

A DIAGNOSTIC INVESTIGATION AND A CORRECTIVE MODEL  
FOR IMPLEMENTING CHANGE IN RESPONSE TO INNOVATION

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A Dissertation  
presented to the Faculty of the Graduate School  
University of Missouri-Columbia

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In Partial Fulfillment  
of the Requirements of the Degree

Doctor of Philosophy

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by  
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DECEMBER 2002

## ACKNOWLEDGMENTS

First, I would like to thank God for giving me the inspiration and guidance to accomplish the goal of successfully ending the doctoral program in Industrial Engineering at the University of Missouri – Columbia. I want to thank my wife Mady and my daughters Deyanira and Madi for always supporting me and for their patience during all these years. To my family and friends in Panama and Columbia, also thanks.

In addition, I would like to thank all the people from the Universidad Tecnológica de Panamá and the Laspau-Fulbright Program, who gave me the opportunity of coming. To Dr. José Luis Zayas-Castro and Dr. Thomas J. Crowe, my eternal gratitude. As advisors they were always there to help and guide me. As friends their advice was always timely and valuable. My deepest gratitude goes also to Dr. Cerry Klein, Dr. Wooseung Jang and Dr. Thomas Dougherty, committee members, for their time, advice and motivation.

To the management and personnel at the Missouri Lottery, thanks for allowing me to conduct this research effort in their organization. I want to give special thanks to Mr. Terry Skinner for all his help during this project.

My deepest gratitude to Mrs. Nancy Burke for helping me in the editing of this document. In addition, I would like to thank Dr. Steven J. Osterlind, Professor of Education and Counseling Psychology at the University of Missouri – Columbia and Dr. Noel Artilles from the University of Puerto Rico – Recinto de Mayagüez for their sound advice in the statistical analyses of this research.

A special thanks to the professors and staff at IMSE, Dr. Chang, Dr. Occeña, Dr. Noble, Dr. Wu, Dr. Miller, Dr. David and Mrs. Sally Schwartz for all their support and advice. Last but not least, thanks to our team members Annette Desarden-Carrero and Sushma Kalavagunta, who really helped us in the last lap of this journey.

# A DIAGNOSTIC INVESTIGATION AND A CORRECTIVE MODEL FOR IMPLEMENTING CHANGE IN RESPONSE TO INNOVATION

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## ABSTRACT

Organizational change can be described as a series of activities oriented towards modifying behaviors and structures within the organization. These series of activities are interconnected internally and externally and are affected by human, operational and environmental factors that dynamically influence decisions and processes in the organization. There has been a significant amount of work in organizational change, using both behavioral and systemic approaches. Moreover it has been argued that research in change processes should include also the dynamic relationship between change processes and outcomes to detect how organizational change context, processes and the pace of change affect performance outcomes. Despite the amount of research, there is a need for more profound studies exploring the contexts, content, and processes involved in a change initiative.

This research proposes a model to help organizations implement change initiatives with an increased likelihood of success. The Influence Model for Organizational Change – IMOC - was developed with the hope of better demonstrating the dynamics that take place in the organization by using a systems engineering view. As an exercise to verify the relationships that govern IMOC a systems dynamic simulation model was partially developed. The dynamic simulation confirmed the impact of

variables such as employees' and management participation, environment and delay in implementing policies on the level of resistance to change existing in the organization. The model proposes the need of an initial diagnosis, performance measures and feedback and control activities as main elements in the success of change initiatives. Finally, the research proposes a multidisciplinary meta-analysis as a tool to extend and generalize IMOC to different organizational settings

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## **Chapter 1**

### **Introduction**

#### **1.1 Foreword**

The well-known author and futurist Alvin Toffler wrote, “If we don’t learn from history, we shall be compelled to relive it. True. But if we do not change the future, we shall be compelled to endure it. And it could be worse (Toffler, 1972, p. 3).” Organizations have been coping with change since the Industrial Revolution, when they had to develop from the traditional artisanal methods of production, to a more enterprising approach in order to meet expanding demands for mass market products and services (Toffler, 1979, Hammer and Champy, 1993).

For an organization to develop, change must occur (Burke, 1994). This change implies that owners, managers and the public must eliminate their traditional approaches to organizing and conducting business and create new approaches and concepts (Hammer and Champy, 1993). When the need of change is recognized, two questions have to be addressed: what changes are necessary, and how these changes will affect the organization. Answering these questions becomes crucial for the success of any change initiative (Heller, 2000).

#### **1.2 Background and Motivation**

Conducting an 18-month reengineering project at the Missouri Lottery, a group of researchers from the University of Missouri found that the Missouri Lottery initiated in

fiscal year 1998 a program called “Because You Are Important” (BYAI). It aimed to improve service quality and to develop a new culture in the organization fostering the idea “that innovation in all areas of our business is a means of gaining and maintaining leadership “(“Because You Are Important”, 1998, p, 7). Cultural changes promoted by this program should have facilitated creativity and innovation. A reengineering process followed this program to improve certain business practices critical to making the Missouri Lottery an efficient and competitive organization.

The reengineering process began with the ideas presented by the executive director about current performance – at that time -, and the need for change in order to make the organization more flexible and adaptive to new markets. The process included a series of interviews with top managers, mid-level managers and other employees with the purpose of finding the main processes needing change. The group in charge of the project presented five main proposals for change, which involved the creation of new working units requiring the development of cross-functional activities, responsibilities and authority. From the proposed new units, one was immediately adopted, resulting in savings in time, paperwork and resources for both the Lottery and retailers. This project was awarded the Governor’s Productivity Award in 1999. Of the other four proposals, only a small portion of the procurement process was accepted.

The experience obtained in this project indicated that while the Missouri Lottery adopted some improvement processes, others were rejected. Usually small incremental changes were accepted, although not easily, while other proposals that were concerned more with managerial decision making or with managerial control were frequently rejected. Organizations, like systems, tend to reach equilibrium even within their

dynamic behavior. Inertia makes systems maintain their initial conditions even if some of the components of the system have been through a small modification (Kelly, and Amburgey 1991, Amburgey, et al, 1993, Kiel, 1994, Anderson, 1999, Gharajedachi, 1999, Pascale, et al., 2000). Is this the reason why only small changes were allowed in the Missouri Lottery?

From these experiences it is possible to ask why, if people supposedly were culturally prepared to adopt new views, the project did not have the expected results. Is there a missing link between organizational learning, organizational change and innovation that makes it difficult, if not impossible, to implement new processes? Are individuals the cause of this failure, or is it the organizational structure?

As was demonstrated in the work at the Missouri Lottery, the strategies used to redesign business activities involve a link between engineering and organizational development (OD). This link enhances the opportunities for success (Moosbruker and Loftin, 1998). While OD is a long-range effort to improve an organization's renewal process (Chmiel, 2000), Business Process Reengineering uses engineering tools, such as process modeling and information technology to create the necessary synergy to generate radical change (Presley, et al 2000). Improvements resulting from this combined effort will generate more benefits for the state and consequently for the public.

The objective of this research is to propose a conceptual model called the Influence Model for Organizational Change (IMOC). This model integrates knowledge on organizational change presented in the literature with concepts from systems dynamics and management and decision sciences into a more detailed conceptual model that can explain the intricacies of adopting change and innovation in organizations using a

systems thinking approach. IMOC explains not only factors that are potential obstacles to change and innovation, but also helps in developing guidelines that can be applied to enhance the chance of succeeding in implementing change and innovation. A case study conducted to investigate with more detail the experiences obtained at the Missouri Lottery is intended to obtain relevant information to determine whether the propositions presented in this research effort are valid, and what information is needed in the future to better address the critical issues.

After 18 months of research and reengineering work at the Missouri Lottery, a solid base to continue a more extensive and profound study exists. Momentum has built up for more research into the expansion of the empirical and theoretical validation of concepts, models, and characteristics of organizational change. This is a unique opportunity to integrate concepts from organizational development, management sciences and engineering to systematically describe, understand and explain the intervening variables and potential relationships existing during a complex change initiative.

The use of integrated and multidisciplinary knowledge is a key element of this research. Figure 1.1 graphically conceptualizes the research process. Knowledge from behavioral and social sciences helps to set the necessary theoretical background for IMOC. Through these concepts the model relationships and study proposition were generated. Engineering and decision science concepts helped to adopt the necessary methodology for modeling a complex activity such as organizational change. Systems thinking theory integrates the concepts from social sciences and modeling techniques in a unique set of relationships and sub models that conceptualize change in a holistic

approach, showing the effect of the different variables and elements on the likelihood of a successful change initiative.

As seen in figure 1.1, the information presented in the literature review, together with the personal experiences obtained by the researcher in a previous project at the Missouri Lottery are the basis that motivated this research effort. At the same time, the literature review served as a guide for the theoretical background needed to understand the complexity of change. In addition, the information presented in this review helped to incorporate the different relationships and causalities posited in IMOC; it allowed the generation of the study propositions. Finally, the information helped in the decision of which modeling methodology was the most appropriate to present the integration of the different causal relationships that exist during a complex change process in a holistic approach.

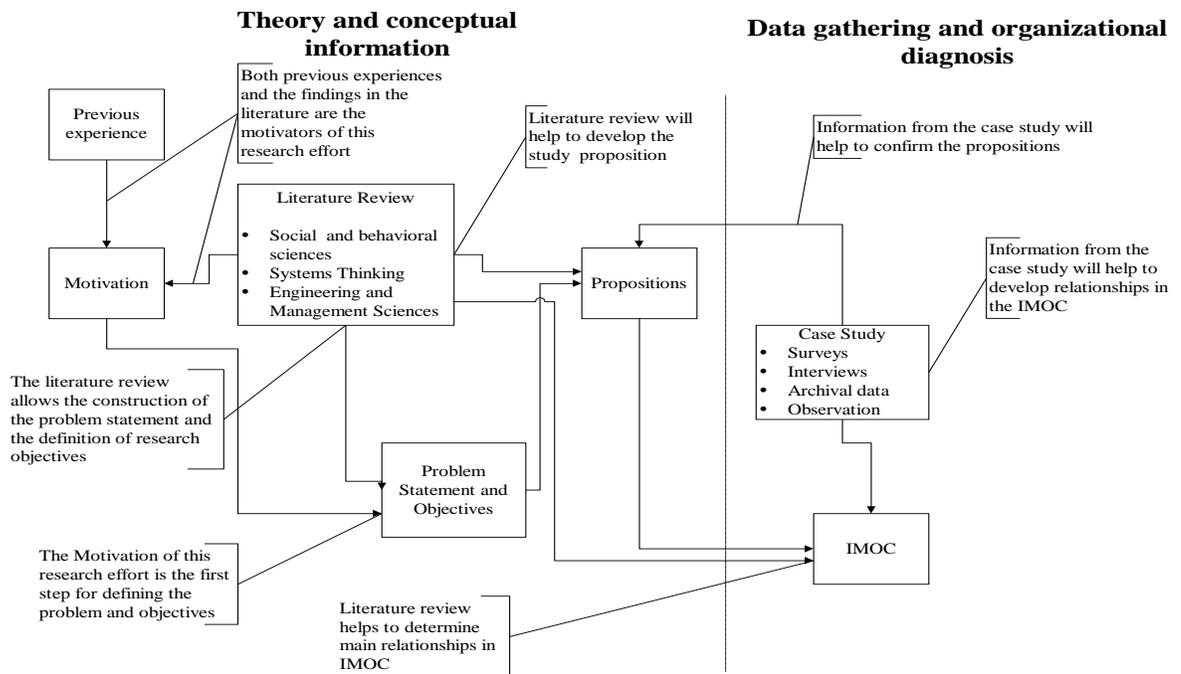


Fig. 1.1 The integrated research approach

Through the case study, as qualitative methodology, the empirical information needed to integrate the knowledge from the literature with the conceptual relationships presented as propositions in this research effort was gathered. Linking the experiences obtained during this case study with the literature assisted in extending the ideas and propositions generated in this research to other organizations, conceptualizing a model that could be used to describe, control and successfully implement organizational change both in government and private organizations.

### **1.3 Organization of this Document**

The organization of this document is intended to facilitate the understanding of the goals and objectives of this research initiative, as well as the tasks performed and the instruments used to test the propositions that will be presented in later sections of this document.

Chapter Two presents a selected literature review on Organizational Change, including theory and models presented by different authors. It includes a section on Business Process Reengineering (BPR) as the best-known strategy to implement radical change and compares it with other strategies for organizational change such as Organization Development, Total Quality Management and Change Management. In addition, this chapter includes information on systems thinking and system methodologies, and briefly presents concepts on different tools to model organizational change. Finally, this section presents the problem statement and objectives of this research effort.

Chapter Three describes the methodology proposed to achieve the goals of this initiative. A section explaining and justifying the use of the case study as research methodology is included. The chapter explains the methodology and activities that are to be performed to accomplish the goals defined in Chapter Two. The data collection, data recording procedures, instruments, verification and validation procedures and specific aspects of the project will be described and explained, including a description of the proposed instruments used to gather the necessary information.

In addition, Chapter Three includes information on the use of an integrated approach for analyzing and solving complex social problems. This approach, called Compram (DeTombe, 2001), indicates the necessary meta-steps that a multidisciplinary team should follow to define, to describe and to solve complex problems using a prescriptive framework as a basic communication tool between researchers with different backgrounds to understand not only the problem but in addition, the different facets and characteristics of the possible solutions. Finally a section on validation of system dynamics models is presented. One of the major criticisms of dynamic systems models is of the validation and reliability. This section intends to present the philosophical concepts and procedures for validating a system dynamics model, and relates these procedures with the actual scope of this research initiative.

Chapter Four of this document presents an analysis of the information gathered through the surveys and interviews conducted at MoLo, and compares the information with the different propositions stated in Chapter Three.

Chapter Five introduces the proposed model and explicates different expressions, in terms of systems dynamics concepts, intended to state the causal relationships existing

in the organizational change process. IMOC models organizational change from different perspectives and dimensions, exploring the relationships in different sub-models trying to better explain the dynamicity of change.

Finally, a set of conclusions and ideas for future work are presented in Chapter Six. The ideas and proposed interrelated work were intuitively developed as part of the findings, commonalities and contradictions discovered during the case study and the literature review.

## **Chapter 2**

### **Literature Review**

#### **2.1 Introduction**

Intense global competition together with all the complexity involved in a world of constant changes makes organizations extend outside their traditional boundaries to conduct business (McCormack and Johnson, 2001). The challenge today is to design organizations that are flexible and adaptive, making them able to survive in time of change and globalization (Burke and Trahan, 2000). In the last 30 years many tools for attacking this challenge have been developed; however many of the conventional managerial practices seem to be outdated and need to be dynamically changed, since the concept of managing business in a stable environment is no longer valid (Elion, 1993). In most cases management practices do not bring significant changes in behavior and practices. Organizations need to stop doing things they have been doing traditionally if they expect to get different results (McNanus, 2002).

Coping with rapid change has been a great challenge and concern for most organizations. Organizational change ranges from a fairly simple project to a complex company transformation (Harrison, 1994), and becomes critical and inevitable due to the unstable nature of the competitive environment (Spector, 1989). This change has the objective to create meaningful competitive differentiation among organizations, which requires a redesign of products, services and processes (Kim, 2000). Changes in the organization have the immediate effect of the actions and agitations that follow any new activity, and a full effect after the organization has adjusted itself to the new situations

created (DeCanio, et al, 2000). Immediate results of a change initiative cannot be expressed in terms of change in routine activities and policies. Instead, more profound changes require the adoption of new structures, culture, leadership and attitudes (O'Hara, et al., 1999, Presley, et al., 2000). As organizations try to keep up with these changes and new environments, they grow in complexity. Organizational complexity can arise from: enterprise stress, diversification, efforts to eliminate waste, pressure from competition, government regulation and deregulation and new technologies, among other factors (Scofield, 1996), and influences the manner in which decisions are made, actions taken and results measured (DeCanio, et al., 2000)

Organizations that have learned to view change as a permanent process are successful in maintaining their competitiveness and surviving in the changing world (Armenakis and Bedeian, 1999). Organizations that fail to keep up with these changes are more likely to disappear in the near future (Hosking and Anderson, 1992). The idea of continual change and renewal is always present for both theorist and practitioner. This is especially true for those who are operating in environments that are either innovative or subject to forces created by competition or economic and governmental-rules changes (Shareef, 1997). Although a consensus as to what constitutes an organizational transformation has not been fully reached (Poole, 1998), organizational change can be defined as an “empirical observation of difference in form, quality, or state over time in an organizational entity” (Van de Ven and Poole in Hurley, 1998, p. 57). In order to implement change in response to external and internal motivations it is necessary to understand how organizations change; how they learn from experiences; how they design

or redesign structures, strategies, and organizational structures; and how they plan for and integrate new technologies.

Actions typically associated with transformation include changes to organizational strategies, personnel changes, new organizational missions, visions, objectives, policies, and culture. Top management has to consider the existing set of organization guidelines and structures before trying to transform the organization (Poole, 1998). In addition, it is important to consider that the outcomes of the organizational change process influence other organizations that interact with the transforming institution (Bloodgood and Morrow, 2000). Among these outcomes are the number of organizations that are changing, the direction of change, and how clear it is whether or not certain strategies are succeeding.

McAfee and Champagne, (1987) define organizational change as “any deliberate attempt to modify the functioning of the total organization, or one of its major components, in order to improve effectiveness (p. 451).” It is important to distinguish two important elements in this definition. First of all it is deliberate. In other words, it is necessary to plan the change process before attempting it. To minimize the risk of failure, it is important to develop a coherent plan that justifies and leads the change process since lack of planning leads to improvisation, which then leads to failure (McAfee and Champagne, 1987). The other important element to consider in this definition is the concept of the total organization as the recipient of the change process. Considering the organization as a whole implies viewing the organization as a set of interrelated elements and variables all of them oriented towards the same purpose (Gharajedaghi, 1999).

Innovation, on the other hand, will be viewed as the adoption of technologies, administrative systems, ideas or procedures that will modify everyday transactions (Edwards, 2000, Gopalakrishman and Damanpour, 2000). Organizations would adapt products, services, devices, systems, procedures or programs that are not necessarily new to other organizations but are new to the adopting entity (Nord and Tucker, 1987). It is possible to argue then that while organizational change implies the adoption of innovations, the adoption of a new system or technology implies the adaptation of the organization to a new element, but not necessarily the generation of organizational change.

The necessity of change is not only a requirement for private organizations. Effective public administration in the era of innovation requires that government agencies develop the capacity to use innovative management tools and techniques (Poister and Streib, 1999). These techniques should be designed to change how government does business with emphasis on the measurement of results (Wechsler and Clary, 2000). The state and federal comprehensive reforms during the 1990s are part of the Government Performance and Result Act (GPRA) implemented nationwide in 1997 as a result of the document “ A Vision of Change for America”. This document describes the comprehensive economic plan proposed by President Clinton in 1993. <sup>1</sup>GPRA requires agencies to develop strategic plans, annual performance plans, and annual performance reports in order to answer the basic question: What are we getting for the money we are spending? To be successful GPRA requires changes in management systems in addition to strategic and performance plans (Kessler, 1998). This effort requires dramatic cultural

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<sup>1</sup> *A Vision of Change for America* (1993) Executive Office of the President of the United States of America.

changes, focusing more on results than on process. GPRA looks for efficiency in government management to reduce federal and state deficits while improving the quality of services to the taxpayers. To achieve this goal, it is necessary not only to develop appropriate performance measures, but also to redefine federal government's and states' processes and agencies.

Applying change to government is different than applying change to private organizations (Armenakis and Bedeian, 1999). The literature addresses change in state government administration related to the climate of change and associated models (Kessler, 1998), implementation of performance measures (Wechsler and Clary, 2000), reinvention of government (Russell and Waste, 1998, and Brudney, et al. 1999), and strategic management in public agencies (Poister and Streib, 1999).

Research on change for public agencies has been limited by the development of two competing and seemingly incompatible perspectives, reinventing government or refounding government (Russell and Waste, 1998). Reinventing government is based on the concept that public administration can deliver goods and services using different approaches. This raises the issue that state administrators have to confront the development of entrepreneurial governments using innovative tools such as strategic management, information technology, and performance measurement, among others (Brudney, et al., 1999). Refounders, on the other hand, argue that individual behavior is socially shaped because of the old social institutions, their rules, paradigms, and goals. Therefore, problems are resolved only if institutions and individuals change (Russell and Waste, 1998). These perspectives appear to be based on both radical changes in

operational processes as well as changes in the principles and practices of organizational development and individual change.

A performance government is distinguished by its emphasis on the measurement of results and is conceptually oriented toward results and accountability (Wechsler and Clary, 2000). Reinventing government requires this orientation to be applied across the states and across individual agencies (Brudney, et al., 1999). State government has to become an organization that utilizes evaluation as an aid to gain from previous experiences, detecting and correcting errors (Leeuw, et al., 1994).

To measure the adoption of reinvention and success of reinvention reforms, Brudney, et al., (1999) studied 93 agencies taking into account variables that affect change across agencies. These variables include state reform effort, agency type, agency characteristics, environmental influences on the agency, and director's attitude toward change. They concluded that agencies with access to resources for investment are likely to sustain a more efficient change process.

Thong et al. (2000), on the other hand, affirm that because state and federal agencies rely more on appropriations and less on market exposure and provide monopolistic and/or mandatory services, there is an increased reluctance to adopt massive changes, less innovative breakthrough and greater cautiousness in thinking and decision making. They add that although social and political changes are the drivers that motivate change in public agencies, due to the greater diversity and intensity of external influences a great resistance to change is found in state and federal organizations.

## 2.2 A Taxonomy of Change

Organizational change involves the transformation of an organization over time (Barnett and Carroll, 1995). It can be seen from two major dimensions: the content of change and the process of change. The content of change can be identified with the goals and objectives of the planned change, and it can be measured by studying the organization before and after the change process has been implemented. The second dimension is concerned with how organizational change is achieved over time (Damanpour, 1991, Barnett and Carroll, 1995, Damanpour, and Gopalakrishnan, 1999).

In order to define both the content and the process of change, it is important to define the type of change that is expected. O'Hara (1999) mentions that it is possible to identify three types of change: a first order change (alpha type) that involves only task accomplishment, a second order change (beta type) that involves tasks and people, and a third level change (gamma type) that involves the whole organization and requires a high level of preparedness. Hence, the content of change can be seen in a continuum going from routine to radical (Nord and Tucker, 1987), while the process of change also can be seen in a continuum, ranging from continuous to radical change (Hammer and Champy, 1993, Grover, et al. 1995, Grover, 1999).

From the content dimension, it is possible to argue that the process of change can be directly related with the adoption of an innovation since the adaptation to a new process, technology or system is closely related to the organizational change process. Routine innovation is defined by Nord and Tucker (1987) as “the introduction of something that while new to the organization is very similar to something the organization has done before (p. 11).” On the other hand radical innovation “in addition

to being new to the organization, is very different from what the organization has done previously, and is therefore apt to require significant changes in the behavior of employees and often in the structure of the organization itself (Nord and Tucker, 1987, p. 11).” According to the definition given by Nord and Tucker, it is possible to suggest that in order to implement radical innovations it is often necessary to radically transform the organization, or as stated by Presley, et al. (2000), to develop a gamma type change. Radical transformation “requires radical leaps, if not fundamental changes, in the way things are done (Burke, et al., 1996, p. 46)”.

Nord and Tucker (1987) go beyond just defining the radicalness of the innovation. They also define innovation with respect to what parts of the organization the innovations affect and the units involved in the adoption of the innovations. With respect to what parts of the organization the adoption may affect, innovations can be defined as technical and administrative. Technical innovations originate in the technical core of the organization and pertain to the inclusion of new products, technologies or process. Administrative innovations originate in the administrative core of the organization and pertain to administrative procedures, policies and systems (Nord and Tucker, 1987, Damanpour, 1991). Damanpour (1991) studied the relationship between the radicalness of the innovation and the part of the organization affected and concluded that the adoption of administrative innovation requires a less transformational change than the adoption of technical innovations. According to Damanpour’s study, administrative change requires what Burke, et al., (1996) define as transactional change, which “requires a fine tuning and improving of the organizational existing behaviors (p. 46).” Therefore, this type of change can be classified as both alpha and beta since it affects tasks and

people without profoundly changing the organization and its core elements (Presley, et al. 2000).

Finally, Nord and Tucker (1987) define central and peripheral innovation in relation to the organizational elements affected during the change and innovation process. affecting the core elements of the organization, central innovations are those elements that internally transform the organization and are related to vision and mission, authority, technologies and strategies (Kelly and Amburgey, 1991, Burke and Litwin, 1992).

Central innovations mandate a core structural change that requires a more profound change involving internal structures and a radical divergence from current practices and behaviors (D’Aunno, et al., 2000). Peripheral innovations affect peripheral structures, which protect core structures from uncertainty by defining the procedures and systems that execute the routine transactions within the organization and between the organization and the environment (Kelly and Amburgey, 1991, Burke and Litwin, 1992).

Table 2.1 Taxonomy of innovations

<b>Radicalness of the innovation</b>	<b>Extent of the innovation</b>	<b>Depth of the innovation</b>	<b>Elements affected</b>	<b>Type of change</b>
Routine	Administrative	Peripheral	Transactional elements	Transactional or continuous
Radical	Technological	Central	Transformational elements	Transformational or radical

As seen in table 2.1 routine innovations involve the adoption of new administrative activities. These activities affect what Burke and Litwin (1992) define as transactional variables or specific elements concerning activities or process. These types of innovations are the result of continuous adjustments within the peripheral or daily business activities in the organization. Radical innovations involve adapting the

organization to what Nord and Tucker (1987) defined as technological innovation. These innovations, as posited by Damanpour (1991), include not only new products and services to satisfy external competition, but the new elements needed to perform the new processes adopted. Radical innovations affect central activities defined by Burke and Litwin (1992) as transformational elements or variables that affect core organizational elements and beliefs. Before attempting to adopt radical innovations, the organization needs radical change (Heller, 2000).

### **2.3 Implementing Radical Change**

Tushman and Romanelli's inertia theory of organizational change (in Sastry, 1997) affirms that transformational change is composed of occasional dramatic revolutions or punctuations. These punctuations overcome organizational inertia and set a new course for the organization to follow. In contrast Hannan and Freeman (in Amburgey, et al., 1993) propose that resistance to change occurs because organizations are embedded in the institutional and technical structures of their environment. They posit that organizations exist because they are able to perform with reliability and accountability if the organizational goals are institutionalized and activities are routinized. Nevertheless, this institutionalization and routinization generates strong resistance to change. Thus, the characteristics that give stability to an organization also generate resistance to change and reduce the probability of change.

In addition, Larsen and Lomi (1999) assert that it is possible to view organizations from two opposite points of views. On one side as organizations grow in size and age; they accumulate competencies and knowledge that help in obtaining a competitive

position. On the other hand, it is possible to view the organization aging process as directly related to the lack of ability to rapidly and adequately cope with rapid change and innovation. Both internal and external stakeholders prefer organizations that exhibit reliable performance because change disrupts both internal routines and external linkages (Ettlie, 2000). But, as Dent and Goldberg (1999) affirm, if people are convinced that change will bring better conditions and more stable conditions, there is more likelihood that the change will be accepted. In conclusion, inertia is an important element in defining which view is true since it has to do with the speed and cost at which the organization can adapt and change to address new and different needs; can find and occupy new resources and space; and can make actors to generate and retain new resources internally (Kelly and Amburgey, 1991, Amburgey, et al., 1993, Sastry, 1997, Larsen and Lomi, 1999).

Organizational change needs to be at a faster pace (Burke, 1994) especially if it is precipitated by traumatic events as is common in today's economy. With radical change the most complex of all the types of change, it is necessary to elucidate the strategies to successfully achieve radical change. The next section covers a more detailed analysis of the strategies developed to implement change. The section emphasizes Business Process Reengineering (BPR) as a strategy for radical change, and compares it with other methodologies.

