficiency.

### 6. Discussion

This research has implications for strategic planning and policies to promote the use of EBP. Based on our conceptual model, ineffective but highly efficient organizations have the best chance to see improvements in organizational performance from implementation in otherwise stable environments (shaded region in Figure 6). This means that organizations with strong reputations that are considered excellent in a community should consider the possibility that implementation may not be an innovation for improving organizational performance, and may even lead to a decline in performance. While improving organizational performance is not the main point of EBP, we do believe it is important to consider as declining performance can lead to a loss in managerial support for implementation that could in turn lead to low intervention fidelity or abandonment of the implementation process.

Figure 6 Zone of expected organizational performance improvement from implementation



The results also point to different strategies for organizational development and implementation of EBP. For inefficient and failing organizations seeking to implement EBP and improve organizational performance, the best initial investments could be on increasing

organizational efficiency through a quality improvement process. That is, it may be better to delay the strategic reorientation until the organization understands and has sufficient control over its service outcomes. For agencies in the region of organizational excellence, EBP represents a disruptive innovation (Christensen 2003). These organizations may be better off developing standalone programs in the shaded region of Figure 6.

For the behavioral analyses, we found that *Pressure to Change* played a key role in understanding whether or not the organization was able to complete the reorientation process (feedback mechanism B1) before the quality improvement process (feedback mechanism R2) took effect. The higher the *Pressure to Change*, the faster the reorientation process, and the greater the likelihood the organization would be able to close the gap between the organization's actual and required strategic direction. This race between completing the reorientation process before the quality improvement process sets in was the main explanation for why some organizations were able to see improvements in organizational performance while other organizations experienced declines.

For the most part, *Pressure to Change* was influenced in this model by treatment efficacy, which was calculated as a function of the initial conditions of the organization. This brought attention to the different ways that organizations can bring about the same level of efficiency and clinical outcomes. Some organizations will achieve high levels of efficiency by reducing the variability of their services, other organizations will achieve this by providing a higher level of resources to their clinical staff relative to need, and a third group of organizations achieve this by deploying clinical interventions that are highly efficacious. On the surface, they would all appear to achieve similar results, but the underlying differences have implications for how the organizations are impacted by or benefit from implementing EBP in terms of organizational performance.

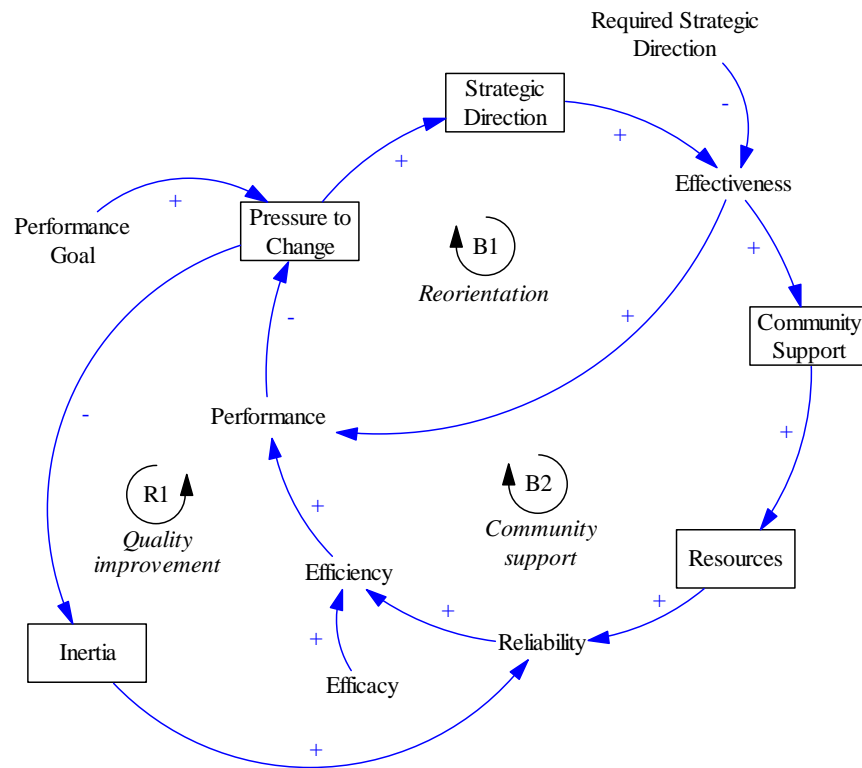
These results suggest a simpler theory and model for understanding the dynamics of implementation on organizational performance (shown in Figure 7). Community support (B2) causes an initial decline and recovery in organizational performance, followed by a period where the reorientation process (B1) dominates, and then the quality improvement process (R1) takes over as inertia begins to build. Whether or not the organization experiences an overall benefit from the transformation process depends on how fast the reorientation process is relative to the quality improvements process. If the organization can move fast enough to align with the requirements in its environment, then the organization will benefit. Otherwise, the quality improvement process will lock into limits to improvements in organizational performance.