### **2.3.1 Business Process Reengineering (BPR)**

Reengineering, as a radical change strategy, offers a formal methodology for identifying and achieving radical performance gains (Davidson, 1999). The idea of BPR

is that simple improvement of processes will not eliminate complexity. Organizations need to go back to the drawing board and consider what they have to do to be most efficiently and effectively organized in order to achieve their goals and objectives (Clarke, et al., 2000), including a complete redesign of the organization.

Several definitions of BPR have been found in the literature. The term “business process redesign” originated in a research project which started at MIT in 1984 (Biazzo, 1998), and was classified as the third step of a business-restructuring model. The model consisted of five levels defined as: localized exploitation, internal integration, business process redesign, business network redesign, and business scope redefinition. Business process redesign consisted of reengineering processes in order to fully exploit IT capabilities. BPR was considered a specific strategy for using information technology efficiently (Biazzo, 1998).

Davenport and Short (1990) defined Business Process Redesign as “the analysis and design of work flows and processes within and between organizations” (p.11). They added that working together with information technology (IT), these tools would have the potential of transforming the organization to “the degree that Taylorism once did” (p.11). In this view, it is possible to say that BPR changed from an IT specific application to a more general strategy enabled by IT (Davenport and Short, 1990, Biazzo, 1998, Al-Mashari and Zaiari, 2000).

Hammer and Champy (1993) affirm that:

“ To reinvent their companies, American managers must throw out their old notions about how businesses should be organized and run...(p. 1)... Reengineering is the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical contemporary measures of performance, such as cost, quality, service and speed (p. 32).”

While Davenport and Short (1990) conceptualize the design of processes not only within the organization, but also between organizations, Hammer and Champy consider, in addition to business processes, the importance of performance measures as an important element of the reengineering process. In addition, such a great impact on the organizational change can be efficiently and effectively reached thanks to the new generation of IT (Davenport and Short, 1990, Hammer, 1990, Hammer and Champy, 1993, Talwar 1993, Martínez, 1995).

Klein, on the other hand includes a more strategic and organizational orientation when he defines BPR saying that:

“ BPR is the rapid and radical redesign of strategic, value-added business processes – and the systems, policies, and organizational structures that support them – to optimize the work flows and productivity in an organization” (Klein, 1993, p. 40).

In the same context, Talwar (1993) defines BPR as:

“An approach to achieve radical improvements in customer services and business efficiency. The central challenge is to rethink and streamline the business process and support architecture through which the organization creates and delivers value” (p. 23).

Lee (1995) compiled a series of definitions of BPR. Some of the definitions that can be considered relevant for this work are presented below:

- E. O. Goll (in Lee, 1995) defined “BPR as the total transformation of a business; an unconstrained reshaping of all business process, technologies and management systems, as well as organizational structure and values, to achieve quantum leaps in performance throughout the business” (p. 6).

- An anonymous definition says that BPR “is a process by which companies become world-class competitors by remaking their information systems, their organizations, their way of working together, and the means by which they communicate with each other and their customers” (p. 6).

Vansina and Taillieu (1996) agree that reengineering is the redesign from a clean slate of an existing organization by inventing a better way of doing work. They affirm that this clean slate approach is not new, but has been part of socio-technical systems for more than a decade. The main difference is that BPR achieves radical changes from the perspective of the customer, while socio-technical approaches accomplish change mainly as a function of people’s needs within the organization.

Moreover, Eisenberg (1998) includes organizational culture when he defines BPR as the radical redesign of a company’s processes, organization and culture to achieve new levels of performance that create a breakthrough in the organization. On the other hand, although Arora and Kumar (2000) do not specifically define BPR, they affirm that BPR is not a continuous technique for implementing change. Rather, BPR is an incremental technique, which implies changes that are more radical. Finally, Irani, et al., (2000) say that BPR is a “vehicle with which to improve performance through radically redesigning strategic, tactical, and operational processes, together with the procedures, policies, structures, and infrastructure that support them” (p. 248).

A partially different definition is given by the U. S. General Service Administration. It defines Government Reengineering as “the fundamental rethinking and radical design of core processes to bring about dramatic improvements in performance under political conditions characteristic of the public sector environment” (GSA, 1997,

<http://www.itpolicy.gsa.gov/mkm/bpr/gbpr/gbpra.htm>). Here, changes are bounded by political conditions found in governmental organizations. Since these political conditions are externally defined, they would limit the reach of any change with environmental factors that cannot be controlled by the organization.

Most of the definitions include other aspects distinct from IT. This makes BPR a more strategic approach, that will include change in all the elements of the organization, from the way work flows through different business processes, to the way customers and the organization communicate with each other; all based on a new culture and values created through the changing process.

### **2.3.2 Relationship of BPR with Other Techniques**

Although BPR emerged as an approach to radical business transformation, Rouse and Watson (1994) affirm that BPR does not restrict itself to making changes in tasks and roles; for BPR to succeed it is necessary that crucial behavioral, cultural, and technical changes be achieved. Burke (1994) affirms that “organization change should occur like a perturbation or a leap in the life cycle of the organization, not as an incremental process (p. 23).” Nevertheless, he posits that despite the change being radical, the management of the change process must be incremental.

Thus, it is possible to affirm that succeeding in radical change implies the use of a combination of tools and practices that guide the organization to the necessary total change required. These practices and tools are based on early theories that have been in use for decades and are brought together by theorists in different areas (Talwar, 1993, Nader and Merten, 1998). These fundamental ideas can be summarized as the radical

redesign of process, the revolutionary nature of the change, and the total commitment of top management (Biazzo, 1998).

Several other strategies have been developed in recent years to cope with organizational change, with BPR, Organization Development (OD) Total Quality Management (TQM), and Change Management (CM) among the most important and best known. The following paragraphs try to explain the existing relationships among the different strategies, their similarities and differences.

In contrast with BPR, TQM emphasizes continuous rather than radical change. Derived from the original concepts developed by W. E. Deming in the late 1940s, TQM may be defined as the process of changing an organization's culture or developing the organization to make it more responsive to customer's needs, more efficient and effective (Pike and Barnes, 1994). This management approach is customer driven and instead of just trying to achieve high profits, TQM proposes that profit will improve as quality improves and the systems are under control (George and Weimerskirch, 1994).

BPR's primary criterion, that the organization is a collection of processes that can be reengineered scientifically and systematically (Biazzo, 1998), has been presented in early works; for example E. W. Deming, pioneer of TQM, emphasized the importance of thinking in terms of processes and process control (Vansina and Taillieu, 1996). Rouse and Watson (1994) report that the theories in socio technical systems present since the early 70's the concept of transformation processes of human activities and the resulting clients being benefited by these transformations as part of the application of systems theories in the social sciences.

**Although originally two opposing and competing areas, TQM and BPR are getting closer as strategies for inducing change in organizations (Jarrar and Aspinwall, 1999). B. Wright (in Jarrar and Aspinwall, 1999) coincides with Burke (1994) when he affirms that reengineering of existing processes can be better achieved using existing TQM activities as facilitators. The authors present a list of similarities between TQM and BPR, including that both are quality movements, they need support and commitment, they provide measurable results, the customer is the focal point, both are focused on processes, results and changes are based on team work, they need a profound cultural change, and training is the basis of learning. Finally, Jarrar and Aspinwall, (1999) affirm that since TQM tends to create a stable organizational culture, it is possible to reduce the stress caused by BPR when it becomes a reality.**

TQM and BPR can be considered similar, since both are based on concepts of process and organizational change (Al-Mashari and Zairi, 2000). Both use benchmarking, are focused on customer needs and need performance measures to verify the change process. They differ mainly in the speed of change. While TQM is based on a continuous incremental rate of change, BPR is innovative and radical in nature (Al-Mashari and Zairi, 2000). The integration of both might improve the likelihood of achieving a successful change. The speed of change can be graphically depicted as in figure 2.1, which shows that continuous improvement takes more time to reach the expected level of change than radical improvement. It is important to consider that the need of a radical change can offset the results by not considering the human variables that in some cases need time for adjustment (Burke and Trahan, 2000)

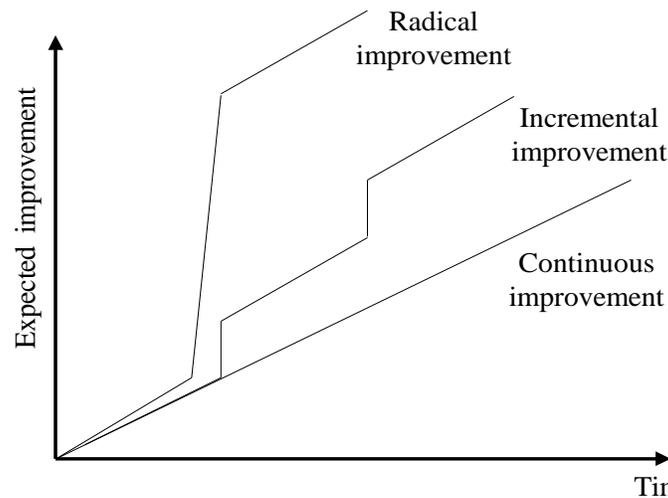


Fig. 2.1 Difference in outcomes depending on the approach to

organizational change used. Adapted from Murnighan et al. (2000).

The classical approach to organizational change uses Organization Development (OD) to create the motivation and accelerate the processes of change within the organization. OD has developed from its roots in human relations' factors to focus on strategic issues (Farias and Johnson, 2000).

“Organization Development is a long-term effort, led and supported by management, to improve an organization’s visioning, empowerment, learning, and problem-solving processes, through an ongoing, collaborative management of organization culture – with special emphasis on the culture of intact work team configurations – using the consultant-facilitator role and the theory and technology of applied behavioral science, including action research (French and Bell, 1999, p. 26).”

By focusing not only on the human side but also on processes, the OD professional has the potential of building teams in the organization with a shared vision and strategy. The OD expert is the facilitator or a neutral third party, which uses diagnosis as an intervention to promote organizational change by means of changing attitudes to change behaviors (Harrison and Shirom, 1999, Worren, et al., 1999). Moreover, Organization Development and other socio-technical theories (Vansina and

Taillieu, 1996, Rouse and Watson, 1994) see change as a dynamic process but from an internal point of view and not based on customer requirements. In order to lead to a planned organizational change, it is necessary to consider values that will focus on improving the concern for people in the organization. Among those values are shared leadership, teamwork, empowerment, employee-wellbeing, participation, flexibility and open communication.

From the definition it is possible to conclude that OD requires long-term effort as well as long-term commitment. In addition, it requires the full commitment of top management and the participation of all the members of the organization. Finally, its main purpose is to improve the processes concerning the products and services the organization offers (French and Bell, 1999, p. 26, Al-Mashari and Zairi, 2000). Although BPR also requires the commitment of top management, it is designed for radical change in a relatively short period of time, such as six months to three years (Skarke, et al., 1995).

Moosbrucker and Loftin (1998) affirm that bringing BPR and OD together is difficult, but that any model that aims for success in organizational change must include the principles and practices of organizational development and business practices and processes. Also they argue that the relationship between OD and BPR inhibits collaboration between both disciplines. Jang, et al., (1999) establish that BPR facilitates communication among departments, improving the flow of ideas and goals as work is passed from one department to the next. The similarities between OD and BPR are numerous. The main difference appears to be both the focus on internal participants and long term incremental change defined by OD versus the focus on customer's needs and

radical change that underlie BPR. Thus, it is possible to posit that BPR enables OD to achieve its objectives by defining the processes that are causing problems within the organization. Redefining processes within the organization can help in developing models for organizational change, considering not only the welfare of people, but also ways to efficiently and effectively reach organizational objectives and goals.

The concept of top management commitment is a basic factor for OD and BPR. Planning for the change is top down. Reengineering must be directed, supported and led by the firm's top managers. Top management commitment and leadership is essential in institutionalizing change (Armenakis, et al., 1999, Worren, et al., 1999), since they must convince all the members of the organization that the change is necessary. The goal is to create a substantive change and in order to succeed it is necessary to have organizational commitment and follow-up.

Innovative approaches to business transformation have arisen to minimize the gaps existing between BPR and other organizational change strategies (Cheyunski and Millard, 1998). As the BPR concept has changed from an IT enabled process change initiative into a more holistic approach, the social and cultural aspects of the reengineering process are emphasized (Al-Mashari and Zairi, 2000).

Worren, et al., (1999), define an integrated approach called Change Management (CM). It is based on two concepts: that human performance is the core of business performance, and that it is possible to optimize an organization's revenue and profit delivery during change. The most important difference between OD and Change Management is that the latter works through teams of experts on different areas. This integrated approach is based on the concept that changes in both structure/systems and

human processes are necessary to effect attitude and change behavior (e. g., Worren et al., 1999, Farias and Johnson, 2000, O'Connor, 2000). In addition, there are attempts to link both OD and Change Management. Cheyunski and Millard (1998) present a particular accelerated approach that blends business process redesign, information technology and organization development disciplines in order to accelerate business transformation. In their paper, the authors define an organizational architect who plays a significant role in enhancing interdisciplinary work that will enable a successful change.

Change management is the process of considering both the technical and socio-technical aspects of radical change in order to achieve a successful transformation (Worren, et al., 1999). Like socio-technical approaches such as OD, change management focuses on ways in which people and technology can be brought together to optimize systems and their interactions through social analysis. However, change management approaches use BPR concepts as they emphasize cross-functional processes that use technology to improve productivity. Finally, Change Management includes communication between all the influential elements within and outside the organization to increase the likelihood of an effective business transformation effort (Cheyunski and Millard, 1998, Worren, et al., 1999).

Continuous change strategies have failed because they do not demand radical organizational reforms (Murray, et al., 2000). Continuous improvement approaches do not work well because they seek to improve existing programs without changing what is being done. Conversely, radical change methodologies such as BPR involve radical rethinking and disregarding of existing processes. They seek new design and processes to provide radical performance improvement. Change management tries to define an

intermediate point, combining concepts from continuous improvement approaches and BPR to develop a process that reaches levels of improvement without the sacrifices and frustration that radical change programs normally bring in the organization (Grover, 1999, Murray, et al., 2000).

Love and Gunasekaran (1997) affirm that while BPR is a combination of quantitative tools inherited from industrial engineering, management theory and systems analysis, in order to be successful radical change initiatives need an organizational culture change to occur. This culture change does not come only as a result of a change in the system, but is a change that needs continuity and is a time-consuming and a delicate process that has to be initiated before the reengineering process (Obeng and Crainer, 1994). Both socio-technical theories and TQM are important tools used to develop this cultural change in organizations (Armenakis, et al., 1999, Jarrar and Aspinwall, 1999, Farias and Johnson, 2000, Worren, et al., 1999). It is necessary to combine concepts and tools from BPR with tools and concepts derived from OD, TQM and CM such as empowerment, teamwork, continuous improvement, and extensive communication in order to successfully achieve radical change (Obeng and Crainer, 1994).

### **2.3.3 Factors Determining a Successful Radical Change Initiative**

Significant publications exist that present both successful experiences and failures when implementing radical organizational change. Hammer and Champy (1993), in their seminal work on BPR estimated a failure rate of between 50 and 70%, while Kotter (1995) affirms that few of the radical corporate change efforts he has observed have been successful no matter what change strategy has been used. Eisenberg (1998) compiles a

sample of reports on how reengineering has affected both a company's performance and its future vitality. Finally, Walston, et al., (1999) observes that many publications present serious doubts of the benefits of reengineering.

Other authors report successful stories of BPR implementation on specific projects (e. g., Hammer and Champy, 1993, Kennedy, 1994, Bisson, et al., 2000, Cooper, 2000, Gunasekaran and Adebayo, 2000, Kettl, 2000). Walston, et al., (1999) report that although reengineering did not improve the average cost position of hospitals under BPR projects, it was possible to notice a significant percentage of hospitals having better processes from the experiences gained from the projects. Maull, et al., (1996) present a series of case analyses explaining the success of BPR in different companies in the U. K., while Drew (1994) does the same but applied to financial services in the U.S.A. and Canada. Finally the literature presents several examples of success in specific projects at government agencies in the United States and other countries (e.g., Caudle. 1994, Libbey, 1994, Mechling, 1994, Veasey, 1994, Narasimhan, et al., 1997, Jang, et al., 1999, McGarry and Beckman, 1999, Allan, et al., 2000, and Thong, et al., 2000).

Hall, et al., (1993) report deterioration in the overall results of observed companies, even after years of careful redesign and dramatic improvements in individual processes. On this line of thought, Martínez (1995) affirms that despite the hard work and determination, reengineering and other radical change efforts have been only marginally successful. He reports that progress in the analysis stages was significant, while developing and implementing new models was much more difficult. Problems with organizational resistance, communication, integration and commitment were the most common found in his study.

Why does radical or transformational change fail? The first difficulty in implementing any radical change project is that there is little agreement among practitioners about what radical change means (Talwar, 1993). Eisenberg (1998) argues that in practice radical change, especially reengineering projects, has become similar to downsizing. The problem, Eisenberg (1998) adds, is that reengineering has been incorrectly applied as an expedient cost cutting tool rather than for the original objective of changing the organization. BPR has to be considered an organizational change strategy rather than simply a “quick change” tool (Kettinger, et al., 1997).

In addition to correctly defining BPR, it is important to correctly define the key factors that need to be considered as determinants in any BPR project (Biazzo, 1998). The literature presents a vast amount of research aimed to define critical factors necessary to successfully implement BPR. Table 2.2 presents a summary of some of this research and the most important factors defined.

Hammer and Champy (1993) list some of the common errors to avoid in order succeeding in a radical organizational change project. They affirm that “the most important concept to grasp is process... to manage businesses around their processes “(p. 219). A business process is “the logical ordering of sequential functional level activities which take inputs and produce outputs which are of value to some customer (Crowe and Rolfes, 1998, p. 116).

Table 2.2 Critical success factors to achieve critical change

<b>Author</b>	<b>Factors</b>
Hammer and Champy, (1993)	Integrated effort, business processes definitions, definition of mission, goals and objectives of the organization and the BPR effort, top management commitment, top-down process, few but important projects, clarity in the definition of BPR, leadership, allocation of resources, human implication.
Hall, et al., (1993)	Roles and responsibilities, measurements and incentives, organizational structure, information technology, shared values and skills, span, extent, leadership
Talwar, (1993)	Extent of the reengineering project.
Drew, (1994)	Past experiences in BPR, number of active projects, number of core processes identified, use of benchmarking, new IT, criteria for selecting BPR projects, teamwork, planning systems, knowledge of BPR, coping with organizational stress and management resistance to change.
Kennedy (1994)	Teamwork, understanding of human implication
Cooper and Markus (1995)	People empowerment, commitment.
Obeng and Crainer (1994)	Participating people, stakeholders.
Lee (1995)	Organizational culture, leadership style, collaborative work environment, top management commitment, change in management systems, formalization of tasks.
Fagan (1995)	Innovation, creativity, work environment.
Clemons (1995)	Defining functional and political risks
Kotter (1995)	Establishing sense of urgency, having vision, removing unnecessary obstacles, powerful teamwork and organizational culture, communication, change process methodology, planning for short and long-term results, time horizon, project duration.
Mauil, et al., (1996)	The change proposed, performance measures, IT, influence of human factors, processes architectures, link between BPR and corporate vision, mission, objectives and strategies.
Love and Gunasekaran (1997)	New skills, motivation, IT, structural changes, cultural changes, communication, integration, teamwork.
Narasimhan and Joyaram (1998)	Identification of core processes, identification of customer types and requirements, project planning, systems view, design principles, methodology, data availability and reliability, employee involvement, project interfaces, project management, performance measures, processes ownership.
Guimaraes, (1997)	Use of outside consultants, customer oriented BPR, BPR education and training, empowerment, efficiently use of resources, project plan, project management, few critical processes, IT as enabler, use of automation, continuous improvement culture, integrated approach, communication, previous experience, process mapping and definition, top-down process, top management commitment.
Beugre, (1998)	Justice considerations.
Jaffe and Scott (1998)	Top-management leadership and commitment, whole system involvement, flexibility, structure, methodology, measurement.
McGarry and Beckman (1999)	Customer, market, environment, product, expertise, processes, management, empowerment, motivation, teamwork, structure, communication, technology, commitment, culture.
Wu, (2000)	Customer oriented processes and organization.
Arora and Kumar (2000)	Definition of goals and expectations, considering human factors, simple and well designed projects, considering customer needs, availability of data, effective and efficient use of IT, long and short-term planning, performance measures, attainable expectations.
Thong, et al., (2000)	Favorable public opinion, pilot implementation, approval of redesign methodology, staffing from neutral staff, neutralizing social and political influences.

Giaglis (2001) defines processes as:

“A collection of decision models, each of which is identified by the type of decision and contains a sequence of processing tasks. These tasks are the smallest identifiable units of analysis, and their optimum arrangement is the critical design variable determining the efficiency of the resulting approach (p. 210). “

The concept of cross-functional processes, shown in figure 2.2, is the foundation of BPR and has the potential to change the way people traditionally define the structure of an organization (Crowe and Rolfes, 1998, Jang, et al., 1999).

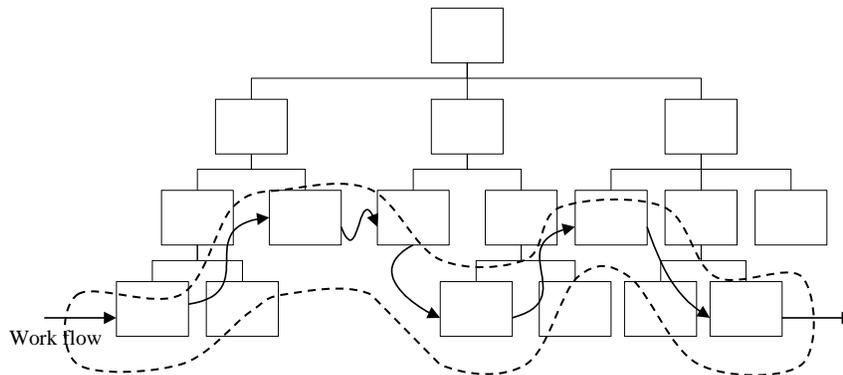


Fig. 2.2 Cross-functional activities within a traditional organization.  
From Jang, et al., 1999.

As Crowe and Rolfes (1998) posit, the traditional organization chart shows the organization as a set of departmental hierarchies located according to the organization’s structure. The traditional view of the organization as a departmental hierarchy limits the existence of activities across the different functions, promoting the separation of activities. Results of the traditional view are:

- People cannot see that the output of their work is the input of others.
- Departments are isolated without communicating common goals, tasks and outcomes.
- Core ideas, objectives and goals can be distorted or lost as activities are performed in different departments.

BPR emphasizes cross-functional processes as opposed to hierarchies, giving special emphasis to customer satisfaction. Processes are strategic assets that go beyond the traditional definition of function to a more integrated view (McCormack and Johnson, 2001).

Different authors also recognize the extent of a radical organizational change project as an important critical success factor. Talwar (1993) affirms that from BPR as change methodology have emerged two major categories of initiatives. The first and more common category is the process redesign, whose emphasis is to identify one or more core processes and redesign their execution. The second category is the business reengineering, which involves a “strategy-driven, top-down revision and redesign of the total business (p. 24)”.

Clemons (1995) on the other hand, defines reengineering as referring to any of three degrees of fundamental business change: business process redesign, process innovation and business revision. From this perspective, it seems to us that some of the errors observed by Hammer and Champy (1993) are so narrow that merely to avoid them will not necessarily guarantee successful implementation of a BPR project. It is necessary to recognize that BPR is not the radical change of isolated processes, but instead it is an integral transformation of all the organization’s systems and processes (Kettinger, et al., 1997).

Hall, et al., (1993) identify a set of crucial organizational factors, summarized in table 2.2, that are to be considered in any reengineering project. These factors will be both motivators and measures of the three critical determinants for succeeding in a reengineering project, which they define as:

- Span or Breadth: whether the project is set up to improve performance across the whole business.
- Extent or Depth: the extent of change of the six organizational elements as a result of the BPR project.
- Leadership: the extent of top management commitment.

Drew (1994) classifies critical factors associated with success as firm specific and project-specific. In this study success was measured in terms of improved customer service, cycle-time reduction, handling increased volume of transactions, headcount reduction, cost savings and overall success of the project. He presents causes of potential failure of reengineering. Among the barriers uncovered in his research organizational stress due to changes resulting from the project was the single most important, with managerial resistance to change the second greatest barrier. Loss of power, new managerial approaches and increase in the workload were the main causes of this resistance. Finally a third barrier was the lack of knowledge and skills to make BPR a success. Other less significant barriers found were employee resistance to change, poor communication, skepticism and customer/supplier resistance to change.

Kennedy (1994) presents two successful cases of BPR in the U. K. She concludes that since the object of BPR is to redesign a business around core processes, the threat to management is more than simple words. According to her article, the redesign of business processes requires the use of cross-functional, multidisciplinary teams. The team becomes an important element of the reengineering process, with the organization flattening as individual functions disappear, becoming cross-functional processes. Yet, she adds, it is possible to reduce the headcount, and the resistance to change, if the

reengineering project is planned from the start with top management fully understanding the human changes involved. Her findings are consistent with those presented by Cooper and Markus (1995). They affirm that the engine of reengineering is not reengineering analysis, but managers and people who do the work. People need to be committed to the reengineering process, not only trained to be part of the reengineered processes.

The factors influencing the success or failure of BPR implementation must be explained considering a holistic approach of the organization, including not only direct participants of the reengineering project but also the effect on the organization's stakeholders and customers, and the effect that internal and external behavior have on the project (Obeng and Crainer, 1994). They define stakeholders as people needed as resources, people who will be part of the redesign processes but are not part of the reengineering team, people who are going to be affected by the change, and people on the sidelines that will not be part of the change process but can affect it. All of them have their own motivation and agenda and can affect the outcome of the reengineering process (Irani and Rausch, 2000).

Lee (1995) does an empirical research on BPR critical success and failure factors. The author classifies the crucial factors affecting BPR implementation as organizational culture, organizational structure and management support. The author also identifies resistance to change as a critical failure factor of BPR implementation. One possible limitation of this study is that it was addressed only to the people directly involved in the reengineered process, either managers or users, not top management and stakeholders. Also the study does not specifically explain how the degree of success was measured,

although it defined as success variables time reduction, cost reduction, output quality and quality of work life (Davenport and Short, 1990).

Fagan (1995) studies the effect of creativity, innovation and work environment among the IT personnel involved in a BPR process. She concludes that in order to be successful in a BPR effort, personnel directly involved with the initiative must have a higher degree of creativity and initiative than personnel involved in any common development or improvement within the organization.

Clemons (1995) characterizes the risks that could affect BPR projects. Although he defines financial, technical, project, functionality and political risks, he considers functionality and political the two most critical.

- Functionality risk is the risk of making the wrong changes to systems and processes, or making inadequate changes that do not accommodate strategic needs. Overconfidence and intellectual arrogance are examples of issues included under this characterization.
- Political risk is the risk that the organization will not complete the project, either because of serious internal resistance or because of a gradual loss of will.

Kotter (1995) on the other hand, points to two lessons to be learned from the most successful cases. First, a change process usually requires a considerable length of time. Skipping steps in the logical process of change creates an illusion of speed and does not produce satisfying results. Secondly, there are mistakes that can, in any phase of the change process, have devastating impact. These possible pitfalls can be converted to success factors with the influence of the right people participating in the change process (Kennedy, 1994, Cooper and Markus, 1995).

Maull, et al., (1996) reported on the implementation of BPR projects in 25 companies. They found that six key issues affect the way in which BPR is carried out: the change proposed, the performance measures used, the impact of information technology, the impact of human factors, the presence or absence of a process architecture and the link between BPR and corporate strategy. In their article, they make clear the importance of having accountability for the different business processes and the importance of IT as a tool enabling a successful BPR initiative.

Moreover, Beugre (1998) in a more humanistic orientation argues that many BPR projects fail because they do not consider justice issues. In order to improve the success of BPR projects, managers should consider justice issues at four levels:

- Distributive injustice occurs when a person does not get the rewards he or she expected in comparison with the rewards others get.
- Procedural justice concerns the fairness of procedures. Procedures are considered fair when people have control over outcomes and participation in developing different options to influence the outcomes.
- Interactional justice refers to the quality of interpersonal treatment people receive during the implementation of a change process.
- Systemic justice refers to perceptions of fairness concerning the organization as a whole.

Jaffe and Scott (1998), define as critical elements for success in a BPR project aspects such as fully engaged top leadership, visibility of change leaders, broad, whole-systems involvement and building capability to sustain change. McAdam (2000) divides over fifty different critical factors of success in small and medium enterprises into six

categories: resources, leadership, flexibility and change, structure, methodology and measurement. Note that McAdam's "resources" were found important but not critical by Lee (1995). Leadership, flexibility and change, structure and methodology are implicit as critical success factors in one way or another in the previous references. Although measurement is also implicit in some of the references presented so far, it is important to mention that Hammer and Champy (1993) consider that processes are the key of any reengineering effort, and that it is necessary to have a set of tools to measure the level of success. In other words, the process must be accountable to the user or customer of this process. Standard measurements must be developed and must include three types of information: time, overall outcome and customer satisfaction (Scherr, 1993).

Several authors define IT as one of the main factors that make BPR possible (e. g., Hammer and Champy, 1993, Martínez, 1995, Clemons, 1995, Al-Mashari and Zairi, 2000, Clarke, et al., 2000), but Love and Gunasekaran (1997) and Irani and Rausch (2000) consider that there are other factors as important as IT to enable BPR. Love and Gunasekaran (1997) group these factors as four enablers of the reengineering process: IT, human resources, organizational elements, and total quality management.

Wu, et al., (2000) support this idea when they affirm that it is the internal or external customer of the process who defines not only the critical success factors of the process, but also the performance measures, the processes necessary to achieve these success factors, the organizational structure to operate these activities, the people and their competencies within the structure, the IT system to support the information flow, and the resources required by the redesigned processes.

Arora and Kumar (2000) surveyed twenty-five firms to determine what factors trigger reengineering, the nature of reengineering projects and common causes of failure among the studied firms. Based on their experiences and findings, Arora and Kumar (2000) present some basic guidelines for reducing the chance of failure. Among the most important are the necessity of having evidence that the BPR initiative is likely to succeed, flexibility and reliability of the new processes and the identification of internal and external customers, the same as the identification and definition of the various supply chains surrounding and influencing the organization.

Caudle (1994) presents a discussion of strategic reengineering issues in government. The author mentions several issues important in the successful implementation of BPR in government. Although most of the issues are similar to the factors defined previously in this article, the author introduces a different factor that is important in a governmental agency. This factor is concerned with the leadership time dimension and is important because motivation and change efforts can be affected by the cycle of executive and legislative elected officials. This factor allows two to four years to generate, develop and implement a reengineering effort before it can be affected by the priorities on projects of the new elected executives.

The U. S. Government, preoccupied with accomplishing the goals of the Government Performance and Result Act (GPRA) that requires state and federal comprehensive reforms, is also interested in defining critical factors common to government agencies. In that sense the U. S. General Accounting Office (GAO, 1995) developed a guide for assessing the BPR effort in government. The purpose of this guide is to provide GAO evaluators and other auditors with a framework for assessing how well

federal agencies are addressing the key tasks and risks associated with reengineering. The guide has three major assessment areas: assessing the BPR case, assessing projects management and process analysis activities and assessing implementation and results.

The U. S. General Services Administration (GSA, 1997) published a Government BPR Readiness Assessment Test in order to identify critical success factors at the earliest stage before making investments in time, money, and human resources. Because of the differences between government and private organization, this test accents specific characteristics of government BPR. The GSA Readiness Assessment Test is a seventy-three-question instrument divided in seven sections: leadership, planning and communication, integration of technology and BPR, anticipated risks, identification of resources and roles, existing performance measures and structured reengineering teams.

Narismhan and Jayaram (1998) developed a longitudinal case study in an Indian state office. They found twelve critical factors that can influence the results of a BPR project including system view of the process, project planning, clarity of objectives, identification of core processes, identification of customers and stakeholders, customer orientation, multiple sources of data, employee involvement, a method for evaluating alternatives, process ownership, communication, project orientation, strategy for change and identifying other project interfaces.

Finally, Thong, et al., (2000) present how BPR may be different in a public organization. They developed a case study at the Housing Development Board in Singapore, finding unique factors for public sector management such as high resistance to change influenced by social and political factors, public opinion, staffing from neutral staff, approval of redesign procedures and pilot implementation.

Burke and Litwin (1992) affirm that many reengineering projects have failed because they ignored human variables. They identify the variables that need to be considered in any attempt to predict and explain the total behavior output of an organization, the most important interactions between these variables and how they affect change.

Burke and Litwin (1992) define two types of variables that are involved in the change process. Transformational variables are concerned with the areas in which alteration is likely caused by interactions with environmental forces and will require an entirely new behavior from the organization. Transactional variables, on the other hand, are related to those elements whose primary ways of alteration are via relatively short-term relationships and internal forces. Tables 2.3 and 2.4 define these variables.

Business Process Reengineering looks for dramatic improvements through radical internal changes, not simply improvement, of the organization. These changes include cultural, human, technological and procedural changes and have to be planned and implemented according to some change strategy previously developed by a committed top management. Achieving radical change requires more than using an isolated theory. It requires a combination of concepts from radical change methodologies to socio-technical and continuous improvement theories that when correctly used will result in a new organization able to overcome the everyday dramatic changes that our business environment is enduring.

The following sections include concepts and techniques to model complex systems, relating the need of dynamically modeled organizational change with several modeling methodologies commonly used in engineering and decision sciences.

Table 2.3 Transformational variables

<p><b>External Environment</b></p>	<p>Burke (1994) defines it as any outside condition or situation that influences the performance of the organization. Environment includes factors such as institutions, groups, government, market pressure and trends and technology. Environment makes demands to the organization, places constraints to actions and objectives but also provides opportunities (Nadler and Tushman, 1983).</p> <p>Burke (1994) and Harrison (1994) suggest that the pace (slow or fast) and the complexity (simple, complex) of the environmental requirements to the organization are elements that define the influence of the environment in the change process.</p> <p>Porter (1998) defines five competitive forces that affect or determine the ability of forms to generate profitability and adequate performance. These forces are: potential entrants, suppliers, substitutes,, buyers, and industry competitors.</p> <p>Some other elements to consider could be: government policies and regulations, institutional trends, social influences</p>
<p><b>Mission and Strategy</b></p>	<p>This factor can be defined as “what employees believe is the central purpose of the organization and the means by which the organization intends to achieve the purpose over an extended time. Burke, 1994, p. 74”. This factor is critical because it determines how the organization is going to cope with the environmental requirements.</p> <p>It is a function of (Burke and Litwin, 1992, Nadler and Tushman, 1983): what management believes are the mission and strategies, what employees consider is the central purpose of the organization, and how the organization intends to achieve the mission.</p>
<p><b>Leadership</b></p>	<p>Leadership is the “aspect of managerial activity that focuses on the interpersonal interactions between a leader and subordinates (McAfee and Champagne, 1987, p. 303)”</p> <p>It is important to realize that any change initiative must come from top management because of the broad vision and authority level necessary to define the necessity of change (Hammer and Champy, 1993). Leaders must have enough power and influence to guide a change process and to convince people to be part of the process.</p> <p>Leadership is an integral element of managerial practices. It is the behavior presented by management that guides and encourages organizational members to achieve the mission and to accomplish the established strategies (Yuki and Van Fleet, 1992).</p> <p>Leaders can be transformational and transactional (Deluga, 1988). Transactional leaders are reactive to the situational contingencies and are engaged in a “bargaining relationship with employees (Deluga, 1988, p. 457). Transformational leaders, on the other hand look for encouraging employees to act according to the organizational mission by changing behaviors and personal actions (Deluga, 1988, Burke and Litwin, 1992).</p>
<p><b>Organizational Culture</b></p>	<p>Burke (1994) defines culture as “the collection of overt and covert rules, values, and principles that guide organizational behavior and that have been strongly influenced by history, custom and practices (pp. 74-75).”</p> <p>Thus, Organizational Culture provides a social environment to which individuals must be adapted in order to fit in or survive (Cooke and Rousseau, 1988), providing a “meaning systems” to organizational members (Burke and Litwin, 1992, p. 532).</p> <p>Frank and Fahrback (1999) affirm that individual behaviors are affected by the information that is exposed to them during the interaction with other individuals. They will look for balance either by adjusting their behavior or by interacting with other individuals with the same beliefs. Organizational culture is the mean used by the organization to develop the formal and informal communication channels needed by the individuals to response to internal and external effects.</p>

Table 2.4 Transactional variables

<p><b>Structure</b></p>	<p>As Burke (1994) states it is “the arrangement of functions and people into specific areas and levels of responsibility, decision-making authority, and relationships (p. 75).”</p> <p>Lee (1995) affirms that three structural variables have an influential effect in innovation and change:</p> <ul style="list-style-type: none"> <li>– <b>Centralization:</b> it is the degree of participation of the organizational members in the decision making process.</li> <li>- <b>Formalization:</b> it is the degree to which job duties are codified in written description, the existence of rules and regulations and the use of systematic reward systems.</li> <li>– <b>Complexity:</b> is given by the degree of complexity in which communication and authority is performed (Van de Ven and Ferry, 1980). A highly complex organization will present a structure oriented toward isolated functions and areas (Myles, et al.1991). Since integration of labor is an important element in process definition during a BPR project, it is necessary to assess the level of integration existing in the organization.</li> </ul>
<p><b>Management Practices</b></p>	<p>Although managers are leaders that guide and influence organizational behaviors (Yuki and Van Fleet, 1992), it is important to define practices that managers use during normal course of events to use the human and material resources to carry out the organization’s goals and strategies (Burke and Letwin, 1992, Burke, 1994).</p> <p>Different managerial practices can be identified in the literature (Luthans, et al., 1988, Yuki and Van Fleet, 1992): planning/COORDINATING, staffing, training/developing, processing paperwork, monitoring/controlling performance, motivating/reinforcing, interacting with outsiders, managing conflict, and socializing/politicking</p>
<p><b>Systems</b></p>	<p>As Burke (1994) affirms, the systems are the set of standardized rules, policies and mechanisms developed and used to facilitate work and processes.</p> <p>This variable is similar to formalization as defined by Lee (1995). Formalization “refers to the extent to which job duties are codified in written description, rules and regulation, and employees are evaluated according to highly codified and specific procedures (Lee, 1995, p. 65).”</p> <p>Van de Ven and Ferry (1980) add to the definition of formal systems the element of standardization. They define standardization as the “degree to which work rules, policies, and procedures are formalized and followed in an organizational unit (p. 161)”, and they present a set of questions directed to measure the degree of formalization and standardization that exists in an organizational unit.</p>
<p><b>Climate</b></p>	<p>Climate can be defined as “the collective current impressions, expectations, and feelings of the members of local work units, all of which in turn affect members’ relations with supervisors, with one another, and with other units (Burke, 1994, p. 75)”.</p> <p>Burke and Litwin (1992) affirm that climate is referred to a local level of analysis. That is, climate is more related with the work unit or team while culture is a more general, organizational concept. On the other hand, Cooke and Rousseau (1988) posit that there are different organizational subcultures within an organization. The different environments within the organization define these subcultures. Subcultures can be aligned with the dominant culture or can be contrary to it, creating conflicts both horizontally and vertically.</p>
<p><b>Tasks requirement and individual skills/abilities</b></p>	<p>It is the “behavior required for task effectiveness, including specific skills and knowledge required for people to accomplish the work assigned and for which they feel directly responsible (Burke, 1994, p. 75).”</p> <p>Van de Ven and Ferry (1980) consider Job Specialization, Job Expertise, Job Standardization, Job Discretion, and Job Incentives as characteristics defining Job Design Factors. Job Discretion and Standardization are also measures of centralization and formalization, thus have to be carefully used in order to avoid confusion in the measurement process.</p>
<p><b>Individual needs and values</b></p>	<p>They are the specific psychological factors that provide desire in the workforce, including job enrichment, job satisfaction and personal values (Burke and Litwin, 1992).</p> <p>While values are a “very broad, general belief about some end state such as honesty or an exciting life (McAfee and Champagne, 1987, p. 37)”, attitudes are more local and focused in individuals (McAfee and Champagne, 1987, Rogers and Byham, 1994).</p>
<p><b>Motivation</b></p>	<p>Is the energy generated by the combined desires for achievement, power, affection, discovery used to move toward goals until satisfaction is attained (Burke, 1994).</p>
<p><b>Performance measures</b></p>	<p>De Haas and Kleingeld (1999) define performance measures as “a formula or rule that enables quantification of performance (p. 234)”. Performance measures are indicators not only of outcomes but also of the effort and achievements of the organization and its members (Burke and Litwin, 1992)</p>

## **2.4 Organizational Change and Modeling Methodologies**

### **2.4.1 The Organization as a Complex System**

Amburgey, et al., (1993) defined organizations as “structured systems of routines embedded in a network of interactions with the external environment (p. 52)”. According to Gharajedaghi, (1999) an organization is a “voluntary association of purposeful members who themselves manifest a choice of both ends and means (p.12).” The organization is simultaneously a social and technical system (Burke, 1992). Organizations have technology, which is oriented to produce tangible or intangible products. In addition, organizations are composed of people, or stakeholders, “who depend on the organization for the realization of some of their goals, and in turn, the organization depends on them in some way for the full realization of its goals (Kueng, 2000, p. 69)”. They interact around the processes performing operations using the technology present in the organization.

On the other hand Fox, et al., (1996) consider an organization “to be a set of constraints on the activities performed by a set of collaborating agents (p. 124).” Resistance to change occurs because organizations are embedded in the institutional and technical structures of their environments (Amburgey, et al., 1993) and it is important to understand these structures and participating agents in order to understand and clearly define both the process and content of change.

As Skarke et al., (1995) affirm, if organizational change could be viewed only as affecting the technical systems in the organization, developing organizational change would be a relatively easy task. They add that since organizational change requires people to modify their beliefs, feelings and behaviors, the complexity of the change

process significantly increases. A social system has not only goals, but also the purpose to attain them. Attaining global goals is not the sum of individual processes performances but the synergistic effect obtained by optimizing the organization's effectiveness (Doumeingts, et al., 2000). Thus, it is necessary to understand the interaction of the different variables involved in optimizing the organization.

A system is “a collection of elements such as people, resources, concepts, and procedures intended to perform an identifiable function or serve a goal (Turban, et al., 1999, p. 40)”. Figure 2.3 graphically describes the different elements of a system.

Systems are composed of inputs, outputs, processes, feedbacks and controls, and system and environmental boundaries (Turban, 1999, Wu, 1994). At the same time, systems have subsystems within the main system that are interconnected and cooperate to accomplish the common system objective (Wu, 1994).

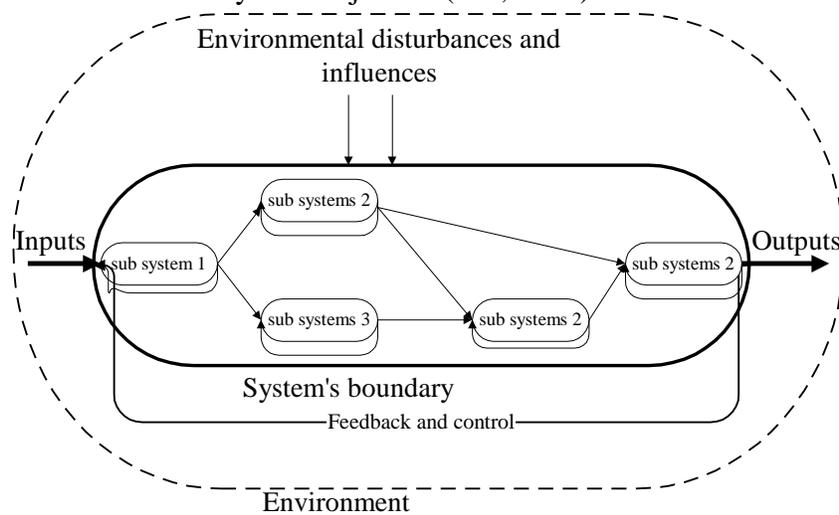


Fig. 2.3 Graphical representation of a system.  
Adapted from Wu (1994) and Turban, et al. (1999)

Organizations are dynamic systems since they are unstable, unpredictable and have the internal capacity to reconfigure themselves into new forms after a dramatic change (Kiel, 1994, Anderson, 1999). Sterman (2000) adds that organizations have

dynamic complexity since they have complex relationships that allow them to be self-organizing and adaptive. He adds that social systems within the organization are policy resistant and characterized by trade-offs, with tight relationships within the different elements composing the social systems. Finally, the response to change of a dynamic organization is non-linear (Anderson, 1999, Pascale et al., 2000, Sterman, 2001). . Effects are rarely proportional to causes, and outcomes are different locally in the system than in distant regions of the area where the cause was generated.

Sterman (2000) defines policy resistance as the action when “policies are delayed, diluted, or defeated by the unforeseen reactions of other people or nature (p.3).” Moreover, Larsen and Lomi (1999) assert that:

“The problematic relationship between strategy conception and execution on the one hand, and between strategy execution and its consequences on the other, is rooted in the observation that business organizations exhibit many of the characteristics of policy-resistant dynamical systems (p. 407).”

Complexity in policy resistance systems arises from the interactions of the system’s most significant variables over time (Sterman, 2001). As Bal and Nijkamp, (2001) affirm, in complex systems, initial conditions may exert a significant impact on the system’s outcomes. These variables have to be studied and understood in terms of time, effect, influences and complete interaction of the change process within the system and its environment, and since the real world is constantly evolving, any study over complex systems can be considered as a sample of a complex universe. The results of the study, they add, are then valid for the specific contextual and environmental conditions defined initially.

The traditional approach to analyze organizations has been based on a functional perspective (Wu, 1994). As shown in figure 2.4, using this functional approach organizations are broken down into individual functions and each of them is analyzed separately, assuming that individual behaviors are additive.

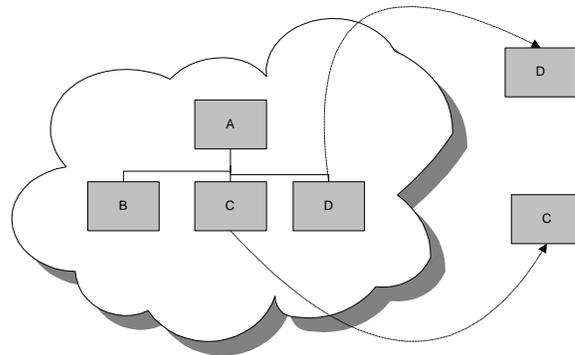


Fig. 2.4 A functional view of the organization  
From Wu, 1994

But organizational behavior cannot be defined as an aggregate concept composed of individual entities with the same average behavior (Anderson, et al., 1999). It is necessary to define the organization as a set of subsystems all of them interrelated. The fundamental idea of seeing the organization from the perspective of a system approach (see figure 2.5), or system thinking, is to analyze it from an overall perspective, considering the different elements in their entirety (Wu, 1994).

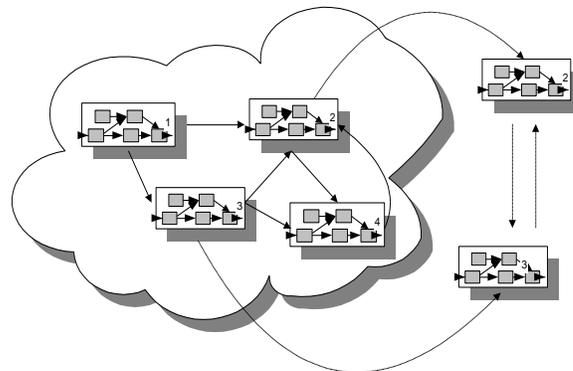


Fig. 2.5 The organization from a system thinking approach  
From Wu, 1994

It is possible to define systems thinking as a way to view the organization from a holistic point of view, trying to explain how to handle interdependent variables within a social system (Gharajedaghi, 1999, Gupta, et al., 1999). It is possible to define the organization as a voluntary association of members with a common purpose. Systems thinking tries to respond to the challenge of combining the complexity of the organization with the interdependency, self-organization and choice in the context of social organizations (Gharajedaghi, 1999).

To explain the concept of voluntary association and how interdependent variables influence the purposefulness of the organization it is necessary to put the system in the context of the larger environment of which the organization is part. Introducing the system in the context of a larger environment defines the principle of the principal world-view. Gupta, et al (1999) define the concepts on which this principle is based:

- Systems as cause: the dynamics of a system is a result of the relationships of causes within the system.
- Operational thinking: it is possible to see the system in terms of how it really works, and to build an understanding of the interdependencies and causalities within the system.
- Close-loop thinking: from a systems thinking approach, causal relationships can be seen as reciprocal. Factors can be both cause and effect and they cease to be the relevant unit of causality; with the main cause being the relationships among variables within the system and between the system and the environment.

Jackson (2001) widens the concept of systems thinking when he defines the concept of critical systems thinking as combining concepts of social theory and systems thinking.

He affirms that critical systems thinking

“is essentially about putting all the different management sciences methodologies, methods and models to work in a coherent way, according to their strengths and weakness, and the social conditions prevailing, in the service of a general project of improving complex societal systems (Jackson, 2001, p. 238).”

According to Jackson (2001) there are three types of critical systems approaches that can be used to describe a complex system. Hard or fundamentalist methodologies assume that the real world is systemic and modeling and analysis is conducted following these premises. Soft or interpretive methodologies do not necessarily assume the world is a system. The modeling and analysis is creative and may not be conducted under the assumption of a systemic world. Finally, emancipatory or radical methodologies assume that the real world can become systemic in a manner alienating to individuals or groups of individuals. Models and analyses are performed in order to identify biases and alienation and are oriented to show the disadvantages of the current situation. Finally, the author adds that no methodology is isolated and unique. While a dominant approach can be used to describe a complex system, dependent views can be used to describe new paradigms and possible alternate actions.

Translating a complex social system into a model that is credible and appropriate becomes a monumental but challenging and necessary task for the theorist and practitioner of organizational change. The next sections introduce the basic concepts of modeling and review some techniques that might be interesting to explore as tools to model complex systems.

## 2.4.2 Fundamental Concepts of Systems Modeling

Due to the complex relationships and great amount of variables involved in the organizational change process, it is necessary to use a tool that allows theorists and practitioners to understand the different variables and elements comprising any organizational change initiative.

Models are directed toward the ideal representation of complex systems (McLeod, 1998, Turban, et al., 1999) or entities, and are part of everyday life (Hillier and Lieberman, 1990). Vernadat (1996) defines a model as:

“Useful representation of some subject. It is a (more or less formal) abstraction of a reality (or universe or discourse) expressed in terms of some formalism (or language) defined by modeling constructs for the purpose of the user. In other words, A is a model of reality B for an observer C, if C can use A to obtain information on B (p. 24).”

Vennix (1996) presents a similar definition. He says that “a model is an external and explicit representation of part of the reality as seen by the people who wish to use that model to understand, to change, to manage and to control part of the reality (p. 15).”

Representation of real systems through models can be done at various levels of abstraction (Turban, et al., 1999). Depending on the level of abstraction at which they express the information they contain, models can be classified as:

- Mental or narrative models: seldom recognized as a model (McLeod, 1998), they describe the system or entity with written or spoken words. As Turban, et al., (1999) affirm, normally mental or narrative models provide a description of how a person thinks about a situation and include beliefs, assumptions, relationships and structures, as they are perceived by an

- individual or a group of individuals. Developing a mental model is usually the first step in the modeling process since they normally are used to describe and define problem structures or perceptions (McLeod, 1998, Turban, et al., 1999).
- Iconic or physical models: they are a physical representation of tangible entities. They are considered the least abstract type of model since they are normally a three-dimensional replica to scale or photograph of the entity to be represented (McLeod. 1998, Turban, et al., 1999).
  - Analog models: contrary to the physical or iconic model, analog models do not look similar to the entity they represent but behave like it. Maps, organizational charts, and simulators are examples of these models (Turban, et al., 1999).
  - Symbolic models: are those in which the properties of the system or entity are expressed with symbols (Pegden, et al., 1995). They can be expressed either graphically or in terms of mathematical equations. A graphic model represents an entity by an abstraction of lines, shapes, forms or symbols. Organizational charts, flow charts or graphics are examples of these types of symbolic models. Mathematical or quantitative models, on the other hand use mathematical symbols, equations and relationships to express the complexity of real systems. They are the highest form of abstraction and are normally part of a more complex modeling abstraction, usually using a combination of model typologies (Turban, et al. 1999, Taylor and Karlin, 1994).

McLeod (1998) affirms that mathematical models account for most of the business interest in business and management modeling. Hillier and Lieberman (1990) define certain common elements of a mathematical model. These elements are: the decision variables that represent the quantifiable decisions to be made; the objective function that represents the appropriate measure of performance to be optimized; the constraints, which are restrictions to the possible values assigned to the decision variables; and the parameters, which describe the factors that limit the problem. Although the parameters tend to be constants, they are not under the control of the modeler, and are independent of the model solution.

Kammath (1994) classifies mathematical models in terms of their purpose and how the model is solved. Based on the purpose of the mathematical model, it is possible to classify them in the categories of evaluative or descriptive models and generative or prescriptive models. Evaluative models describe the situation of the system and define the objective function in terms of a defined set of decision variables that meet a certain set of constraints. On the other hand, generative or prescriptive models (also known as optimization models) prescribe a set of actions or decision variables that meet certain performance criteria or objective functions.

Based on the solution methodology, mathematical models can be classified as analytical and simulation models. Analytical models are based on mathematical relationships that are solved by means of computational procedures or algorithms. Although oriented to find the optimal solutions of a model, optimality tends to be an ideal concept. As a result of this concept, analytical models are solved using a heuristic

procedure that does not guarantee an optimal solution, but the best possible solution that can be found (Hillier and Lieberman, 1990).

A simulation model, on the other hand, predicts the behavior of complex systems by mimicking the interactions and relationships that exist among the components of the system (Pedgen, et al., 1995, Kammath, 1994). As Pedgen, et al. (1994) affirm, through experimentation using simulation models it is possible for a decision maker not only to describe the behavior of the system but to construct propositions or theories that account for the observed behavior.

A prescriptive or generative model can be classified according to the type of prediction that it makes (Taylor and Karlin, 1994). Deterministic models predict a single outcome from a given set of decision variables. Stochastic models predict a set of possible outcomes as a function of the probability distribution of the different decision variables.

A slightly different prescriptive model is the causal mathematical model. A causal model tries to describe the best causal relationship between variables and predicts possible effects on the dependent variables as result of a change in the input or independent variables of the model (Cryer and Miller, 1991). Cook and Campbell (1979) present a detailed discussion of the philosophical aspects and meanings of causality, but for the purpose of this research a causal relationship between two variables  $x$  and  $y$  exists if it “implies a time dependent controllability of  $x$  over  $y$ ;  $y$  follows  $x$  in time and  $x$  is a necessary and sufficient condition for  $y$  (Klabbers, 2000, p. 382).”

Loehlin (1998) introduces two types of causal models, one in which the different variables present in the relationship are observed and another in which some of the

variables are unobserved or latent. Typical cases of the formers are regression models, which try to define the best linear causal fit between the observed variables. On the other hand, latent causal models or latent variable analysis have been developed for dealing with situations where multiple variables, some of them unobserved, are involved. Encompassed in this category are path analysis, factor analysis and structural equations modeling. Loehlin (1998) and Pearl (1999) among others, present the theoretical foundations and a detailed analysis of these methods.