This model (Figure 7) moves us more in the direction of strategy as opposed to tactics of implementing evidence based practices. At the level of individual organization, issues are raised about the relative timing and speed of change relative to organizational inertia, community support, and environmental requirements. It suggests that a key decision for managers is deciding when to focus on strategic direction versus quality improvement. At the level of organizational ecology, the model raises questions about how a population of organizations with differences in treatment technology, community support, and organizational inertia will fare through broad changes in public mental health policies.

There are, however, a number of limitations that need to be addressed in future research. First, the work so far has only considered individual organizations and then assumed only stable environments. That is, we have not sought to include the effects of organizations on service networks. More work is clearly needed to understand how broader changes such as state-wide transformation efforts play out over time to impact public mental health and financing of

services. To make such studies more meaningful, it will be essential to have a better empirical basis for the organizational demographics within a regional mental health service sector.

Figure 7 Simplified causal loop diagram of implementation and organizational performance



It is also important to recognize that for many organizations, the environment is changing and this is likely to increase when effectiveness is judged on technical as opposed to institutional criteria. This is happening as funding sources begin to push for empirically supported treatments and establish systems for monitoring the fidelity of mental health interventions. Thus, we need to understand the organizational demography along with the interplay between the organizational demography and changing environment in the form of new evidence based practices, changing funding requirements, and restructuring of private-public and state-local partnerships in delivering mental health services. We see these as important opportunities for applying system dynamics for advancing services research, improving mental models of health delivery systems, and increasing stakeholder participation and consensus for more consumer-driven and accessible services.

## 7. Conclusion

We have made an argument for the importance of understanding the dynamics of implementation and organizational performance in mental health services. Using theory, preliminary empirical research, and models, we built and simulated a model of the implementation process to understand how changes in organizational performance varied by organizational characteristics. We then conducted a more detailed behavioral analysis to understand these variations in terms of the causal structure. This led us to a simplified

understanding relating strategic reorientation, community support, and quality improvement processes.

The model we have presented is still largely conceptual and in the early stages of development. Nonetheless, it does demonstrate the potential effects under idealized conditions of implementation on organizational performance. It also represents an important advance in services research, which has often been characterized as lacking an adequate social theory for guiding research and public policy. Specifically, we have demonstrated the utility of applying system dynamics for combining what we know from existing models and theory with pilot data to develop and test a model that leads us to substantive insights and into the next iteration of research.

We believe the IOP Model is an improvement over existing and often static mental models of mental health policy regarding implementation of evidence based practice. Moreover, we see attention to organizational dynamics and strategic as opposed to tactical issues as innovations in services research. Our research demonstrates an application of system dynamics to one cycle of research that can develop into a longer program of evaluation and policy design. Such programs are essential to making significant gains in public mental health in years to come.



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