With respect to causal models, Pearl (1999) mentions that they are different from probabilistic models in that probabilistic models show how probable events are and how probabilities may change with subsequent observations, while causal models tell, in addition, how these probabilities change as a result of external interventions. The ability of a causal model to predict the effect of these interventions, Pearl (1999) adds, rests on the knowledge that causal relationships can be defined and that the system will respond to interventions locally, that is, only under the specified causal relations.

Klabbers (2000) reflects on the limitation of traditional mathematical models when modeling social systems. The author summarizes these limitations as: inadequate knowledge of the state of the system; limitations in the identification of the system; interconnected systems are difficult to model by discrete equations; the need of a multidisciplinary approach to define the state variables, which normally are of different and incompatible dimensions, and difficulties in obtaining the necessary data to validate the model, which if obtained tend to be noisy. Sterman (2000) posits that that traditional causal models are based on correlations, which present relationships based on past behaviors of a system and do not represent the structure of a system. As a consequence,

traditional causal models do not show how the interactions occur and how a change in any element will affect future behaviors in the system. Traditional causal or correlational models are based on the *ceteris paribus* clause (Bal and Nijkamp, 2001). Analyses are made based on the variation of a limited amount of variables while all the others remain constant. Since organizations are part of a complex evolving world, other variables not considered might affect the existence of the system and the validity of observed behaviors may vary given slight changes in conditions.

Which is the best model to represent the intricacies of a social system? The best model will be a function of the methodology selected and the usefulness of the model for the theorist or practitioners. The next section explains about the usefulness concept and present an overview of modeling methodologies oriented towards modeling organizations.

### **2.4.3 Modeling Methodologies**

Vernadat (1996) defines a modeling methodology as:

“ A set of activities to be followed for creating one or more models of something (defined by its universe of discourse} for the purpose of representation, communication, analysis, design or synthesis, decision making or control (p. 24).”

In addition, Vernadat (1996) explains that any modeling methodology is characterized by:

- The definition or purpose of the model, that is, what is the objective of the model.
- The viewpoint of the model, in other words, the extent of the model, variables and elements included and not included.

- The detailing level of the model, that is, the depth of the model or how detailed is the system explained by the model.

Recall the definition of processes given by Giaglis (2001):

“A collection of decision models, each of which is identified by the type of decision and contains a sequence of processing tasks. These tasks are the smallest identifiable units of analysis, and their optimum arrangement is the critical design variable determining the efficiency of the resulting approach (p. 210). “

In this definition there are several elements that can be related to the modeling concepts mentioned in the previous section. As seen, the decision variables for a model of the business processes would be the best way they can be arranged across the organization, with the objective of optimizing the outcomes from these processes.

Taylor and Karlin (1994) introduce the concept of usefulness as a criterion for selecting the most appropriate model to develop. As they affirm, since there is not a best model to represent a system, usefulness allows the existence of more than one model to represent the same phenomenon, but each one with a different objective. While some models accomplish the desired objectives by quantitatively modeling a certain behavior, a different type of model may provide only general qualitative information about the relationships among elements of a system and their relative importance. This model may accomplish the same objectives but in a different way.

The most suitable modeling methodology is defined not only in terms of how elegant or complex it is, but how useful. The criterion of usefulness defines the choices and preferences of theorists and practitioners. The selection of the most suitable model methodology will be a function of its capacity to fulfill the objectives that were defined at

the beginning of the modeling process. Finally, the modeling methodology will be a function of the principles, methods or tools relevant to the selected model and how useful the model is at representing the different aspects, components, relationships and complexity of the system.

Giaglis (2001) affirms that because of the complex and dynamic nature of organizations, it is necessary to select a modeling methodology that helps to understand their behavior. He adds that modeling methodologies are supported by techniques that provide diagramming tools for studying and analyzing the modeled system. Three techniques for causal modeling are briefly explained below. These techniques are considered for this research effort since they can be used to present a graphical model of complex structures, processes and sequential decisions. The selected techniques are Influence Diagrams, Petri nets and System Dynamics.

#### **2.4.3.1 Influence Diagrams**

Pioneered by Miller, Merkhofer, Howard and Rice in the mid 1970's, influence diagrams were developed as tool to communicate with computers about the structure of decision problems intending to use the influence diagrams as a front end tool for decision analysis computer systems (Shachter, 1986). Influence diagrams were developed in order to automate the modeling of complex decision problems involving uncertainty and incomplete information (Agogino, 1999).

An influence diagram can be defined as an acyclic directed graph designed to solve Bayesian decision problems (López, 1994). It is a graphical representation of the interrelationships between the variables involved in the problem consisting of a series of

sequential decisions. It visually reveals the flow of information, influences and the overall structure of the problem (Agogino, 1999).

The graph corresponding to an influence diagram is composed of three types of nodes: uncertainty or probability nodes represented as circles, decision or control nodes represented as rectangles and value nodes represented by a diamond-shaped node (Shachter, 1986). Uncertainty nodes are associated with random variables, decision nodes are associated with actions and value nodes are associated with the criterion to choose decisions (López, 1994).

Consider the elementary graph shown in figure 2.6. The circular nodes represent two state variables  $x$  and  $y$ . The arc that connects the two nodes can be seen as the possible existence of a conditional influence between the two variables (Agogino, 1999). A variable  $x$  is said to influence a variable  $y$  if information about  $x$  tells something about  $y$ . However, Agogino (1999) adds, this influence should not be interpreted as a causal relationship between  $x$  and  $y$ .



Fig. 2.6 Interpretation of influences.  
From Agogino (1999)

The arcs into the different nodes have different meanings. Arcs into random variables or chance nodes indicate probabilistic dependency and do not represent causality or time dependency. Arcs into decisions specify the information available at the time of the decision. They indicate that the information must be available at the moment

of the decision and imply time precedence. Any uncertainty or decision preceding a decision node needs to be resolved before the decision at the head of the arc is made (Shachter, 1986).

Figure 2.7 shows examples of each of the different relationships that can be shown in an influence diagram (Shachter, 1986). In case a) the value depends on the random variable which depends itself upon a decision. In case b) the value depends on both the random variable and the decision. Case c) is similar to b) but the random variable does not depend on the decision. In case d) the random variable influences the decision and the value. Finally, in case e) a situation where the random variable only influences the decision is presented. In the last two cases, informational arcs are presented. These arcs go into a decision node and indicate that the necessary information must be available at the time of the decision.

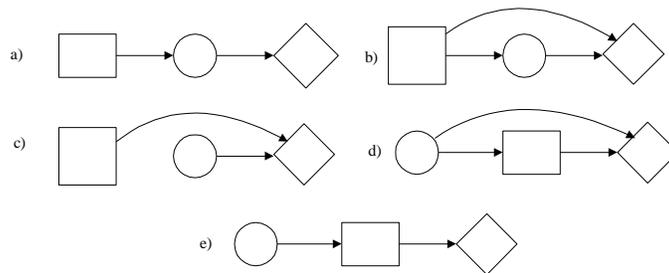


Fig. 2.7 Interpretation of the arcs. Adapted from Shachter (1986)

Shachter (1986) and Agogino (1999) present information on the conceptual foundations, methodology and use of influence diagrams. Examples of their application in decision sciences can be found in López (1994), Crowe and Rolfes (1998), Agogino (1999), Bielza, et al. (1999), and Rathi (1999) among others.

Since influences diagrams are acyclic directed graphs; cycles are not permitted. Cycles do not represent any expansion of the probability distribution of the variables involved in the problem representation (Agogino, 1999). Cycles might imply that the decision maker can make inferences about a decision that has not been made or might violate the assumption of time precedence (Shachter, 1986). In addition, arcs do not necessarily present causality but show some type of dependency or influence between the variables. For the previous reasons it is possible to affirm that influence diagrams, although an important and useful tool for Bayesian decision making processes, are not suited to represent the intricate relationships and causalities that are present in a complex social system.

#### **2.4.3.2 Petri Nets**

Petri Nets are mathematical/graphical representations of dynamic systems (Giaglis, 2001, Odrey, et al., 2001). They were named after Carl A. Petri who created a mathematical tool expressed as a net for study of communication with robots in 1962 (Zhou and Venkatesh, 1999). Petri nets can be used to study the qualitative and quantitative performance of complex systems with extensive internal dependencies (Kammath, 1994, Zhou and Venkatesh, 1999 ).

Petri nets are based on the concept that the state of the system completely describes the current status of the entire system and any occurrence of an event may change the current status of the entire system (Zhou and Venkatesh, 1999). The state of the system is represented as a function of a transition diagram with two types of nodes named places and transitions joined by directed arcs (Ben-Arieh and Carley, 1994.).

A formal definition of Petri nets can be found in Zhou and Venkatesh, (1999). A Petri net (PN)  $Z = (P, T, I, O, m)$  is a five tuple where:

- $P = \{p_1, p_2, \dots, p_n\}$ ,  $n > 0$ , is a finite set of places pictured by circles.
- $T = \{t_1, t_2, \dots, t_s\}$ ,  $s > 0$ , is a finite set of transitions pictured by bars, with  
 $P \cup T = \emptyset$ ,  $P \cap T = \emptyset$ .
- $I: P \times T \rightarrow N$ , is an input function that defines the set of directed arcs from  $P$  to  $T$  where  $N = \{0, 2, 3, \dots\}$ .
- $O: P \times T \rightarrow N$ , is an output function that defines the set of directed arcs from  $T$  to  $P$  where  $N = \{0, 2, 3, \dots\}$ .
- $m: P \rightarrow N$ , is a marking whose  $j^{\text{th}}$  component represents the number of tokens in the  $j^{\text{th}}$  place. An initial marking is denoted by  $m_0$ . Tokens are represented by dots in the places.

The four tuple  $(P, T, I, O)$  is called a Petri net structure and defines a directed graph structure. The introduction of tokens into places and their flow through transitions enable the description and study of the behavior of the network decomposed in discrete-time events.

The following example from Zhou and Venkatesh, (1999), shows a formal description of a Petri net. In addition, Figure 2.8 shows the graphical representation of this Petri net.

$$P = \{p_1, p_2, p_3\}$$

$$T = \{t_1, t_2\}$$

$$I(p_i, t_j) = \begin{pmatrix} 1 & 0 \\ 1 & 0 \\ 0 & 1 \end{pmatrix}, \quad O(p_i, t_j) = \begin{pmatrix} 0 & 0 \\ 0 & 1 \\ 1 & 0 \end{pmatrix}$$

$$m = \{1, 1, 0\}$$

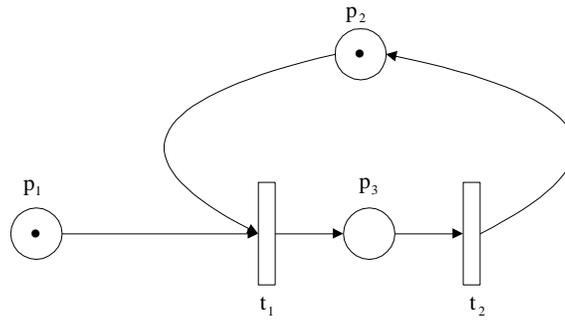


Fig. 2.8 Graphical representation of a Petri

net (From Zhou and Venkatesh 1999)

Ben-Arieh and Carley, (1994) explain that the inputs and outputs of a transition in a Petri net are defined as a bag of places, allowing multiple occurrences of a particular place as an input or output of the transition. Tokens allow the transitions to “fire”, which represents the execution of activities. A transition can fire when all of its input places have tokens. The firing process removes all the tokens from the input places and puts new tokens in all the output places of the transition that fires. More detailed explanations of the theoretical foundations and applications of Petri nets can be found in Jensen, (1996), Zhou and Venkatesh, (1999), and Nielsen and Simpson (2000) among others.

Examples of Petri nets applications in organizational development and change are shown in Odrey et al. (2001) who use a Generalized Stochastic Petri net to model the control of re-entrant flow semiconductor wafer fabrication. Lu and Cai (2001) use Petri

net concepts to develop a Collaborative Design Process Petri net to manage the design process conflict and to improve the collaborative design productivity based on a sociotechnical design framework.

According to Giaglis (2001) the Petri net has received great attention as a tool for modeling business processes. Petri nets have been expanded to include quantitative and qualitative variables. However they have limited ability to represent reactive systems (Ben-Arieh and Carley, 1994) and they are not explicit and manageable enough to represent high level, complex business processes (Giaglis, 2001). Finally, a limitation in the application to model complex organizational change is that while it is necessary to picture the organization as a whole in order to understand the dynamic complexity of organizations (Gupta, et al. 1999), Petri nets focus on local information rather than a global view of the system under study (Zhou and Venkatesh, 1999).

#### **2.4.3.3 System Dynamics**

System dynamics has been identified as an approach to introduce a more dynamic thinking approach to the fluctuating aspects of decision-making and organizational change (Winch, 1998). Systems Dynamics helps in explaining the relationships existing between the context of change and the behavior of the changing system (Morecroft, 1988, Rasmussen and Mosekilde, 1988). While its application in modeling managerial policies and as a management problem-solving tool has been widely reported, the potential for testing and building organizational theories is still largely unexplored (Larsen and Lomi, 1999, Richardson, 1999).

Forrester (1961) defined system dynamics as “... the investigation of the information-feedback characteristics of (managed) systems and the use of models for the design of improved organizational form and guideline policies (p. 13)”. On the other hand, Coyle (1996) defines system dynamics as “the branch of control theory that deals with socio-economic systems, and that branch of Management Science which deals with problems of controllability (p. 9).” Finally Gharajedaghi, (1999) defines system dynamics as an approach to “understand the interaction of critical variables in the context of the following: time, the totality and the interactive nature of the change with the system, and the system’s environment (p. 120).” To achieve this understanding, the combination of four different fields is necessary (Richardson, 1999, Gupta, et al. 1999): information-feedback control theory, decision-making processes, information technology and simulation. All together these fields help to explain the complexities that arise as part of the daily execution of activities in the organization and the interactions that appear within the different elements that are involved in any organizational change process (Sterman, 2000).

Using the concepts and ideas originally developed by Forrester (1961), it is possible to show how the system functions using a simple diagram, delineating information, activities and decision flow within the organization, and their influence on the different components integrated in the system. At the qualitative level of analysis, systems dynamics provides a vehicle for structuring a concept that is otherwise too complex to analyze (Dangerfield, 1999, Richardson, 1999).

As explained by Giaglis (2001) system dynamics models are based on cause and effect diagrams called Causal Loop Diagrams. They have the purpose of showing in an

explicit manner mental models about system structures and strategies. Giaglis (2001) adds that the structure of the system implies the information feedback and the relationships existing within the feedback, the decision-making elements and outcomes.

The information contained in the following paragraphs has been summarized from Sterman (2000) who presents a detailed analysis on the foundations, methodologies and tools that comprise system dynamics. He affirms that causal loop diagrams are an important tool for representing the feedback structure of systems because they allow extraction and capturing of mental models of organizations, explaining the feedbacks that might cause problems and helping to expose the possible cause of dynamicity in a system.

As shown in figure 2.9, a causal loop diagram consists of variables connected by arrows representing the causal influences among the variables. These causal links can be either positive or reinforcing, and negative or balancing links. The direction of the causality is called the polarity of the loop and indicates how the dependent variable changes when the independent variable changes.

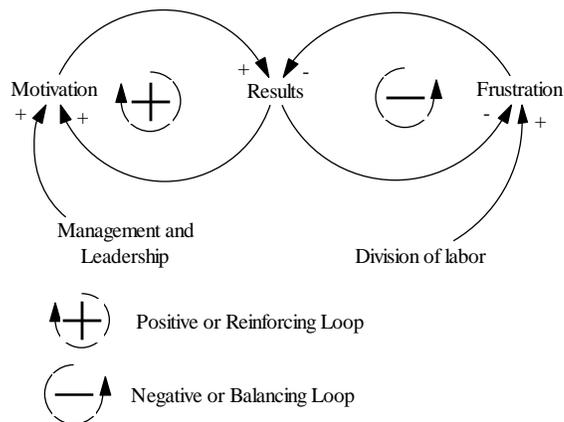


Fig. 2.9 An example of a causal loop diagram. Influential factors in performance.

Figure 2.10 shows the concepts of links and causality among variables. A positive link means that if the cause increases (decreases) the effect should increase (decrease) above (below) what it otherwise could have been. On the other hand, a negative link means that if the cause increases (decreases) the effect should decrease (increase) below (above) what it otherwise could have been.

Symbol	Interpretation	Mathematics	Example
	<p>All else equal, if X increases (decreases) then Y increases (decreases) above (below) what it would have been.</p> <p>In case of accumulations, X adds to Y</p>	$\frac{\partial Y}{\partial X} > 0$ <p>In case of accumulations</p> $Y = \int_{t_0}^t (X + \dots) ds + Y_{t_0}$	<p>Effort  Results</p> <p>Net income  Earnings</p>
	<p>All else equal, if X increases (decreases) then Y decreases (increases) below (above) what it would have been.</p> <p>In case of accumulations, X subtracts from Y</p>	$\frac{\partial Y}{\partial X} < 0$ <p>In case of accumulations</p> $Y = \int_{t_0}^t (-X + \dots) ds + Y_{t_0}$	<p>Frustration  Results</p> <p>Losses  Earnings</p>

Fig. 2.10 Definitions and examples of link polarity.

From Sterman (2000)

The loop polarity is a function of the feedback effect on the different variables. If the feedback effect reinforces the original change, then it is a positive loop; if - it opposes the original change it is a negative loop. A positive loop does not mean a beneficial change in one variable. It means that the type of causality is positive, causing the effect to change in the same direction as the variation of the cause.

It is important to stress two aspects from the definition of linking and polarity: the aspect that a variation in the cause should generate an effect over the entire model, and the aspect of increasing (decreasing) above (below). The first aspect is concerned with

the situation where more than one variable affects the output of the system. It is possible that the other variables offset the effect of the cause under study. To avoid this possible noise effect it is necessary to assume, at a certain point, that all the other variables remain constant. The second aspect is concerned with the non-linear behavior of social systems. An input will not necessarily produce the same type and amount of outputs at different time intervals. The presence or absence of certain factors will affect the existing relationships in the system, making it necessary to define, by feedbacks and control, the variation of the different outputs once the causes have changed.

Causal loop diagrams, although well suited to represent relationships, causality and feedbacks, cannot handle the non-linear behavior typical of complex systems. Non-linearity on system dynamics models is manipulated by means of calls stocks, flows and accumulations (Dutta and Roy, 2002, Sterman, 2000). Stocks are accumulations and characterize the state of the system since they accumulate the difference between inputs and outputs at a certain point of time. Figure 2.11 shows the diagramming notation for stocks and flows.

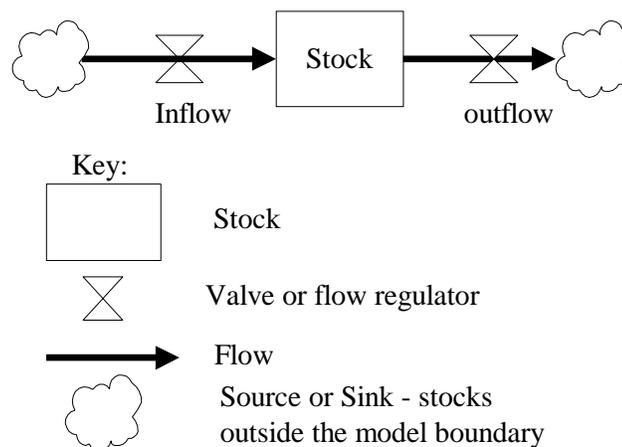


Fig. 2.11 Stock and flow diagramming notation  
From Sterman (2000)

Stocks accumulate or integrate their flows. In other words, if the net flow into the stock can be defined as the rate of change of the stock, then the total accumulation at time  $t$  of the stock can be defined by the following expression:

$$\text{Stock}(t) = \int_{t_0}^t (\text{Inflow}(s) - \text{Outflow}(s))ds + \text{Stock}(t_0)$$

In this expression,  $\text{Inflow}(s)$  represents the value of the inflow at any time  $s$  between the initial time  $t_0$  and the current time  $t$ . Equivalently, the rate of change of any stock at any time  $t$  is given by the differential equation:

$$\frac{d\text{Stock}}{dt} = \text{Inflow}(t) - \text{Outflow}(t)$$

Stocks and flows contribute to system dynamics models since they characterize the state of the system and provide the basis for actions; provide the system with inertia and memory; are sources of delays; and create disequilibria by decoupling the flow rate.

Figure 2.12 shows a more complete vision of how system dynamics model a complex system. The diagram combines causal loop diagrams and stocks and flows in order to represent by means of a dynamic population model how food and birth rates counterbalance to control population.

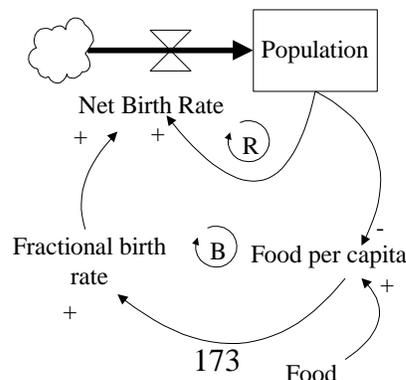


Fig. 2.12 A population model showing the different elements of a system dynamics model. From Sterman (2000)

Giaglis (2001) posits that system dynamics has several limitations, including the fact that it places too much emphasis on feedback and control, which he contends may be of limited importance in many practical situations of business modeling. He asserts that these relationships are unable to cope with stochastic elements frequently found in real-life business processes. Despite his position, it is precisely the use of feedbacks and causal relationships that makes system dynamics appropriate to model organizational change. System dynamics provides the possibility of mapping complex relationships that evolve as change is implemented (Dutta and Roy, 2002, Sterman 2000, Lomi, 1999). Causal loops aid in the understanding of these changing relationships and the effect that change has on the system's outcomes.

It is possible to find different sources that support the claim that system dynamics is suitable for modeling complex organizational systems. Richardson (1999) reflects about the future of system dynamics in different areas including health services and education. Klabbers (2000) summarizes epistemological views of learning in the context of system dynamics. Campbell (1998) models the process failure in a rapidly changing high-tech organization. Finally Larsen and Lomi (1999) present an analysis of the dynamics of the organizational inertia model for organizational change using system dynamics. Other examples can be found in Rasmussen and Mosekilde (1988), Coyle, (1996), Vennix, (1996), Dangerfield (1999), and Bauer, et al. (2000), among others.

System dynamics models have been criticized because of the lack of formal validation methodologies (e. g., Wittenberg, 1992, Barlas, 1996, Larsen and Lomi, 1999, Klabbers, 2000) since the extent to which the model is useful is more the concern of the user than of the developer (Klabbers, 2000) thus models seem to be arbitrary for the

observer. Validation of a system dynamics model is concerned with two criteria (Wittenberg, 1992, Larsen and Lomi, 1999). First of all, the model must generate behaviors that do not significantly differ from that of the real system. Secondly, a model can be said to explain the behavior of a system if it reflects the real causal relations of the system. Finally, Klabbers (2000) affirms that validation of a system dynamics model is more a function of the usefulness of the model and the purpose of it than of traditional techniques and methodologies that are oriented towards the analysis of more traditional correlational models. A more detailed discussion on the philosophy and fundamentals of system dynamics models can be found in Barlas and Carpenter (1990), Barlas (1996) and Klabbers (2000) among others.

## **2.5 Enterprise Modeling**

As seen previously in this document, organizations are composed of a series of functions and processes that are performed by people and machines in a collaborative manner in order to attain the objectives on which the organization is based. It is necessary to understand the enterprise from both the functional and behavioral point of view, that is, the processes and the actors of the processes (Vernadat, 1996).

The organization can be described using two approaches: from the point of view of business processes and information flow (Giaglis, 2001). Describing the organization from these two points requires the development of a special type of model that uses information technology in order to optimize the knowledge of the organization (Kirikova, 2000). These types of models are known as enterprise models.

. Defined by Fox and Gruninger (1998), an enterprise model “is a computational representation of the structures, activities, processes, information, resources, people, behavior, goals and constraints of a business, government, or other enterprise (p. 109).” Vernadat, (1996) adds that the enterprise model is a representation of the perception of the organization. Enterprise models are aimed at representing the organization in terms of its functions and its dynamic behavior (Lin, et al., 1999). The basis of the representation is the model developed during a profound diagnosis of the organization (Kirikova, 2000) that would help in understanding not only the elements the organization consists of, but also how they are related.

An enterprise model can be made of several sub-models, among which are process models, data models and organization models (Vernadat, 1996, Lin, et al. 1999, Kirikova, 2000). Enterprise models can have different purposes depending on the situation and environment under study (Kirikova, 2000): business analysis, new business definition, and organizational knowledge management among other uses. Enterprise models can range from organizational charts to flow complex information systems and dynamic programs that interrelate the different activities, processes and flows of the organization (Raczkowsky and Reithofer, 1998, Wortman, et al., 2000, Whitman and Huff, 2001)

Enterprise models represent different levels of integration such as intercompany integration, intracompany integration and value chain integration (Lin, 1999). Intercompany integration represents the vertical integration of an organization with its partners, suppliers and customers. Intracompany integration refers to the integration of the processes and functions within the organization, and it is normally called horizontal

integration. Finally, value chain integration combines both intra and intercompany integrations in terms of the organization's mission, quality, customer satisfaction or some other different factors.

An enterprise model can be studied from a system approach from three points of view (Doumeingts, et al., 2000): functional, structural and dynamic. From the functional point of view, the organization is decomposed in a series of functional activities interconnected by a network. From the structural point of view, the organization is described in terms of its different components and activities. Finally, from the dynamic point of view, the organization can be decomposed in two related entities: a physical system that includes the elements or functions that are dynamically related, and control systems that carry the decisions and information needed to control and operate the physical system.

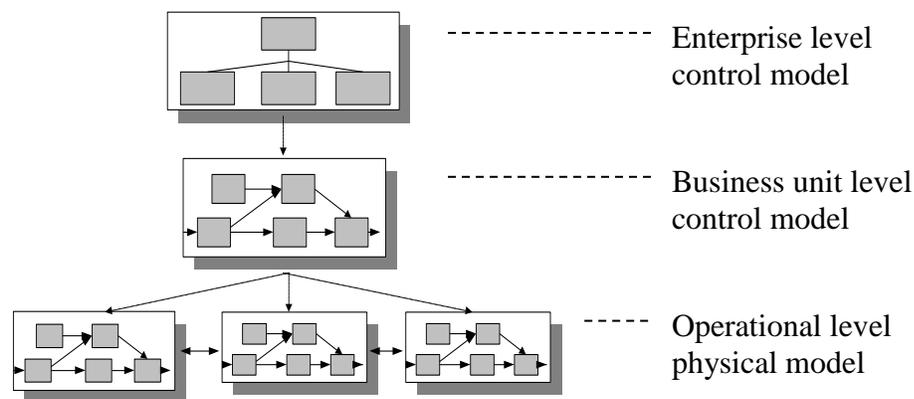


Fig. 2.13 An extended enterprise model with the different views embedded.  
Adapted from Lin, et al., 1999, Doumeingts, et al., 2000 and Wortmann, et al. 2000

Figure 2.13 presents a graphical representation of the fundamentals of an extended enterprise model. As seen, it integrates the different levels of the organization with the different views, functional, structural and dynamic. This complete integration allows the theorists and practitioners the complete understanding of the processes,

relationships, links and outcomes of the organization based on the objectives and goals previously established. Using the extended model permits the complete representation of the intricacies of a complex and dynamic organization considering all the functional and behavioral elements embedded in the enterprise.

Because the goal of this section is the introduction to the fundamental concepts of an enterprise model, a description of the different enterprise modeling methodologies will not be included. The reader can consult the existing literature to review the existing and proposed methodologies (e.g. Vernadat, 1996, Rackzowski and Reithofer, 1998, Cantamessa and Paolucci, 1998, and Doumeingts, et al., 2000).

## **2.6 Modeling Organizational Change**

It is possible to describe organizational change as a series of coordinated efforts and processes oriented to achieve a transformation in the organization. Moreover, organizational change can be described as a reactive process (Ben-Arieh and Corley, 1994), since change is the result of the reaction to different input signals from both internal and external sources. Organizational components are constantly active and every input might cause a state change in the system.

Organizational change models can be described as guidelines to implement organizational change and usually provide the recommended actions and variables to be considered to successfully achieve organizational change. There is a great amount of effort put into organizational change modeling. Much of the work found in the literature focuses on the development of new conceptual or theoretical organizational change models that present a global view of the process of organizational change (e. g. Lewin,

1951, Kelly and Amburgey, 1991, Filkenstein, 1992, Mayer and Schoorman, 1992, Burke and Litwin, 1992, Amburgey, et al., 1993, Barnett and Carroll, 1995, Farias and Varma, 2000, Gordon, et al., 2001).

Lewin (1951) proposed a classical model that has been the foundation of most of the organizational change models developed (Marshak, 1993, Armenakis and Bedeian, 1999, Grover, et al., 1995). Known as the “Force Field” model, it provides a simple representation and fundamental idea of the change process (Burke, 1992). The model describes change as a three-stage process in the implementation of change: unfreeze, change and refreeze. Burke (1992) explains that the unfreezing stage means confronting the present social system and depicting the need for change. The change step includes a movement or a series of actions or interventions oriented towards achieving the desired change. Finally, the refreeze stage contains deliberate actions to ensure that the new state of behavior remains permanent.

Lewin’s model (Lewin, 1951) considered that the organization under change is in steady state or “quasi stationary equilibrium (p. 199)” by equal and opposing forces. But as Burke and Trahant (2000) affirm, it is important to focus more on disequilibria than on equilibrium, implying that change is not linear. Change in a social system is constant, but cannot be described as a constant. Social systems are constantly evolving and the change process must be defined and studied from different dimensions in order to understand it (Pacale, et al., 2000).

Armenakis and Bedeian (1999) present a review of different models and theories developed in the 1990’s. They divide the models into three areas: content, context and process issues. Models dealing with content issues focus on the factors that are critical for

both successful and unsuccessful change efforts and their relationships with organizational effectiveness. Models dealing with contextual issues normally describe forces or conditions existing in an organization's external and internal environments. The third area of research includes models that deal with the process of change. These models generally describe the actions and activities executed during an organizational change effort.

Figure 2.14 illustrates the distinction between content and process of change (Barnett and Carroll, 1995). The nodes represent two different states of the organization at any two points in time. A and B can represent the different strategies used by the organization, being A before and B after the change initiative, and  $r(A)$  and  $r(B)$  can be described as the rate of failure of organizations with strategies A and B respectively. When an organization changes, the content effect of change can be defined as  $r(B) - r(A)$ . A negative value indicates that the adoption of strategy B indicates a better likelihood of success than strategy A. The process of change can be described by the function  $r(\Delta AB)$  which represents the hazards associated with changing from A to B. The total effect of change from strategy A to strategy B can be defined as  $r(B) - r(A) + r(\Delta AB)$ . Even if the hazard of change is substantial, if the change from A to B produces strong beneficial effects, the content of change can offset the process of change.

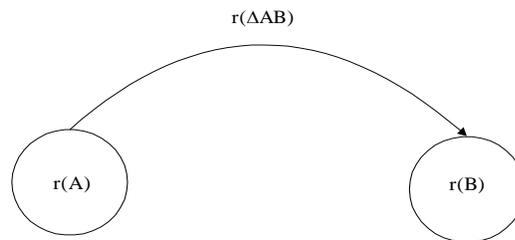


Fig. 2.14 The process and content of organizational change.  
From Barnett and Carrol, 1995

The previous statement presented by Barnett and Carroll (1995) is precisely what Hammer and Champy (1993) described as the need of radical change and the dangers associated with BPR. The results of the change effort offset the dangers of the process. The important point here, as Barnett and Carroll (1995) affirm, is to measure the outcomes of the change process and content in order to evaluate the organizational change. Any change must be described in terms of outcomes variables that have to be measurable at the organizational level. There may be a gap between organizational strategies and the actions actually undertaken. In addition, the change effort could be affected by the existing gap between the perception of the importance of performance measures among users and process actors (Jiang, et al., 2000). Kueng (2000) proposes that any performance measure system should not be focused on generic concepts such as effectiveness, efficiency, quality, costs and timeliness. He adds that these concepts should be measured from a stakeholders' point of view. Relevant strategic measures have to be introduced which can control and coordinate decisions during the change effort (Mayo and Brown, 1999, Nørreklit, 2000).

Change is a dynamic process. A dynamic strategy is needed to increase the adaptability of the organization to accomplish present and future changes. To understand the dynamicity of the organization it is necessary to view it as a system and take a strategic and holistic approach to manage organizational change in order to achieve the desired outcomes (Ackerman, et al. 1999).

Morel and Ramanujam (1999) affirm that the dynamics that guide organizational change are a mix of randomness and planned or unplanned reaction to internal and

external pressures. The organization will self-adjust up to a point where the organization reaches a critical point and it is necessary to influence the adjusting process. Change will be successful if it leads to an increase in performance. Figure 2.15 graphically explains this concept. Changing the entire business is not an isolated process. It requires that a set of competing processes be executed, normally at the same time in the organization, each of them with different individual goals but all of them oriented towards the same objective (Marshak, 1993, Dulton, et al., 2001). Organizational change becomes continuous and will be motivated by previous experiences and results (Kelly and Amburgey, 1991).

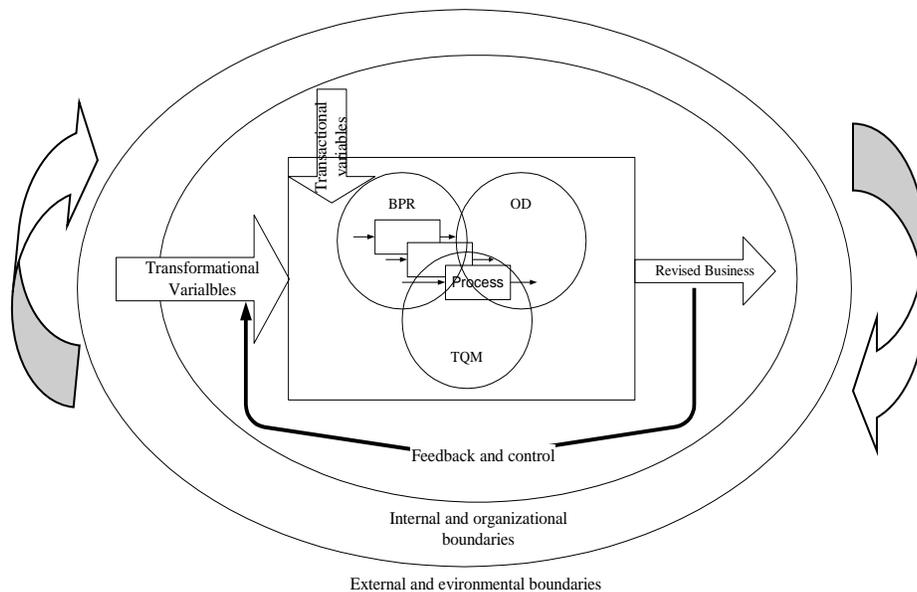


Fig. 2.15 A conceptual view of the organizational change process

Special attention has to be paid to several critical success factors in order to minimize the risk of failing on a radical change initiative. First of all it is necessary to recognize the necessity of change and how profound the organization wants this change to be. The change can be either at a core process level or at an organizational level,

affecting different units and areas of the organization and people, either participants, stakeholders or both.

Secondly a complete definition of the processes involved in the change initiative is necessary in order to analyze them and determine the elements that have to be redesigned. It is necessary to define the appropriate measurements in order to assess the performance of the redesigned processes in contrast with the old ones. It becomes indispensable to communicate the necessity for change, and to use leaders who will convince people to join the change effort and overcome resistance. Finally, it is necessary to use a set of tools derived from BPR, OD and TQM to manage and control the activities, ideas and outcomes of the radical change processes executed within the organization.

As mentioned in previous sections, complex systems show a complex and chaotic behavior since initial conditions may exert a significant impact in the final outcomes (Bal and Nijkamp, 2001). Thus, inputs may affect the systems depending on the temporal or environmental situations surrounding the boundaries of the system. On the other hand, organizational change affects not only physical and financial structures but essentially profoundly affects the many actors involved. Hence, since organizational change affects all levels, structures and members of the organization (De Tombe, 2001), it is possible to affirm that it shows the characteristics and behavior of complex systems since it is composed of a set of competing processes that integrate different elements of the organization. Thus, it is important to develop a model that not only includes the elements that are involved in the change processes, but that integrates the dynamic behavior of change, the context in which organizational change is developed, the processes involved

in the change effort, and the pertaining measures of organizational change (Zayas-Castro, et al., 2002).

Hitherto, the reader has been exposed to a series of concepts and fundamentals of organizational change and modeling methodologies. In spite of the large amount of research and theories in organizational change, the literature presents a series of contradictions with respect to the application of specific techniques for organizational change and the results thereafter. It has been posited that it is necessary to model organizational change from a more dynamic perspective, considering the context of change, the internal and external characteristics of the change process and the organization subject to the change effort. It is important to model the causal relationships that are present before, during and after the change effort has been attempted.

## **2.7 Problem Statement and Objectives**

The literature attempts to explain the elements that are necessary for an organizational change initiative to be successful, and presents a series of models that elucidate the relationships among the different variables involved during an organizational change process and the influences that these variables might have on the resulting objectives. Change can be defined as the existing need to be different, while innovation might be seen as the actions directed toward accomplishing change. Much of the reviewed literature uses the terms change and innovation interchangeably, prompting the question of whether change generates innovation or vice versa.

However, the literature seems to fall short in attempting to explain how to model these interrelationships and how to control the influences such that a positive result can

be obtained. Much of the work focuses on conceptual or theoretical studies supporting new or existing change models (e. g. Lewin, 1951, Kelly and Amburgey, 1991, Filkenstein, 1992, Mayer and Schoorman, 1992, Burke and Litwin, 1992, Amburgey, et al., 1993, Barnett and Carroll, 1995, Farias and Varma, 2000, Gordon, et al., 2001).

Moreover, there is a significant amount of research attempting to test the validity of the different relationships explained in various theoretical studies using either large data sets or a large sample of different organizations, normally with 20 to 30% rate of return on the instruments used to test the different propositions developed. Many publications present specific experiences and how these experiences align with the proposed hypotheses and the literature (e. g., Ettlie, et al., 1984, Damanpour, 1991, Grover, et al., 1995, Guimaraes, 1997, Grover, 1999, D' Aunno, et al., 2000, Greve and Taylor, 2000, Staw and Epstein, 2000, Sørensen and Stuart, 2000). These studies present profound and extensive statistical analysis based on correlational and structural relationships. The validity of the results might be contradictory because traditional correlational models show relationships over a certain period of time or at a specific time and do not present cyclical relationships that create dynamic causalities in reality. This may develop the problem of relating variables based on past behaviors of a system without introducing the actual dynamic structure of the organization (Hartman, et al., 1998, Sterman, 2000, Sterman, 2001, Bal and Nijkamp (2001).

Despite the amount of existing information, there is a need for more profound studies in the area of organizational change exploring the contexts, content, and processes involved in a change initiative (Aguinis, 1993, Burke, 1997, Larsson, et al., 2001, Pettigrew, et al., 2001). Pettigrew, et al. (2001) posit that research in change processes

should include also the dynamic relationship between change processes and outcomes to detect how organizational change context, processes and the pace of change affect performance outcomes.

Change tends to be described as a discrete series of events that ends with the accomplishment of the proposed intervention (Marshak, 1993, Dulton, et al., 2001). The seminal work of Lewin (1951) is being used as the base for the different models presented in the literature (Marshak, 1993, Armenakis and Bedeian, 1999, Grover, et al., 1995). This model is discrete, as it describes the process of change as composed of three main processes: unfreeze, move and refreeze. Change consists of a set of competing processes with managers influencing them depending on the importance and priorities defined by the different influencing elements within the organization (Marshak, 1993, Dulton, et al., 2001).

Furthermore, Murgatroyd, et al. (1998) assert that traditional approaches in change initiatives do not address the major gaps existing between top management conceptualizations of what has to be done, and lower-level understanding of what is actually needed and what can be achieved in order to successfully attain change. In view of this situation, several authors (e. g. Cantamessa and Paolucci, 1998, Raczkowski and Reithofer, 1998) suggest a bottom-up approach for enterprise modeling. The process is an iterative activity that includes the definition of the goals and objectives, the boundaries of the system, the definition of the functions, inputs and outputs and the definition of the existing constraints, all together with the relationships and activities that link every element together.

This research integrates knowledge on organizational change presented in the literature into a more detailed conceptual model that can explain the intricacies of adopting change and innovation in organizations using a systems thinking approach. The proposed model will incorporate not only factors that are potential obstacles for change and innovation, but also will introduce guidelines that can be applied to enhance the opportunity of succeeding in implementing change and innovation. In addition, this research attempts to develop a series of conceptual propositions that will be used as the foundation of new research efforts in organizational change, combining concepts from systems dynamics, management sciences and organizational behavior.

This research effort explores the following question: How to model organizational change such that change context, processes and organizational outcomes can be dynamically related.

In order to attain the final goal of this initiative, three main objectives are proposed

- a. To develop and explore a new model for organizational change called The Influence Model for Organizational Change that dynamically links the content, context and processes of change with the organizational outcomes during and after the change initiatives have been conducted.
- b. To conduct a case study with the objective of describing and explaining the change processes that have been attempted at the Missouri Lottery and to use data, information and conclusions to corroborate, reject or explore different aspects that are linked to the different propositions on which IMOC is based.

- c. To generate a series of assertions explaining the experiences and conclusions found in the case study that may be extended, for future research, to other entities.

## 2.8 Scope of the Study

Figure 2.16 describes the scope of this research. The research is limited to developing a conceptual model for organizational change using systems thinking methodologies as a framework. It attempts to present a qualitative approach to organizational change modeling, with the objective of exploring the gaps that have been presented in the literature, trying to link operational elements of the organization, the strategies and methodologies for radical change, with the human face of radical change (Ackerman, et al., 1999).

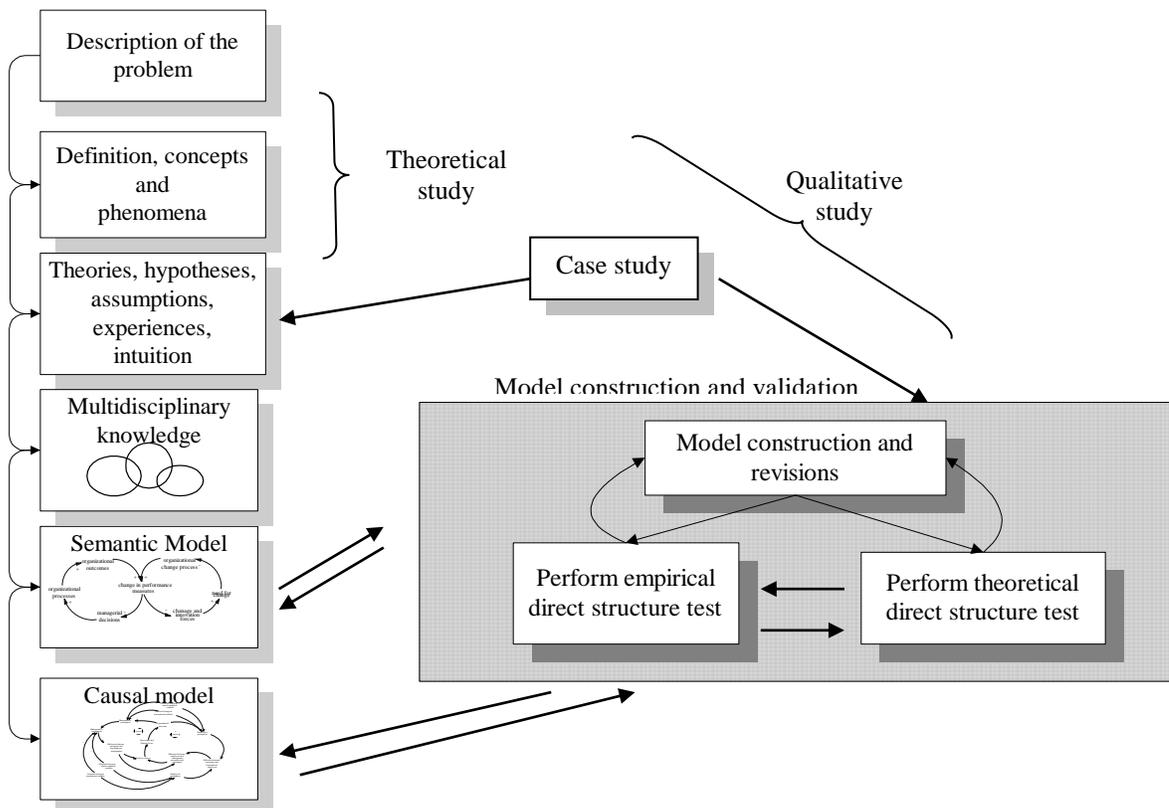


Fig. 2.16 Scope of the research

The model investigates the conceptualization of change in organizations that present policy resistance characteristics (Larsen and Lomi, 1999, Sterman, 2000), that is, situations where decisions are delayed by actions from people. Although the scope of the project was limited by the amount of information provided by the case study, it is important to realize the necessity of a qualitative analysis of a complex system in order to understand the complex relationships that are present in a changing system. This understanding defines the framework for a more profound research initiative in which it would be possible to determine more detailed quantitative relations that can contribute to the decision process in organizations (Senge and Sterman, 1992, Van Dijkum, 2001).

Within the context of this research, organizational change is defined as “any deliberate attempt to modify the functioning of the total organization, or one of its major components, in order to improve effectiveness (McAfee and Champagne, 1987, p. 451).” Innovation is viewed as the adoption of technologies, administrative systems, ideas or procedures that will modify everyday transactions (Edwards, 2000, Gopalakrishman and Damanpour, 2000).

Because a case study is a main component of this research initiative, the effort is delimited by the boundaries of the study (Creswell, 1998), which are defined in this case as the Missouri Lottery. The case study was comprised of two elements: a description of the activities performed at the Missouri Lottery aiming to generate organizational change, and an analysis of the situations and experiences presented during the execution of the different programs intended to generate this change. Throughout the case study different change programs and strategies attempted were analyzed without concentrating on a specific activity or result. This information was used to test the Influence Model for

Organizational Change. Since the study will was conducted only at the Missouri Lottery, the amount of information explored and studied presented a limitation to the statistical analysis and conclusions. Thus, the data and experiences surveyed limited the analysis to the scope of the organization, and no generalization to other organizations was made.

## **Chapter 3**

### **Methodology**

#### **3.1 Introduction**

As mentioned in the previous chapters of this document, one of the main objectives of this research was to propose a model that will help organizations implement change initiatives with an increased likelihood of success. To achieve these goals it was necessary to define a methodology. The method selected was a function of the goals of the research and how they are to be reached (Howard, 1985).

Because systems modeling through systems dynamics focuses the modeling process on the whole system (Garajedaghi, 1999), and it is based on synthesizing separate perceptions into a coherent whole, systems dynamics modeling suggests the use of a multidisciplinary approach to identify and structure the different relationships involved in a complex system. Thus, it was necessary to apply a methodology that allowed the analysis of the real systems as a whole, searching for the different variables, their relationships, causalities and influences within the system. Because a case study is a qualitative methodology designed to analyze situations where phenomena are little known (Yin, 1994), it seemed the most viable methodology to reach the goals of this research effort. Through the case study, the relevant relationships that mimic the real system were developed to such a degree that the model behaves similarly to the real environment.

As part of the research effort, a case study in the Agency was conducted to obtain information that could corroborate the propositions derived from the proposed Influence Model for Organizational Change. Figure 3.1, repeated here from chapter 1, indicates the approach used to complete this research effort. As depicted in figure 3.1, after a review of the literature and from previous experience, a series of propositions that support IMOC were generated. These propositions were then analyzed by means of a case study, which helped to both corroborate these propositions and to generate new propositions that are the foundations of future research. The role of the case study is presented in figure 3.2

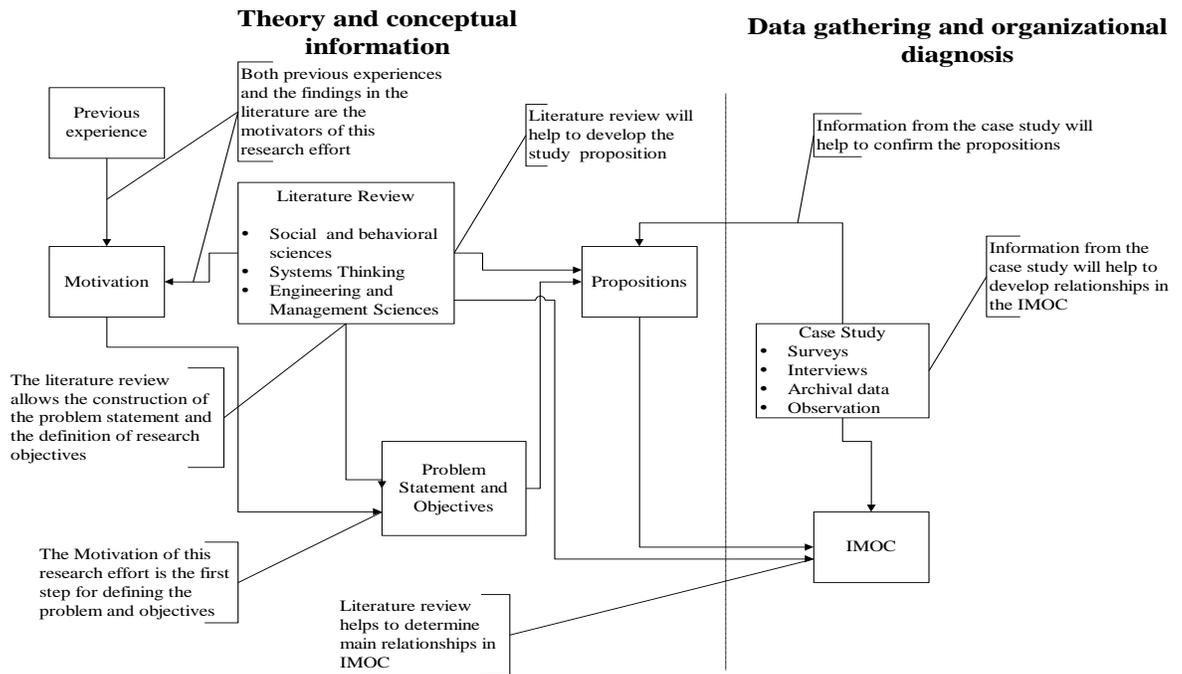


Fig. 3.1 The integrated research approach

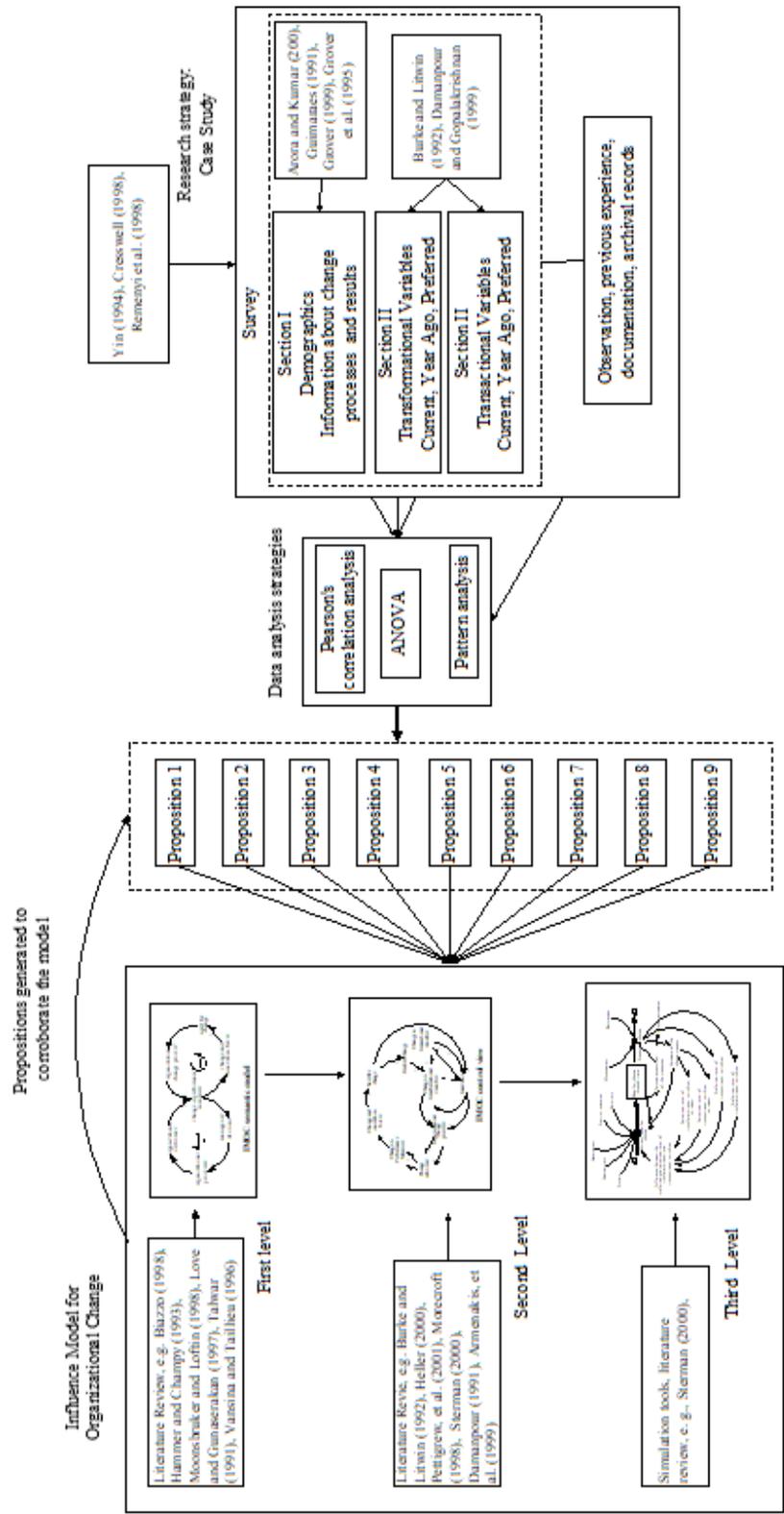


Fig. 3.2 The Role of the Case Study as a Research Methodology

The case study, as a research tool allows the investigation to directly study, analyze and draw conclusions about certain phenomena that may occur in a limited environment. The next sections of this chapter present a summary of the rationale of the case study as a qualitative research tool and the characteristics and uniqueness of the case study proposed for this research effort.

### **3.2 The Rationale of the Case Study**

A methodology that allows an integrated study of the different relationships and actions generated during a complex and radical organizational change process is needed in this research effort. Since the information needed to construct a system dynamics model comes mainly from interviews and observation (Sterman, 2000) the use of a qualitative approach is recommended to gather the necessary information to complete this research effort. The following paragraphs attempt to summarize the fundamental concepts and characteristics of the case study as an approach for the proposed qualitative research paradigm.

#### **3.2.1 The Qualitative Research Paradigm**

Research methods are often classified as qualitative or quantitative methods, with the most important difference being the manner by which the method treats data (Brannen, 1992). As research methodology, qualitative methods are instruments that enable the researcher to understand phenomena that are little known or that present questions that are exploratory. They help to identify situations or to understand behaviors or events that could be used to compare existing theories with the objective of validating

or modifying them in a specific environment or to develop completely new ones (Remenyi, et al. 1998, Creswell, 1998, Morse and Field, 1995).

“A qualitative research is an inquiry process of understanding based on distinct methodological traditions of inquiry that explore a social or human problem. The researcher builds a complete, holistic picture, analyzes words, reports detailed views of informants, and conducts the study in a natural setting (Creswell, 1998, p. 18).”

Based on this definition, qualitative research needs a high degree of flexibility in its design; allowing the researcher to observe the different settings of the environment in which the project is immersed, without losing the sense of a holistic picture (Morse and Field, 1995). Although some of the qualitative data may be quantified, the analysis itself is generally qualitative (Remenyi, et al. 1998, Strauss and Corbin, 1990).

In contrast, quantitative methods isolate and define variables and their relationships. These relationships are then tested using the data in order to accept or reject hypotheses framed before the data was collected (Brannen, 1993). Quantitative methods seek relationships between variables in order to explain causality and predict outcomes. They are based on theories and hypotheses previously established and the relationships between variables are tested using abundant numerical data and rigorous statistical methods (Morse and Field, 1995).

Quantitative methods are based on the deduction of potential relationships based on hypotheses generated from previous research and from intuitive knowledge of the phenomena. Qualitative methods are based on the identification of patterns and commonalities with the goal of deriving new knowledge. They identify variables to generate theories (Morse and Field, 1995, Creswell, 1998).

Traditional quantitative research tries to identify and explain causality between variables that provoke a phenomenon while qualitative inquiry attempts to explain and interpret the phenomenon itself (Herda, 1999). To develop the dynamic relationships and propositions framed in a systems dynamics model it is necessary to discover the intricacies that exist in the real system. Sterman (2000) affirms that this task is accomplished by conducting a series of interviews and conversations with people within and outside the organization. This necessitates the adoption of qualitative research methods as the best approach to complete this research effort.

### **3.2.2 The Case Study**

The case study is considered one of the fundamentals tools of qualitative research methods (Remenyi, et al. 1998, Creswell, 1998, Yin, 1994, Gummesson, 1991). Case studies have been widely used in social sciences (Yin, 1994) and now are being used as a research methodology in business and management (Remenyi, et al. 1998) and decision sciences research (Clausen, et al., 2001) because they allow retention of a more holistic and realistic perspective than traditional cross-sectional or longitudinal studies (Remenyi, et al. 1998). In addition, the research approach in engineering management considers the use of the case study because it is changing from the “traditional problem solving or algorithmic flavor to empirical research on complex interactions of macro-level organization of business functions and processes (Ahire and Devaraj, 2001, p. 319).”

### 3.2.2.1 The Design of a Case Study

Yin (1994) defines a case study as an “empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident (p. 13)”. Shaughnessy and Zechmeister (1994) on the other hand define a case study as “an intensive description and analysis of a single individual (p. 297)”. Whereas traditional research pays attention to few variables that are controlled in order to analyze the outcomes from a phenomenon, case studies are preferred when questions about “how” or “why” are asked when relevant behaviors and variables cannot be controlled (Yin, 1994, Creswell, 1998). Its use is necessary when the results of particular treatments or interventions need to be described and explained (Shaughnessy and Zechmeister, 1994). Although qualitative methods are normally oriented towards the definition of new theories or hypotheses, the case study benefits from existing theoretical propositions to guide the development of the study, especially the data collection and analysis (Remenyi, et al. 1998, Yin 1994).

Yin (1994) classifies case studies as exploratory, descriptive, and explanatory. Exploratory studies explore situations where the outcomes from a real-life intervention cannot be clearly defined. Descriptive studies try to describe interventions in real-life settings and the results obtained. Finally, explanatory studies aim to explain causal links resulting from complex interactions in real-life settings.

Yin (1994) and Remenyi (1998) define five elements common to any case study design:

- a. Study questions: questions expressed as “why” and “how” give clues about how the case study is to be performed.

- b. Study propositions: this component includes a set of propositions directed to some particular aspect to be examined within the scope of the case study.
- c. Unit of analysis: this component is related to the definition of the study and how the initial research questions have been defined. The definition should not be unique, allowing the study to be compared to or differentiated from similar research.
- d. Linking data to propositions: in this case, the data collected must be related to the research questions and propositions. Because normally in a case study there are more variables of interest than data points, multiple sources of evidence are needed, where the data must converge to confirm or reject the related proposition. This conversion is called triangulation. There are six sources of evidence that are used in case studies (Yin, 1994, Remenyi, et al. 1998). Table 4.1 shows the definition, examples, strengths and weakness of these sources.
- e. Criteria for interpreting the findings: a logical consequence of the previous element, it is necessary to define some measures that will help in interpreting the information obtained from the study. These measures should address the ideas, concepts, relationships and issues being studied.

### **3.2.2.2 Judging the Validity of a Case Study**

It is possible to judge the quality of a case study through four tests, construct validity, internal validity, external validity and reliability.

Validity and reliability of a case study are direct functions of the advantages and disadvantages existing in this methodology. According to Shaughnessy and Zechmeister

(1994) among the main advantages of the case study is the possibility of challenging theoretical assumptions generally accepted and being the source of new ideas or theories. Among the main disadvantages of the case study is the possibility of bias in the interpretation of the results since the researcher might have been participant and observer at the same time (Gummesson, 1991).

Table 3.1 Sources of evidence for a case study

(Adapted from Remenyi et al., 1998, Yin, 1994)

Source of Evidence	Objective	Strengths	Weakness	Examples
Documentation	Are primarily used to corroborate and augment evidence from other sources.	<ul style="list-style-type: none"> <li>- Can be reviewed repeatedly.</li> <li>- Not created as a result of the case study.</li> <li>- Contain exact information.</li> <li>- Long span of time, wide coverage of events</li> </ul>	<ul style="list-style-type: none"> <li>- Can be of low retrievability.</li> <li>- Reporting bias.</li> <li>- Selective bias.</li> <li>- Deliberately blocked</li> </ul>	Proposal, contracts, accounts, personal correspondence, other corporate material.
Archival Records	Are normally highly quantitative and are produced for a specific purpose and specific audience.	<ul style="list-style-type: none"> <li>- Same as in documentation</li> <li>- Precise and quantitative.</li> </ul>	<ul style="list-style-type: none"> <li>- Same as in documentation</li> <li>- Accessibility</li> </ul>	Payroll records, old correspondence, accounting records, service records, lists, personal records, maps, and charts.
Interviews	Verbal reports that allow the recognition of facts	<ul style="list-style-type: none"> <li>- Targeted to the case topic.</li> <li>- Provide perceived causal inference</li> </ul>	<ul style="list-style-type: none"> <li>- Bias due to construction of question.</li> <li>- Response bias.</li> <li>- Inaccuracies.</li> <li>- Reflexivity</li> </ul>	Open ended or unstructured, focused and structured (including surveys)
Direct Observations	Collects observed evidence by visiting the case site by observing the environment, relevant interactions and behaviors.	<ul style="list-style-type: none"> <li>- Covers events in real time.</li> <li>- Covers the context of the event.</li> </ul>	<ul style="list-style-type: none"> <li>- Time consuming.</li> <li>- Selectivity bias.</li> <li>- Observation bias.</li> <li>- Cost.</li> </ul>	Observation of location, behaviors, dress code, corporate culture.  Live, photo or video observations.
Participant-Observation	Is the participation of the researcher in the daily work of the organization under study	<ul style="list-style-type: none"> <li>- Same as for direct observation.</li> <li>- Insights of interpersonal behaviors.</li> </ul>	<ul style="list-style-type: none"> <li>- Same as for direct observations.</li> <li>- Bias due to researcher's manipulation.</li> </ul>	Researcher as consultant or employee.
Physical Artifacts	Collection of physical and cultural artifacts to study their use under specific events and circumstances	<ul style="list-style-type: none"> <li>- Insights to cultural elements.</li> <li>- Insights to technical operations.</li> </ul>	<ul style="list-style-type: none"> <li>- Selectivity.</li> <li>- Availability</li> </ul>	Technical instruments, tools and equipment, art work, pictures, etc.

In addition the researcher might find bias in the data collection created by either the participants or by the role of the researcher. Finally, the generalization from studying

a single individual is also a disadvantage in the case study. The bias in both data and results may become a flaw in the validity of the case study, while the reliability can be compromised from the generalization if there is not enough variability in the population studied (Shaughnessy and Zechmeister, 1994).

Construct validity refers to the existence of the correct operational measures for the propositions being studied. According to Remenyi et al., (1998) and Yin (1994), in order to meet the test of construct validity it is necessary to identify the ideas, concepts, relationships and issues to be studied. It is also necessary to demonstrate that the selected criteria actually give a measure of the ideas, concepts, relationships and issues to be studied. Finally, to guarantee construct validity it is necessary for the researchers to use triangulation to verify the information, to establish a chain of evidence to show a logical sequence of events and their relationships, and to make the draft of the case report to be reviewed by key informants.

Internal validity can be defined as the inference that a particular result is caused by a particular phenomenon, without having all the evidence. Having the necessary tools to inspect the evidence and to relate it to the original propositions are tactics that would help to increase internal validity. Yin (1994) mentions pattern-matching, explanation-building and time-series analysis as data analysis tools used to create internal validity.

External validity deals with the generalization of the findings of the study for which it is necessary to replicate the study in other organizations. Generalization is possible only if the phenomenon exists in other settings (Aguinis, 1993, Remenyi, et al., 1998). With respect to generalization Gummesson (1991) affirms that:

“It no longer seems so ‘obvious’ that a limited number of observations cannot be used as a basis for generalization. Nor does it appear to be ‘obvious’ any

longer that properly devised statistical studies based on large numbers of observations will lead to meaningful generalizations (p. 79)”.

This statement is gaining support and credibility in business and management research where a large number of observations of a phenomenon are not necessary to draw conclusions about the findings in a case study (Remenyi, et al., 1998). On the other hand, pure quantitative descriptions may not be the best approach to understand the effect of different phenomena since the lack of hard quantitative data is a characteristic of these cases, and generalization is done more on the basis of phenomena description and explaining than in terms of traditional quantitative analysis (Aguinis, 1993). Finally, as Shaughnessy and Zechmeister (1994) affirm, “the ability to generalize from a single case study depends on the degree of variability in the population from which the case study was selected (p. 305).”

When the evidence found and the measures used are consistent and stable, the study will be defined as reliable, which is especially important if the findings are going to be extended to other situations (Remenyi, et al. 1998, Gummesson, 1991). Reliability can be reached by means of a case protocol, which formalizes, standardizes and documents the procedures used in the case study, and by developing a case study database, which should contain the evidentiary data used to formulate the conclusions of the case study (Yin, 1994).

Case studies do not serve to confirm existing knowledge by repetition of the experiments (Bal and Nijkamp, 2001). Instead, they aim at generating new knowledge. The *ceteris paribus* clause implies that only a subset of contextual variables is used in a specific study. Since organizations are part of the complex evolving world, other variables not considered in the study and that do not remain constant in the study might

affect the existence of this subset. Variables such as time, space, environment and human preferences and ideas cannot be set constant during a study, hence the validity of repetition is dubious. As an example, not every organization reacts in the same way to environmental conditions. During any given crisis, it is possible to observe organizations that successfully overcome critical moments and become leaders, while some leaders cannot survive under critical and extreme conditions.

### **3.3 Case Study Elements**

Yin (1994) affirms that before developing a case study, a series of basic elements has to be defined. Before detailing the main elements of the case study at the Agency it is important to recall that within the context of this study, organizational change was defined as “any deliberate attempt to modify the functioning of the total organization, or one of its major components, in order to improve effectiveness (McAfee and Champagne, 1987, p. 451).” Innovation, on the other hand, was viewed as the adoption of technologies, administrative systems, ideas or procedures that will modify everyday transactions (Edwards, 2000, Gopalakrishman and Damanpour, 2000).

#### **3.3.1 Study Questions**

As stated previously in the present chapter, a series of questions was raised after an 18-month research experience at the Agency. The following is a summary of the experiences obtained during this project and the main motivation for this research:

- How do the results obtained at the Agency compare with those described in the literature?

- Is it possible to generate new propositions that can explain the results obtained in the Agency after the different initiatives that were attempted?
- Why did the project not have the expected results?
- Is there a missing link between organizational learning, organizational change and innovation that makes it difficult to implement new processes?
- Is there a pattern in the results after a series of different organizational change initiatives?
- What are the factors that were common during the different organizational change initiatives attempted at the Agency?
- How must the Agency measure the results of the different change initiatives attempted?

From the previous questions and the observations presented by Pettigrew, et al. (2001) and Dulton (2001) among others, the case study was conducted with the goal of exploring the following main research question:

**How to model organizational change such that change context, processes and organizational outcomes can be dynamically related.**

Thus, the Influence Model for Organizational Change –IMOC- is developed to address the previous research question. The case study was oriented to corroborate or to redefine the different propositions on which the model is based, leaving the door open for the possibility of more research in the area.

### **3.3.2 Study Propositions**

With the main goal of devising a new model for organizational change, a series of propositions was generated, as seen in figure 3.2, after observing how different change projects were implemented at the Agency and the experience derived from these projects. The research questions that motivated this study indicated that there are factors that influence change that need to be studied with more detail. The following study propositions incorporate these factors with the objective of examining them within the scope of the proposed model for organizational change.

**Proposition 1: Radical change motivated by innovation is more difficult to implement than radical change motivated by strategic or environmental reasons.**

This is the main proposition on which this research is based. Radical change must be motivated by more profound reasons than the simple adoption of innovation. Heller (2000) showed, through a series of case studies, that for manufacturing enterprises, the development of new products without considering the possibility of radical changes in the structure or processes in the organization is likely to be a failure. According to the author, it becomes extremely difficult to produce radical administrative and structural changes without a strategic agenda that guides the attempts. On the other hand, the strategic thinking of the radical changes needed before the introduction of new products, would result in a positive experience when a new product is introduced.

This research extends this concept to a more general scope, with the premise that radical change should come before any innovation. The adoption of innovation generates the need for incremental change that would positively induce transactional change. Under certain circumstances the innovation leads to a more profound type of change, which requires transformational variables, as defined by Burke and Litwin (1992), to be modified.

It is possible to argue that developing transformational change at the same time that innovation is adopted is difficult. The model attempts to explain how to conduct these activities in parallel in a self-adjusting organization to avoid having people partially adopt the innovation while rejecting major changes that affect aspects beyond day-to-day activities.

**Proposition 2. Environmental and internal forces will motivate radical change, while institutional forces will induce innovation.**

**Proposition 3. A need for change will induce a need for innovation.**

Institutional forces induce the adoption of innovation in a search for prestige or desire to look like similar organizations. In contrast radical change is motivated by more profound reasons such as the need to survive or to cope with competition. Both environmental and internal elements could force the organization to attempt radical change that would provoke then the adoption of different innovations.

Even if the radical change is not totally accomplished, the model argues, the innovation will be more easily adopted, and inertia would not impede partial or total radical change in transformational variables because the internal structures of the organization would be impregnated by the need for change.

**Proposition 4. Innovation will generate a change in transactional variables.**

Innovation, from the perspective of this research, consists of the adoption of new elements that will make everyday tasks easier to achieve. Since transactional variables are based on the current climate of work and are directed toward modifying or changing specific activities and processes (Burke and Litwin, 1992), the adoption of an innovation will modify some or all of the transactional variables currently present at the organization.

If transactional variables need to be modified to accommodate the adopted innovation the results will be observed as an improvement in the related performance outcomes of the organization if the innovation is related to internal organizational processes or will depend on other factors, such as market or customer preferences, to be a success.

**Proposition 5. Radical change will generate change in transformational variables.**

**Proposition 6. Transformational variables will change in a positive direction even if the change initiative fails.**

As defined by Burke and Litwin (1992) transformational variables affect the culture of the organization, transforming it to a more holistic perspective. The model proposes that the need for radical changes will conduce to a continuous, concurrent process in which both transformational and transactional variables will change since the need for innovation will appear, as established in proposition 3. This argument is contrary to what is suggested by previous models derived from Lewin's original work (Marshak, 1993, Dulton, et al., 2001), which suggests separate change processes for both transformational and transactional variables.

Radical change will positively influence changes in transformational variables. At the same time, the motivation for change in transactional variables will be induced, not only as part of the requirements resulting from the changes in transformational variables (Burke and Litwin, 1992), but also because radical change would induce the adoption of innovations. Because radical change is induced by internal and strategic factors, the need for change in transformational variables would be institutionalized by the message from participants and the commitment from different members of the organization (Armenakis, et al., 1999).

**Proposition 7. The success of a radical change initiative will be negatively influenced by the differences between employees' perceptions and expectations of the critical success variables influencing the change process.**

**Proposition 8. The success of a radical change initiative will be negatively influenced by the difference between employees' perceptions and management expectations of the different critical success variables influencing the change process.**

**Proposition 9. Groups of people with similar perceptions and expectations of the critical success variables will positively influence radical change.**

**Proposition 10. Length of employees' tenure time at the Agency will positively influence the adoption of transactional change.**

**Proposition 11. Length of employees' tenure at the Agency time will negatively influence the adoption of transformational change.**

The concept of perception and expectation as a measure of organizational performance was originally adopted as a crucial element in the quality movement measure of quality on service (Parasuraman, 1988, Zeithaml, 1988, Duffy, et al., 1998, Lu, 1998). The first three propositions are derived from the fact that any type of radical change initiative should be supported by the presence of a series of critical variables that

help in internalizing the need for change in the organization and by the people's perception of these variables (e.g Burke and Litwin, 1992, Armenakis, et al., 1999, Larsson, et al., 2001). In addition, as transformational variables affect how the organization accomplishes its goals (Burke and Litwin, 1992), it is important not only that people's perceptions and expectations be aligned in the same direction (Cook and Rousseau, 1988), but also with management's perceptions and expectations (Gordon, et al., 2001).

Finally, the last two propositions come from previous studies on how time affects the adoption of organizational change (e. g., Damanpour, 1991, Amburgey, et al., 1993, Staw and Epstein, 2000, Sørensen and Stuart, 2000). These studies conclude that old organizations resist radical change while accepting change that is based on previous experiences and affects more routine activities. Using these conclusions, this research argues that the same can be concluded for people in the organization. People with longer tenure time at the organization will accept change better if it is based on previous experiences and does not radically change their environment, while people with shorter time at the organization will accept more willingly radical change because they have not absorbed prevailing organizational culture.

### **3.3.3 Unit of Study**

The case study was conducted at the Agency. Since their introduction to the United States in 1964, similar government-sponsored organizations have become a major source of revenue (Miyazaki, et al., 1998). With sales in 37 states and the District of Columbia of \$33.3 billion and proceeds of \$12.2 billion in 1998 (U. S., Bureau of the

Census, 1999), the services provided by state-sponsored organizations as the one studied are the leading product produced and sold by state governments to the public (Miyazaki, et al., 1998). As mentioned in the previous chapter, change is not exclusive for private organizations. Governments, state and federal, are looking for efficiency in the management of resources and competitiveness in terms of costs and services. Since the primary goal of the Agency is to generate the maximum amount of revenue for the state (Miyazaki et al., 1998), they are facing increasing pressures to innovate, to be more efficient, more creative, more effective, and more responsive.

Agencies operate as a quasi-private organization, functioning in some situations like private service companies, while in other situations operating as pure government agencies. In some states agencies are viewed as corporations, while in others they are defined as mainly a management office, outsourcing most of their operations. In still other states, agencies operate basically as pure state organizations. This fact shows that business processes differ from state to state, not always with the best business practices in any one state (Crowe, et al., 2000, Jang, et al. 1999).

Given that state agencies, as the ones studied are a distinct type of public agency, the revised literature does not present studies involving such a different and interesting setting. Instead the literature emphasizes studies in a more traditional type of state organization (Narismhan and Jayaram, 1998, Thong, et al.)

The Agency was created in 1984 when Missouri voters approved Amendment 5, which modified the state constitution. The Agency's vision is: "That our products and promotions should be fun, innovative and provide players, retailers and employees with unsurpassed opportunities of success. " The Agency's mission is defined as: "To

maximize revenues for public education through the creation and sale of fun and entertaining products with the highest levels of service, integrity and public accountability.” Sales at the Agency began in January 1986, and in fiscal year 2000 they reached \$508 million, with a profit of near \$154 million.

The headquarters of the Agency are located in Jefferson City with three regional offices located in Springfield, Saint Louis and Kansas City. A five-member commission, appointed by the Governor and approved by the State senate, governs the Agency, while the executive director manages the daily operations of the agency. Its operations are supported by nearly 180 employees, and it is composed of four divisions- Finance & Administration, Marketing, Security, Communications - and the Executive Office, which contains other activities not included in the four divisions, such as Research & Development, Budgeting, Human Resources and Minorities Business Development among others.

The Agency first attempted to accomplish important changes in the organization in part as a result of an organizational diagnosis performed by an external consulting firm during 1996. This diagnosis revealed the need for change in different areas and the need for modernizing some processes and activities in order to improve the efficiency and effectiveness of the organization. A series of projects has been attempted since then, some with a great impact on the performance of the organization, others without accomplishing the desired results. As part of this research effort an analysis of the different projects was performed using the information collected from the case study. The means of data collection and the methodology used to classify and analyze the data is presented in the following sections.

### **3.3.4 Data Collection**

Yin (1994) affirms that case studies rely on different sources of evidence. Six of these sources were studied in previous sections. For this research effort, the necessary data to evaluate the different propositions presented was collected by means of:

- Documentation: relevant information for this case study came from sources such as strategic plans, direct documentation from the different organizational change efforts previously attempted, current projects, organizational charts and documentation from the researcher's personal data base derived from the previous experience at the Agency.
- Archival records: data from archival records consisted of data from the first year a formal strategic plan was developed up to the current year. The data was located in financial information, or strategic performance information, such as sales per product, per region and per employee. In addition, relevant performance information derived from the different projects was studied. Information related to customer satisfaction, cycle times for certain important processes created or modified by previous organizational change initiatives and other relevant performance information was used to corroborate certain propositions presented in this proposal.
- Interviews and surveys: Two types of interviews were conducted: structured and semi-structured. The structured interview consisted of an instrument or survey that was applied to 100% of the employees at the Agency. Using the total population in

the survey avoided complications related to the sampling procedures and possible bias in the answers (Gummesson, 1991, Thompson and Seber, 1996). Of the 177 surveys distributed, 83 useful questionnaires were received with a response rate of 47%.

The survey, shown in the appendix, consisted of three sections. The construction of this instrument followed a series of unstructured interviews with Agency's personnel, including the Executive Director and other top executives in order to define different elements contained in the instrument, as well as to determine how to name them and how to phrase the different questions according to the Agency's common language or semantics. In addition, the meetings helped to determine the necessary logistics to apply and return the survey and the necessary communication between the researcher and the participants. This process follows the ideas presented by Isabella (1990) for a case study and data gathering processes. The first section of the survey gathered demographic information necessary in the study. In addition, it included questions regarding the type, purpose and result of different change initiatives attempted in recent years at the Agency. Finally, it presented a list of possible characteristics and motivators of change in order to define what are the main similarities or differences of the different projects. The second section of the questionnaire consisted of a series of questions that assessed important critical change variables, as defined by Burke and Litwin (1992). The instrument was adapted from a 150-item instrument designed by Burke and Litwin as a diagnosis tool for their causal model for organizational change (Burke, 1994, Burke et al., 1996, Armenakis and Bedeian, 1999). Anderson-Rudolf (1996) and

Falletta (1999) validated the Burke and Litwin instrument, with similar findings for the different constructs presented. Both studies derived high measures of internal consistency since both the Cronbach's alpha and the item loading were higher than 0.7. Cronbach's alpha is a measure of how well a set of items measures a construct or dimension (Nunnally and Berstein, 1994, Rea and Parker, 1997). For this measure, the higher the value, the higher the inter-item correlation. Factor analysis is a statistical tool to reduce and group items in common factors or dimensions (Shaughnessy and Zechmeister, 1994), with high loadings between related items indicating a high significance of the item grouping (Lee, 1995). This section of the questionnaire consisted of 66 questions that were adapted from a sample of the most relevant items present in the original survey (Burke, 1994, Burke, et al., 1996), but worded and structured in a manner that is consistent with the Agency culture and metaphor. Most of the questions were positively worded, with the exception of five of them, which were negatively worded (reverse order scaling) for control purposes. Each question was rated on a 5-point Likert scale, for 1 being "To a very small extent" and 5 being "To a great extent". In addition, the questionnaire in this section included the option of "I don't know" if the respondent considered himself not familiar with the question or the information asked and "Not Applicable" if the informant considered that the question or information asked does not relate to the individual's personal condition. In addition, the respondent in this section had to answer each question for three possible scenarios. The first scenario described "Today" and it referred to the extent at which every situation presented is perceived for the day the respondent answered the survey. The second scenario presented "A

year ago” which is the extent at which each situation is perceived, as it was a year before the respondent answered the instrument. Finally, the “Preferred” scenario represented the expected or preferred situation.

The third and final section of the instrument consisted of a series of open-ended questions to obtain information that explained trends and low or high variability between surveys in the results.

In addition, 21 semi-structured interviews were conducted. Participants from all the divisions, at different managerial levels and different tenure times were interviewed during a 3-week period. The interviews gave the respondents the opportunity of expressing personal concern with respect to the overall change process at the Agency. The answers to these questions gave a more centered perspective of the intricacies of the organizational change efforts attempted at the Agency, and the expectations and perceptions of the different members of the organization. Information from these interviews helped to explain certain answers obtained from the questionnaires and to fill some gaps necessary to study and conclude with respect to the different propositions.

### **3.3.5 Data Analysis**

Sterman (2000) posits that the data needed to develop the dynamic relationships implied in a system dynamics model should come from interviews and conversations with people within the organization. The use of surveys, interviews and observation together with quantitative data obtained from the organization’s archives and documentation fostered the development of the different causal relationships and loops relevant to the model.

Figure 3.3 shows how each of the different propositions is to be related with the information gathered by the surveys. Since a qualitative methodological approach was used to gather the necessary information, it is difficult to conduct traditional and profound statistical analysis. As seen in Figure 3.3 statistical analyses such as Pearson's correlation matrices and mean comparison were used to analyze the different propositions and to present the different variables and influences that are present in the change environment. Furthermore, qualitative content analysis of the different open-ended questions served also as a verification tool for some of the propositions.

Table 3.2 presents the structure of the questionnaire and the classification of items by the corresponding dimension measured. Transactional variables were assessed in questions 1 through 26 while questions 27 through 66 assessed transformational variables. Questions 13, 14, 20,23, 27, 28 and 58 were evaluated in reverse order, and they were used as a controlling strategy to detect bias or false trends in the questionnaires.

Table 3.2 Classification of items by dimension measured

<b>Dimension</b>	<b>Items</b>
Section I	
General information	1-9
Business processes	10
Change initiatives	11, 12
Section II	
External environment	1 a, b, c, d, e, f, g
Mission and strategy	2 – 14
Leadership	15 – 18
Organizational culture	19 – 26
Structure	27 - 28
Management practices	29 – 40
Systems	41 a, b, d, d, e, f
Work climate	42 a, b, c, d, e, f
Job/skills match	43 – 49
Motivation	50 – 53
Individual needs and values	54 – 58
Performance measures	59 - 66

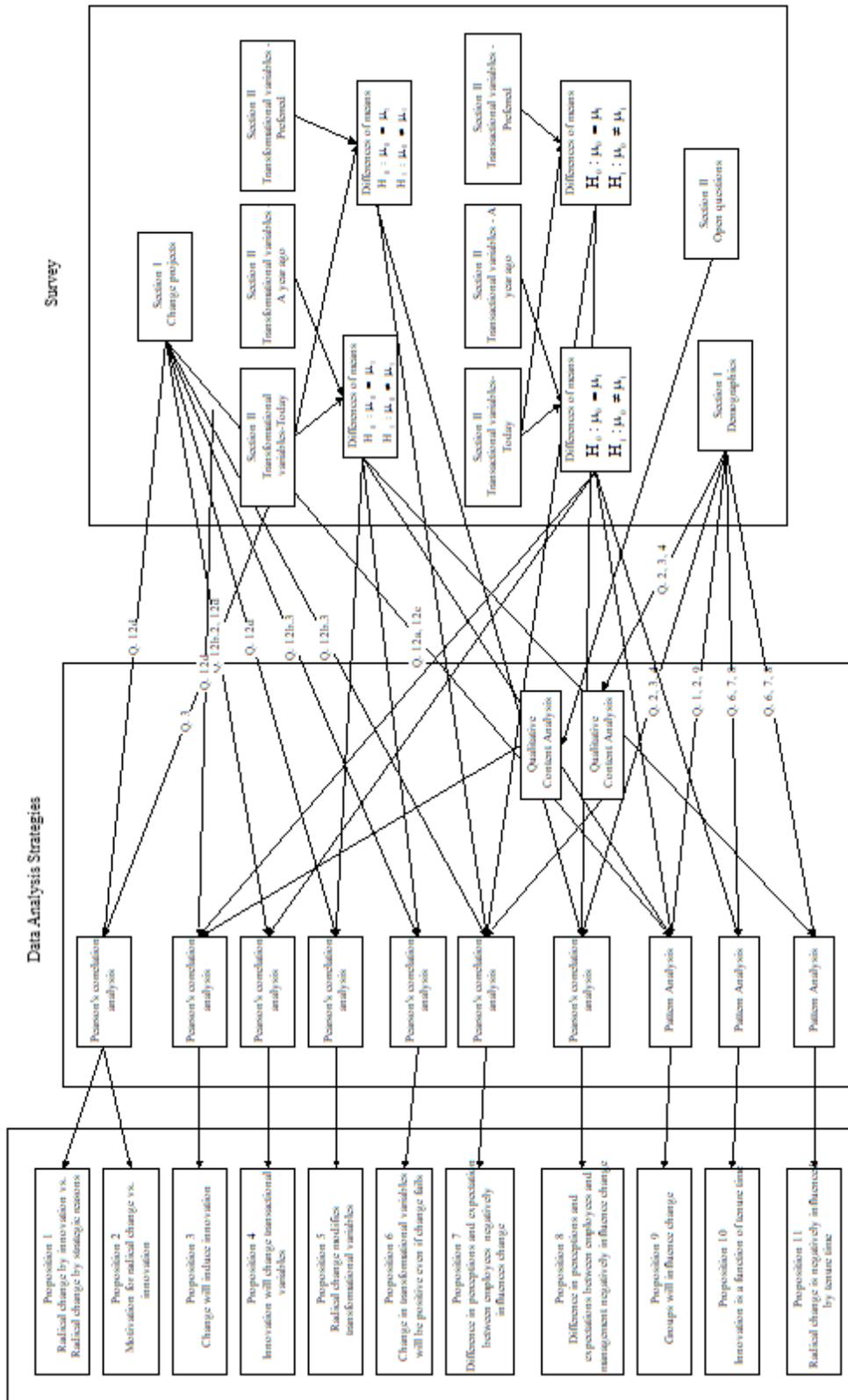


Fig. 3.3 Verification Process

Total scores for section two were determined as the weighted average of the individual scores discounting the N/A, Don't Know answers. These answers did not count on the scores but could be used for trend analysis if they presented a common pattern among the participants. The number of questions used to assess a corresponding variable determined the corresponding weight. This calculation was performed for both transformational and transactional variables for each of the scenarios presented in the survey. The internal consistency and reliability of the instrument was tested through a Confirmatory Factor Analysis and by the use of the Cronbach's alpha estimate as shown in the following chapter.

The assumption of normality is important in order to perform quantitative analyses using the mean as the population parameter. If the sample size, or the population is large, the use of the central limit theorem justifies the use of the normal distribution as the sample distribution. Even if a modest departure from the assumption of normality is reported, the validity of the conclusions should not be compromised (Daniel, 1990). It is possible to argue that if the response rate of the survey is large enough, the normality assumption can be supported, and the use of traditional parametric statistical analysis can be explored. Hereto, the mean will be used as a parameter of the population under study, and for the analysis of the different propositions presented in the previous sections.

The expression used to determine the individual average for each set of variables (transformational and transactional) is given by:

$$\bar{X}_i = \frac{[n_k - (N_{N/A,k} + N_{No,k})] \sum_{j=1}^{n_k - (N_{N/A,k} + N_{No,k})} x_{k,j}}{\sum_{k=1}^K [n_k - (N_{N/A,k} + N_{No,k})]}$$

Where:

- $\bar{X}_i$  : Is the mean for variable i, for i = Transformational or Transactional
- $n_k$  : Is the total number of items corresponding to dimension k for variable i.
- $N_{N/A,k}$  : Total number of items with N/A scores in dimension k for variable i.
- $N_{No,k}$  : Total number of items with Don't Know scores in dimension k for variable i.
- $X_{k,j}$  : Score for item j in dimension k for all the items in this dimension.

The difference between means for a corresponding variable, given by  $\Delta\bar{X} = \bar{X}_1 - \bar{X}_2$ , defines a measure of change. Comparing the corresponding means and testing for a null hypothesis defined as  $H_0: \bar{X}_1 - \bar{X}_2$ , where 1 and 2 depict the different scenarios defined in the survey, will determine if a significant change for the different variables exists.  $\Delta\bar{X}$  was correlated with the aggregate results for the different projects in order to verify propositions 1 through 8, as indicated in figure 3.2.

Propositions 9 through 11 were verified using data from questions 1 through 10 of the first section of the questionnaire. These questions defined the demographics of the Agency. The information provided here was used to determine the trends and possible grouping that will verify the propositions, as shown in figure 3.2. It is important to consider the size effect of the results whenever a test of statistical significance is used (Vacha-Haase, 2001). The use of ANOVA was explored to determine significant differences among groups of respondents. A high collinearity resulted during the analysis of some of the variables –as was expected since there is a great degree of collinearity among the different critical variables -, which made difficult the clustering of groups. The

use of qualitative analysis was necessary in order to determine possible similarities among groups of participants and the change in transformational and transactional variables as assessed by this study in the cases where ANOVA was of no use.

### **3.4 Construction of the Model**

DeTombe (2001) defines complex societal problems as real life problems that present a dynamic behavior. They can be classified in different subgroups such as complex social problems, complex technical policy problems and complex organization problems. Organizational change affects not only physical and financial structures but essentially profoundly affects the many actors involved in it. Hence, organizational change can be viewed as a complex societal change since it affects all levels, structures and members of the organization.

The author presents Compram as a methodology for handling complex societal problems. Compram, which stands for COMplex societal PROblems Analysis Methodology, is a prescriptive framework to analyze, guide and predict complex societal problems. The method indicates the necessary meta-steps that a multidisciplinary team should follow to define, to describe and to solve complex problems. DeTombe (2001) develops a seven-layer model that is the basic communication tool that helps actors with different backgrounds and organizational levels to understand not only the problem but the different facets and characteristics of the possible solutions. This approach is shown in Figure 3.4.

Layer I of the Compram methodology consists of the motivation and problem definition included in this document. Developing a formal model that describes not only

the content but also the process and context of change became the main objective of this research effort. Layer II contains the definition of the concepts and theory that support the necessity of a solution of the problem under analysis and the theoretical foundations that will later support the proposed model.

In Layer III, DeTombe (2001) proposes that the relationships between the theories and the phenomenon under study have to be described using natural language. It is at this step that the Influence Model for Organizational Change –IMOC- is proposed as a conceptual model that explains in a more detailed and holistic manner radical change in organizations. Layer IV considers the different knowledge islands required to develop a solution for the problem proposed. In this layer the definitions of the different approaches combined to develop the model were explained.

The use of knowledge from systems thinking, social and behavioral sciences, enterprise modeling and system dynamics is conjugated in this study to develop a three tier model that is defined in layers V, VI and partially in layer VI since the proposed model is a conceptual model that attempts to present a qualitative approach to organizational change modeling, without profound quantitative simulation or mathematical modeling at this step.

### **3.5 Validation of the Model**

Barlas (1996) affirms that models can be defined from two points of view. The positivist or traditional approach sees the model as an objective representation of a real system. From this approach a model is correct or incorrect once it is compared with empirical facts from reality. On the other hand, the phenomenologist or holistic approach

sees the model as one of many possible ways to describe a system. “No particular representation is superior to others in any absolute sense... for every model carries in it the modeler’s world view (Barlas, 1996. p. 187).”

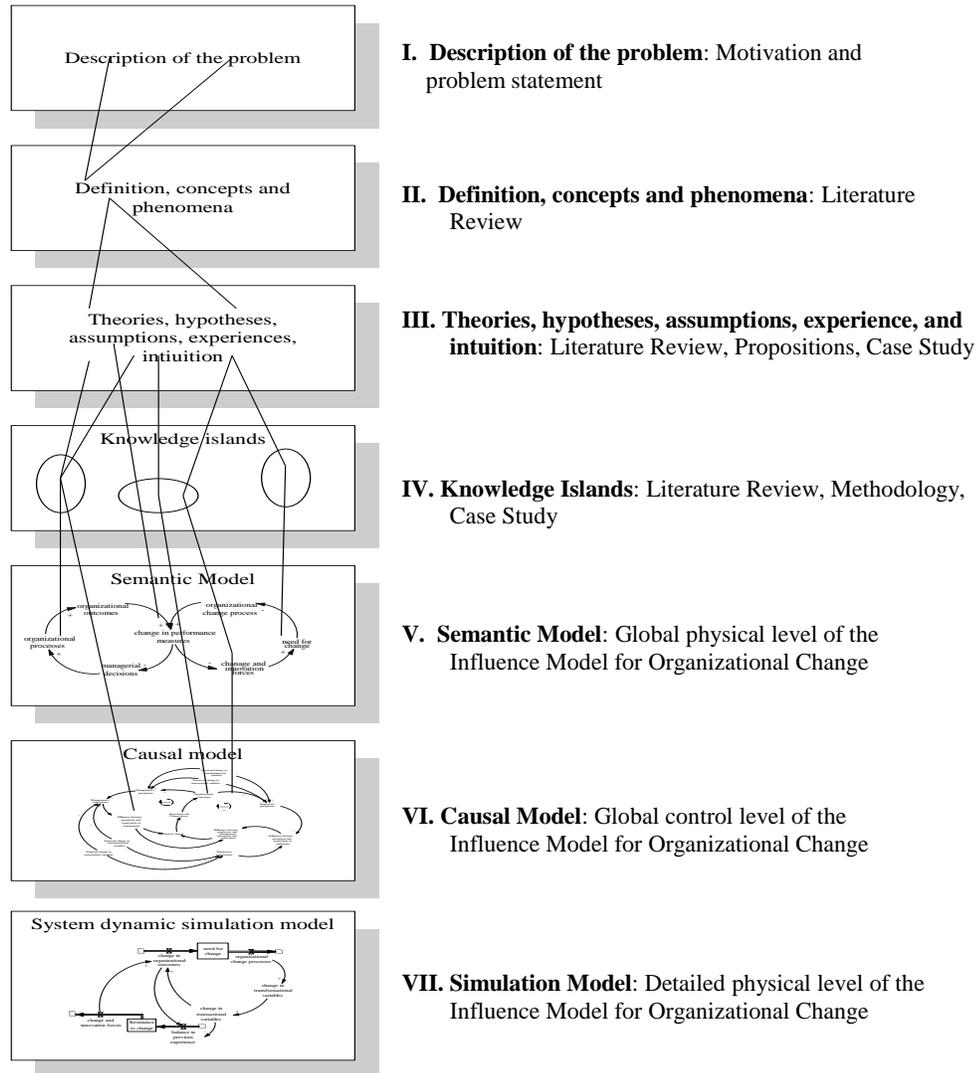


Fig. 3.4 The Compram Methodology applied to the model construction. Adapted from De Tombe, 2001

Vennix (1996) defines the validation of a model as the "degree to which the base model input: output relations map on those of the real system (p. 323)". But, Vennix (1996) adds, the demonstration that a model is fully correct is impossible because the problems represented by the model are not independent of the observer or of other people. Validation is best understood as "an ideal towards which we must strive if we are to be at all faithful to the idea that management science aims to support action in the real world (Vennix, 1996, p. 318)'.

IMOC is based on concepts of system dynamics underlying the relationships inherent to an organizational change process. Klabbers (2000) affirms that when system dynamics models are developed for practical uses such as policy development of social systems, they are incomplete, relative and partly subjective. These characteristics make model validation a process related to the validity of the model with respect to the purpose of it (Taylor and Karlin, 1994).

As Vennix (1996) states, a model is a deliberate creation that includes relationships that try to represent the real world, or at least part of it. These relationships are supposed to be understood by the developers and users of the model. Thus, the detailed internal structure of the model should be compared with that of its reference system. Klabbers, (2000) posits that traditional validation, typical for data-driven econometric models or traditional simulation models, is based on the predictability, historical independence and deterministic nature of these problems. These procedures are not suited for validating system dynamics models. Since they are descriptive models, the

validation would primarily cover the validity of the internal structures of the model and then the validity of the system behaviors.

Since validation of IMOC should be based more on the usefulness of the model rather than other aspects such as elegance, realism or reproducibility (Taylor and Karlin, 1994), it would be necessary to answer the following questions stated by Klabbers (2000):

- Since the validity of a system dynamics model is defined by its adequacy with respect to a purpose, who are the judges or owners of such purposes?
- Because the knowledge about the structure of a social system is not only a matter of representing reality but understanding that the structures and relationships within the social system evolve with time, who can be the judges of such validity?

Klabbers (2000) adds that the answer to these questions is more a matter of a profound study of social systems than a practical issue. The validation of a system dynamics model should include more a qualitative approach than the use of traditional quantitative techniques. The qualitative approach should be based on (Vennix, 1996, Klabbers, 2000):

- The knowledge about the structure of the system,
- The knowledge about the dynamic characteristics of the system.
- The knowledge about the relationships between the structure and dynamics of the system.

Barlas (1996), argues that there is not an established definition of model validity and validation of system dynamics models. As a tentative solution for this problem the author suggests a logical sequence of formal steps of model validation. To better understand the ideas on system dynamics model validation, the following information is taken from Barlas (1996).

As seen in figure 3.5, the tests are carried out in a logical sequence, and the modeling process moves to the next step only if it is possible to establish confidence in the current step. First of all, direct structure tests assess the validity of the model structure by direct comparison with knowledge about real system structures.

The tests compare the model's causal relationships with both the relationships that characterize the real systems and with the structures and relationships proposed and explained by the literature. Secondly, the structure-oriented behavior tests assess the validity of the model by applying certain behavior patterns using simulation. These tests involve observing the behavior of the system under extreme conditions and comparing this behavior with the response of the system under the static conditions.

Finally, behavior pattern tests involve testing the system based on pattern prediction rather than point or event prediction in order to see if the model shows the corresponding behavior for long term policy implementation shown in the real system.

For the current research effort, the validation process was concentrated in the first set of tests as shown in figure 3.5 by the shadowed area. The case study that was conducted as part of this research effort had the main objective of finding the answer to the challenges of validation. Observations through the questionnaire and interviews, added to the previous experiences at the Agency generated adequate information to verify

the suitability or usefulness of the proposed model to represent the different aspects involved during an organizational change effort. In conclusion, the proposed Influence Model for Organizational Change –IMOC–, rather than being an attempt to develop a complete representation of the organizational change process, was oriented towards the generation of a debate about the processes involved in organizational change and the possible results if the different variables and interdependencies could be observed and studied.

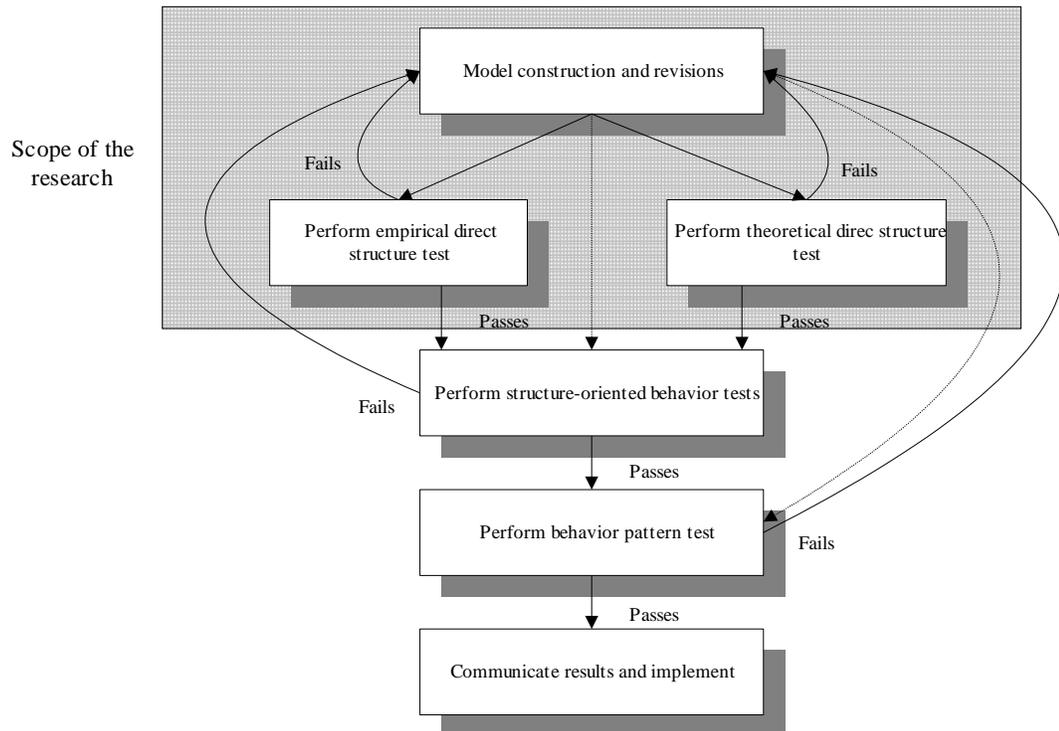


Fig. 3.5 A logical formal procedure for dynamic systems models validation. Form Barlas (1996).

## **Chapter 4**

### **Results and Discussion**

#### **4.1 Introduction**

This section includes the results and diagnosis of the case study conducted at the Agency. These results are necessary to analyze and understand the different propositions on which this study is based. The information summarized and presented in this chapter will then be used to develop and explain the proposed Model for Organizational Change in the next chapter.

This chapter is divided in different sections to discuss the characteristics of the instruments used to gather data, the environmental situation of the case study subject and participants and to better analyze the propositions presented in Chapter Three.

#### **4.2 Internal Validity and Reliability of the Survey**

For the purpose of gathering data for this research, a questionnaire was distributed among the personnel at the Agency. The questionnaire is shown in Appendix I.

As mentioned in the previous chapter, the questionnaire was divided in two main sections. The first section included questions concerning geographical area, administrative division, tenure at the Agency, time at current position, organizational level and functions. In addition the section included information about the main organizational projects executed at the Agency since 1994, the extent, depth, goals, and results.

Furthermore, the respondents had to answer questions regarding their roles in the different projects and the stage of the project at which they were involved.

The second section consisted of 66 questions to measure the different constructs or critical variables originally defined by Burke and Litwin (1992). The section used as framework the Burke and Litwin 150-item instrument designed as a diagnosis tool for their causal model for organizational change (Burke, 1994, Burke et al., 1996, Armenakis and Bedeian, 1999). Anderson-Rudolf (1996) and Falletta (1999) validated the original instrument with similar findings for the different constructs presented.

#### **4.2.1 Internal Validity**

The second section of the questionnaire was intended to assess the level of the critical variables grouped in two main dimensions: Transformational and Transactional Variables (Burke and Litwin, 1992), and three possible scenarios: “As today”, “A year ago”, and “Preferred”. As Stevens (1996) affirms, this type of design using repeated measures ensure robustness of the instrument since the respondents are the same and are not affected by time, place or individual differences effects. The different items included in this section were adapted from the original instrument based on the Agency’s culture and metaphor. A Confirmatory Factor Analysis (CFA) was executed to verify the validity and internal consistency of the instrument used in this research, which confirmed that the adapted instrument was designed to assess these two different dimensions. CFA uses the obtained data to verify, based on strong theoretical or empirical foundations, that the instrument’s items are correlated to the different factors or dimensions measured (Stevens, 1996). The data used for the CFA corresponded to the answers for the “As

Today” scenario of the 66 questions in section two. The reason of selecting these items for the analysis is that since this is the current situation analyzed by the respondents, it is possible to affirm that the majority of the participants would answer this scenario.

A method to determine the amount of factors that can be explained with the variables used in the survey is the scree plot. The scree plot uses the eigenvalues of the correlation matrix - the points or roots that express maximum common correlations between factors and variables (Neter, et al., 1996, Loehlin, 1998) - versus the amount of possible factors influencing the model. The scree plot graphs successive eigenvalues and the user arrives at a decision based on the point at which the slope of the curve of eigenvalues rapidly changes declining to an almost flat slope (Loehlin, 1998).

From the scree plot shown in figure 4.1 it is possible to see that effectively two factors group most of the variability of the items. The behavior of eigenvalues does not significantly change after the second factor. This indicates that most of the variation among responses can be attributed to the two dimensions, transformational and transactional variables, defined in the Burke and Litwin model (Burke and Litwin, 1992).

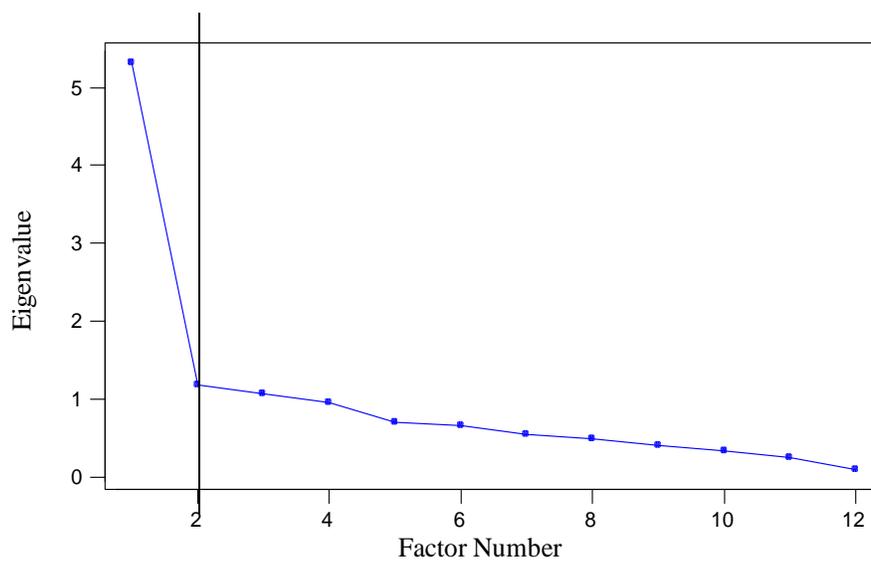


Fig 4.1 Scree plot of the variables under analysis

Stevens (1996) defines the loading on each factor as the Pearson's correlation between the factors and the variables; thus, the higher the loading, the better the existing correlation between the factor and the variable. An important step in factor analysis includes the transformation of the correlation matrices used in the analysis in order to minimize the amount of relations between variables (Loehlin, 1998). The varimax rotation was used for the CFA since with this rotation each factor tends to load high in few variables and very low on the rest, helping in the interpretation of the resulting factors (Stevens, 1996).

Moreover, Stevens (1996) affirms that the interpretation of the loadings must be carefully done, with larger samples giving a sounder analysis. The critical values of the loadings must increase as the sample decreases. In this study, the amount of valid responses is 72; thus, as he recommends, factors with a loading of approximately  $|0.6|$  must be used.

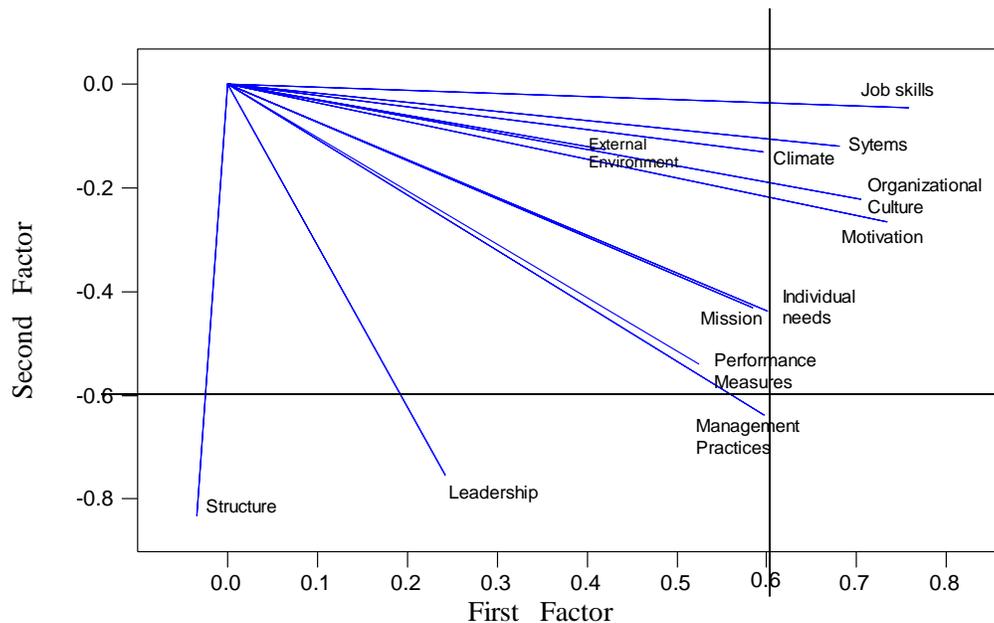


Fig. 4.2 Loading plot for the different variables under study

Figure 4.2 shows a plot of the different factor loadings. As seen, the loadings with values greater than  $|0.6|$  are not necessarily classified according to the original classification defined by Burke and Litwin (1992). Thus, although the second section of the survey measures the two dimensions – transformational and transactional - it seems that the items do not group as mentioned by Burke and Litwin (1992). It is possible to argue that this behavior is due to three basic considerations:

- Gorsuch (1983) indicated that for factor analysis to be effective, a minimum of five valid cases per survey item is needed. Otherwise, the efficiency of the method is not guaranteed. This is because covariance and correlation coefficients tend to be greatly influenced by the presence of outliers if the sample size is not large. Since the second section of the survey consisted of 66 items, a minimum of 330 surveys would be needed to accurately measure the loading of the different factors.
- Furthermore, Loehlin (1998) affirms that factor analysis is highly restricted since causal links among variables might result in erroneous interpretation of the correlations. When a test over the 66 items was performed, the results indicated that the correlation matrix was not positively definite. This result led to belief in the existence of high multicollinearity between the 66 items, which creates a problem because the determinant of the correlation matrix is close to zero (Neter, et al., 1996). To solve this problem, averages of the different items were used for the CFA. That is, instead of 66 independent items, the aggregate for 12 different variables was used. Since the instrument used was adapted from a tested instrument, it can be assumed that the

individual items are already grouped to assess the different variables included in the study.

- The restriction previously mentioned implies additionally that the different variables and factors explained by Burke and Litwin (1992) should be independent and explained by simple correlations (Neter, 1996, Stevens, 1996). Figure 4.3 shows that the relationships between the different variables and dimensions explained by Burke and Litwin (1992) are not simple. Actually, they tend to be complex and cyclical, which is one of the main limitations of factor analysis and one of the core problems assessed in this research.

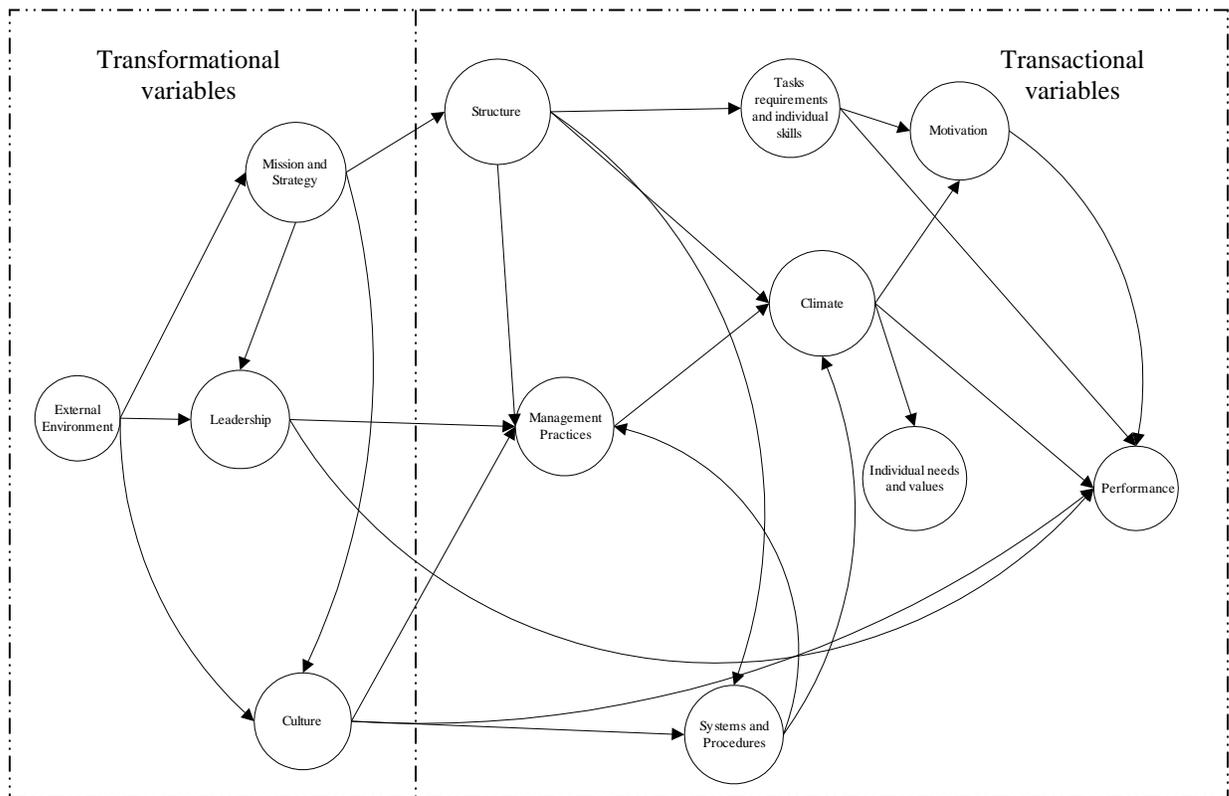


Fig. 4.3 Interrelationships among the critical variables of the Burke and Litwin Model. Adapted from Burke and Litwin (1992), Anderson-Rudolf (1996), Falletta (1999)

#### **4.2.2 Internal Reliability**

Once the validity of the instrument, in terms of the measured constructs has been assessed, it is necessary to determine if the instrument presents internal reliability, that is, how accurately the questions or items that compose the instrument measure the behavior that the research wants to assess. The coefficient alpha, commonly known as Cronbach's alpha estimate is often used as an index of the homogeneity of a set of items. The coefficient alpha should not be lower than 0.70 for presuming the reliability of the questionnaire (Nunnally and Berstein, 1994). For this analysis, the Cronbach's alpha for the different items was 0.8673, which can be considered high for this type of study.

To guarantee internal validity it is necessary to triangulate the responses to verify the information (Yin, 1994). In addition to the Confirmatory Factor Analysis and the Cronbach's alpha estimate a series of interviews were conducted during a three-week period. The interviews confirm some of the answers obtained and filled gaps present in the survey. To conduct the interviews a sample of 14 employees was selected. The sample included personnel from the different divisions and with different tenure time. Additionally the four division directors, the controller, and director of planning were also interviewed.

#### **4.3 Analysis of the Study Population**

The survey was sent to 100% of the employees at the Agency. Of the 177 questionnaires distributed, 84 were received and one of them was eliminated because the information was not complete. The response rate was 47%, which is considered high for

this type of study since the average response rate is between 15%-30% (e. g., Bourque and Fielder, 1995, Guimaraes, 1997, Grover, et al., 1995, Grover, 1999).

The surveys were distributed using internal mail in a package for each Agency employee. To guarantee anonymity and confidentiality a white envelope addressed to the Agency contact and a pre-stamped manila enveloped addressed to the researcher were included in the package. If the person agreed to participate in the study he or she inserted the consent letter in the white envelope while mailing the survey in the pre-stamped envelope. There was no control or identification number that could link the survey with the consent letter. An email from the Executive Director of the Agency was sent in advance to all the employees informing them of this research and requesting the participation of the employees in this research. A follow up email was sent two weeks after the surveys were distributed to the employees.

Table 4.1 shows how the surveys were distributed to the different regions across the State of Missouri, and the response rate from the different offices. As seen, 72% of the respondents were from Headquarters. Furthermore, Headquarters also presented the highest individual return among the different regions with 54% response rate.

The great majority of the responses are from the Jefferson City area, which includes Headquarters and Vault, with a total of 79%. In addition, the individual response rate of these individual offices was also the highest, 54 and 60% respectively. Therefore, the analysis of the information presented in the surveys was be analyzed as aggregate, not by individual regions, and conclusions drawn assuming a uniform behavior across the different regions. Figure 4.4 graphically shows this information.

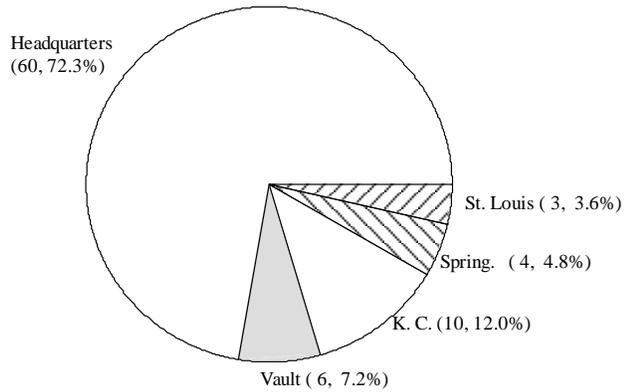


Fig. 4.4 Participants by region

Table 4.1 Responses by region

Region	Total	Received	% by region	% by total
Headquarters	112	60	54	72
Jefferson City (Vault)	10	6	60	7
Kansas City	19	10	53	12
Saint Louis	23	3	13	4
Springfield	13	4	31	5
Totals	177	83	47	100

Table 4.2 shows the responses by division. Figure 4.5 graphically depicts these percentages. The divisions that have the greatest weight in the total responses are Administration and Marketing since they are the largest divisions at the Agency, with nearly 60% of all the employees. Nevertheless, Marketing presents the lowest rate of response among the different divisions. One reason for the lower rate of response could be that a majority of the employees in this division are field personnel who spent most of their time on the road. In addition, it might be possible that since most of them do not

directly participate on any of the different projects –although being affected by them – they considered that they did not have enough information or knowledge to fill out the survey.

Table 4.2 Responses by Division

Division	Total Received	% of received	Total FTE	% of FTE
Administration	31	37	43	72
Communication	8	10	13	62
Executive Office	8	10	11	73
Marketing	26	31	86	30
Security	10	12	24	42
Totals	83	100	177	---

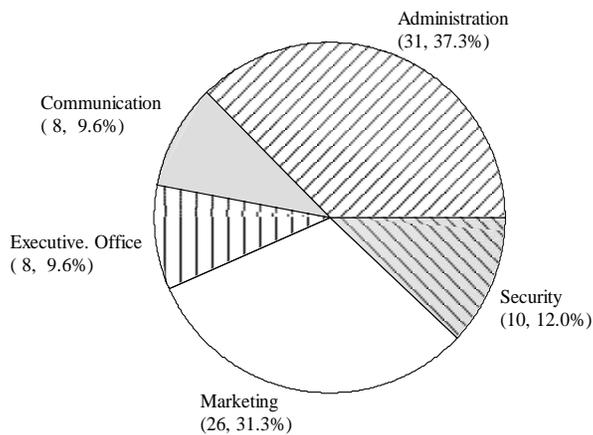


Fig. 4.5 Participants by Division

Figure 4.6 shows the participants by tenure at Agency and figure 4.7 shows the participants by time working at the current position. In addition, tables 4.3, 4.4, and 4.5 show the frequencies and basic statistics for both variables: years at the Agency and years at the current position.

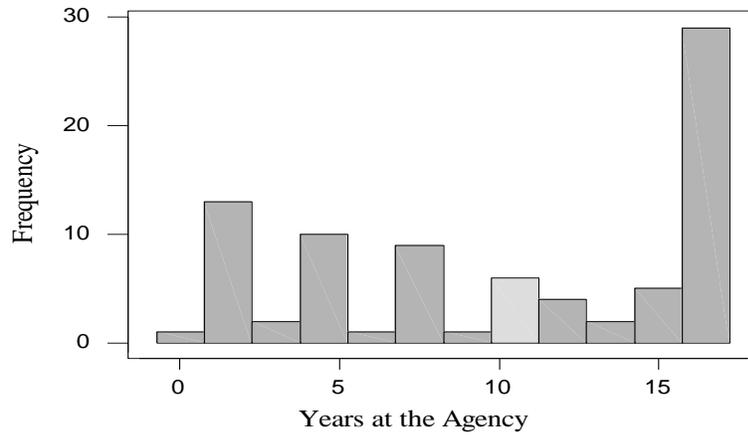


Fig. 4.6 Participants by years at the Agency

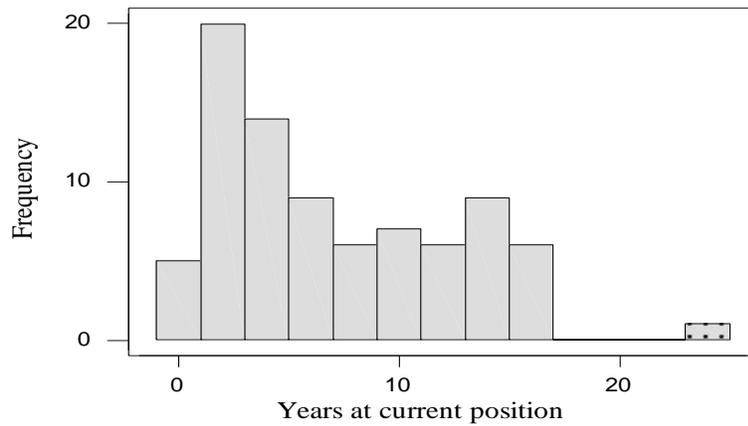


Fig. 4.7 Years at the current position

Table 4.3 Frequency table: Years at the Agency and years at current position.

	Years at			
	Agency		<i>Current position</i>	
	N	%	N	%
Less than 2 years	14	16.87	25	30.12
2 to 5	12	14.46	21	25.30
5 to 10	16	19.28	15	18.07
10 to 15	12	14.46	16	19.28
15 to 20	29	34.94	5	6.02
More than 20 years	0	0.00	1	1.20
All	83	100.00	83	100.00

Table 4.4 Frequency table: Years at the Agency by division

Division	Less than 2 years	2 to 5	5 to 10	10 to 15	10 to 15	15 to 20	All
Admin.	6	3	3	5	5	14	31
Commun.	2	0	5	1	1	0	8
Exec. Of	2	3	0	1	1	2	8
Mktng.	3	4	5	4	4	10	26
Secur.	1	2	3	1	1	3	10
All	14	12	16	12	12	29	83

These tables show that almost 50% of the participants have been at the Agency for 10 or more years, 50% of them have been less than 5 years at the current position, and 25% of them in the same position for less than two years. The average working time of the respondents is 10 years while the average time in the current position is over 6 years. Table 4.7 indicates that employees in Administration show the longest time working at the Agency and the longest time at the same position, while employees at both Communications and Executive Office present the shortest time for both total working time and time at the same position.

Table 4.5 presents with more detail the basic statistics for the population at the Agency. Tenure related variables are rounded to the nearest half. For example, 0-years category includes individuals that have been up to 6 months working at the Agency. In addition, even though the Agency has been in operation for less than 17 years, due to the round up procedure it appears as having being in operations for 17 years. Finally, one respondent affirms that he has been working at the same position for near 25 years, while has been working at the Agency only 17. After further analysis it was clear that the respondent has been working in the same position for the State of Missouri for 25 years.

Table 4.5 also shows the high variability of the responses, as depicted by standard deviations of 4 or more years. It seems that while there are people that have been both working at the Agency and being in the same position for long time, others have at the Agency for few months. This apparently indicates a relatively high turnover among people with less tenure time while a long permanence in the same position among those with longer time at the Agency.

Table 4.5 Basic statistics: Years working and tenure time in years at the state and at the Agency by division

<b>Variable</b>	<b>Division</b>	<b>N</b>	<b>Mean</b>	<b>Median</b>	<b>StDev</b>	<b>Minimum</b>	<b>Maximum</b>
Years at the Agency	Admin.	31	10.81	15.00	6.02	1	16
	Commun.	8	7.25	7.50	4.06	1	13
	Exec. Of	8	7.25	4.50	6.58	0	17
	Mktng.	26	10.77	12.00	.5.49	1	16
	Secur.	10	9.90	9.50	5.59	2	16
	All	83	10.000	10.000	5.74	0	17
Years at current position	Admin.	31	7.48	5.00	5.74	1	16
	Commun.	8	6.00	7.50	4.31	0	10
	Exec. Of	8	4.06	2.50	4.54	0	11
	Mktng.	26	6.65	5.00	4.89	0	15

Finally, the hierarchical level of the participants was measured in terms of the people supervised by the respondent. Several hierarchical levels were defined to facilitate the analysis. As seen on table 4.6 and figure 4.8, the levels range from “none” to “More than 20” employees under supervision. Table 4.6 shows that 60% of the participants do not supervise employees, while 29% have between one and five. It is difficult to define how high the level of the supervisor is because of the different size of the divisions. For example, while Administration has over 50 employees, Communication has less than 15.

Table 4.6 Participants by supervisory level

Level	N	%
<b>1 to 5</b>	24	29
<b>5 to 10</b>	5	7
<b>10 to 15</b>	1	1
<b>15 to 20</b>	1	1
<b>More than 20</b>	1	1
<b>None</b>	50	60
<b>NA</b>	1	1
<b>Totals</b>	83	100

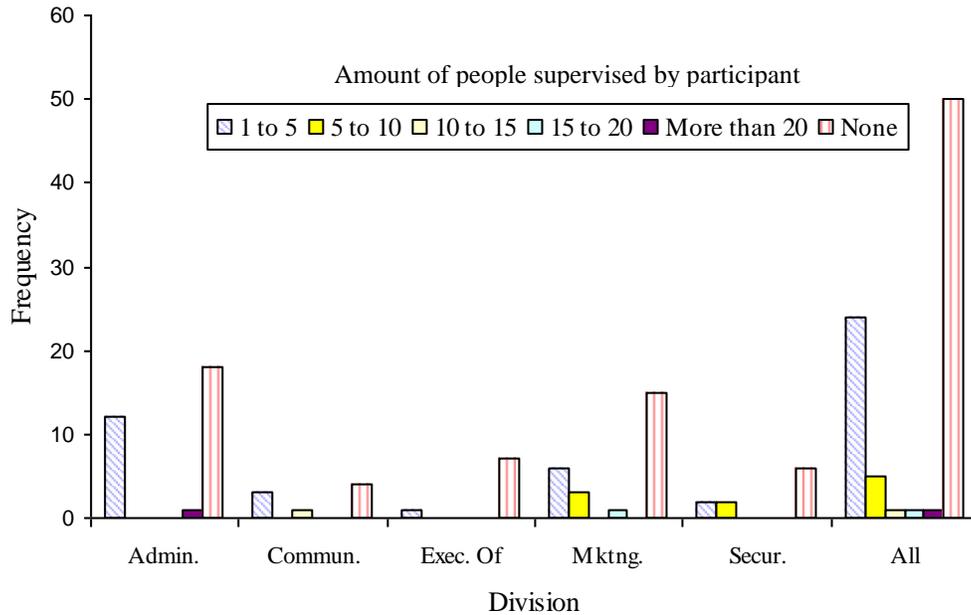


Fig. 4.8 Supervisory level of participants by division

Two other characteristics of the population were assessed with the first section of the questionnaire. These characteristics are more specific and assess the role and stage at which the different respondents participated in a series of change and innovation projects conducted at the Agency since 1994. Figure 4.9 shows that 81 of the 83 respondents

participated in some degree in the different projects either as leaders, steering committee, direct participant, support or other, which included from advising and consulting to temporary clerical personnel, logistics or other non-direct support.

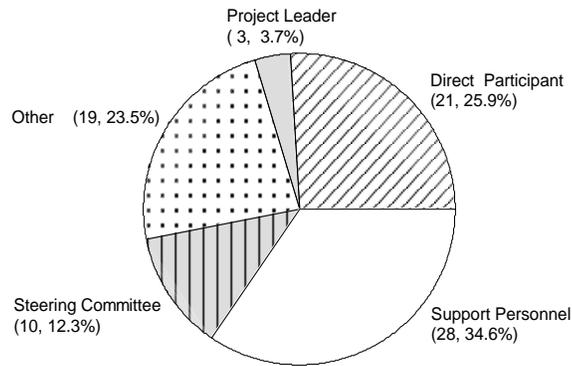


Fig. 4.9 Respondents by role in the different projects

Additionally, as figure 4.10 shows, more than 50% of the respondents participated either on the implementation or execution of the different projects, while the rest were either at the definition or planning stages. Finally, 10% of the respondents considered that they were final users or customers of the different projects. The number of respondents for this section was 103. This indicates that some respondents considered that they participated at more than one stage of the projects.

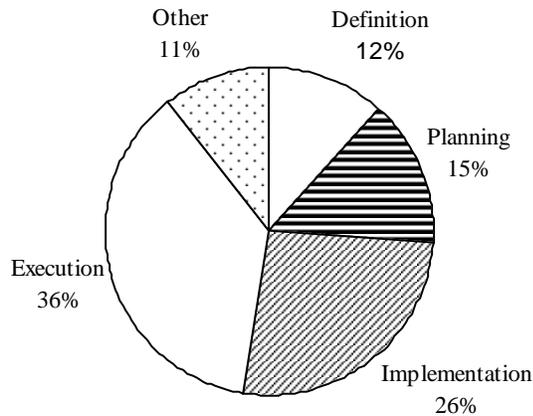


Fig. 4.10 Participants by the stage of the project

In conclusion, despite the fact that the results are aggregates from the different geographical locations, it is possible to see that the sample of respondents covers a wide variety of characteristics of the participants.

Consequently, it is possible to affirm that the sample is a good representation of the Agency and that inferences about expected behaviors and situations could be done for the Agency from this sample. This confirms the external validity of the instrument (Hedrick, et al., 1993)

#### **4.4 Analysis and Verification of the Study Propositions**

This section analyzes the information to corroborate or reject the different propositions that led to this research effort. Before analyzing the different propositions, it was appropriate to verify if the conditions of both transactional and transformational variables had changed from one year to another, and if there were significant differences among the preferred vs. the current conditions for both dimensions.

To verify the statistical significance of the change between years, the mean for both transactional and transformational variables was calculated for the following conditions: “Today vs. A year ago” and “Preferred vs. Today”. A paired t-test was used to verify if the differences between means were significant.

Table 4.7 presents the results of the test for the alternate hypotheses that there is significant positive difference between the means of the assessed level for transformational variables today vs. a year ago. The result is significant; there was a positive improvement in the transformational variables in the current year vs. a year ago. People at the Agency perceived that the extent to which the mission, vision, influence of

external environment and structure are influencing the organization has improved over time.

Table 4.7 Paired t-test for Transformational Variables Today vs. A year ago

<b>Variable</b>	<b>N</b>	<b>Mean</b>	<b>StDev</b>	<b>SE Mean</b>
Transf_t	77	2.7427	0.6327	0.0721
Transf_a	77	2.6528	0.6222	0.0709
Difference	77	0.0899	0.2210	0.0252
95% lower bound for mean difference: 0.0480				
T-Test of mean difference = 0 (vs > 0): T-Value = 3.57 P-Value = 0.000				

Similarly, table 4.8 shows that there is a significant difference between the expected level of transformational variables vs. the perceived level today. That is, even though there was a significant improvement in the perceived levels of transformational variables from a year ago with respect to the current year, people perceive that there is still room for improvement.

Table 4.8 Paired t-test for Transformational Variables Preferred vs. Today

<b>Variable</b>	<b>N</b>	<b>Mean</b>	<b>StDev</b>	<b>SE Mean</b>
Transf_p	73	3.966	1.326	0.155
Transf_t	73	2.770	0.681	0.080
Difference	73	1.196	1.303	0.153
95% lower bound for mean difference: 0.942				
T-Test of mean difference = 0 (vs > 0): T-Value = 7.84 P-Value = 0.000				

Similar results were found after doing the corresponding paired t-test for transactional variables for analogous scenarios. Tables 4.9 and 4.10 show the corresponding paired t-test and the significance of the difference.

Table 4.9 Paired t-test for Transactional Variables Today vs. a year ago

Variables	N	Mean	StDev	SE Mean
Trnst_t	82	2.942	0.681	0.075
Trnst_a	82	2.719	0.917	0.101
Difference	82	0.2238	0.7273	0.0803
95% lower bound for mean difference: 0.0902				
T-Test of mean difference = 0 (vs > 0): T-Value = 2.79 P-Value = 0.003				

Table 4.10 Paired t-test for Transactional Variables Preferred vs. Today

Variables	N	Mean	StDev	SE Mean
Trnst_p	79	3.9257	0.8792	0.0989
Trnst_t	79	2.9514	0.6775	0.0762
Difference	79	0.9743	0.7582	0.0853
95% lower bound for mean difference: 0.8323				
T-Test of mean difference = 0 (vs > 0): T-Value = 11.42 P-Value = 0.000				

The previous results supported the definition of a new variable that measures the total change of both transformational and transactional variables for the scenarios tested. These variables are used for further analysis in the following sections.

**Proposition 1. Radical change motivated by innovation is more difficult to implement than radical change motivated by strategic or environmental reasons.**

To assess the validity of this proposition, it was necessary to compare different aspects corresponding to both the first and second section of the questionnaire. The first aspect to consider is the definition of radical change. Recalling the concepts presented in Chapter 2, radical change is any deliberate change that alters or modifies the core elements of the organization affecting either one or more of its major components or the organization as a whole. As Hall, et al. (1993) mentioned, to define the radicalness of the

change it is necessary to define both the extent and span of the change. The span of the change is defined as the degree to which the change affects one or more elements of the organization. The span of the different projects is assessed with question 12.b.1 for the different projects. This question assesses how the respondents perceive the way change and innovation projects have affected different levels of the organization: specific functions, working unit, several working units, the division or the Agency. The respondent answered the question using a scale going from specific functions (one) to the entire Agency (five).

The extent of change is defined as the degree to which the core elements of the organization have been affected. Question 12.d assesses the extent of change of the different projects. The literature (e.g., Damampour, 1991, Grover, et al., 1995, Guimaraes, 1997, Arora and Kumar, 2000, Amburguey et al., 1991) defines different types of project extents according to their goal or radicalness. These definitions were adapted to the survey to have a measure of the radicalness of the projects. The question asks the participant to answer to which degree the individual projects fall into the following categories: adoption of new working procedures, adoption of new working systems, adoption of new technology, adoption of new functions and responsibilities, and adoption of a new way of conducting business. Each category was assessed independently on a scale of 1 to 5, with 1 being to no extent at all, and 5 to a very great extent.

In addition, question 12.b.2 assesses the perception of the respondent of the goal or radicalness of the process. This question is answered on a scale that ranges from continuous to incremental to radical. Question 12.b.3 assesses the degree of success of

the different projects as perceived by the participants. The assessment scale goes from total failure to total success. Both scales are coded similarly, using values from 1 to 5, 1 being used to code the minimum level and 5 the maximum. Scores used to test the proposition are the average from the different projects and not single values of the individual initiatives.

The perception of the influence of the different environmental and institutional elements over the decision of change is assessed on questions 1.a to 1.f of the second section of the questionnaire. This question individually assesses the influence of: competitors, government, other lotteries, management, employees, players and retailers. For the purpose of this research, it is considered that competitors, players and retailers are environmental elements while government, lotteries, management and employees are institutional elements.

Table 4.11 shows the perception of people about the span, goals and results of the different projects. Near 50% of the respondents saw the different projects as attempting to change more than their local activities, i. e., the projects are cross divisional. In contrast, 34% of the respondents considered the changes to be more as improving the current situation, while 24% considered the projects as radically changing the organization. Finally, 55% of the respondents valued the projects with a certain degree of success, 33% considered them a total success. This indicates that people consider that the different projects have influenced the daily activities of the Agency. It is worth noticing that for all three variables, more than one third of the respondents did not know or could not respond to the corresponding questions.

Table 4.11 Perceptions of span, goals and results of the different projects

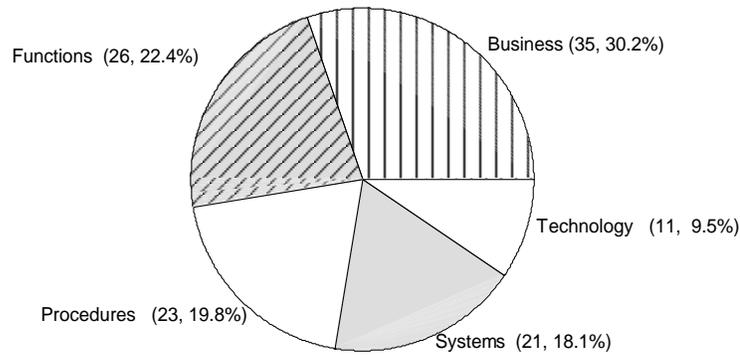
Level of Change			Goal or radicalness			Perceived success		
	N	%		N	%		N	%
My functions	1	1.20	Continuous	28	33.73	Total Failure	7	8.43
My unit	1	1.20	Incremental	8	9.64	Some Success	20	24.10
Several units	11	13.25	Radical	20	24.10	Total Success	27	32.53
My division	23	27.71	NA	27	32.53	NA	29	34.94
The Agency	18	21.69	All	83	100	All	83	100
NA	29	34.94						
All	83	100						

In addition, table 4.12 shows the extent to which the participants perceive the influence of the different environmental and institutional elements over the decision for change. Over 65% of the respondents considered that management was the principal source of change at the Agency, while 60% consider that it is government, which is the main motivator. Additionally, employees and the effect of other lotteries have an equal weight of near 35%, but nearly one third of the respondents considered competitors, players and retailers as the drivers. These answers led to the conclusion that institutional, with more weight on government and management, rather than environmental forces, are the main drivers of change at the Agency.

Figure 4.11 shows the perception of the participants concerning the extent of the different projects. The percentages across the different projects' extents are similar, except for the adoption of new technology which is described as the least significant type of project. It is important to notice that 30% of the respondents considered that the different projects were oriented towards the definition of a new business.

Table 4.12 Perceived extent for different environmental and institutional elements over the decision for change

	Competitors		Government		Other lotteries		Management		Employees		Players		Retailers	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
<b>Not at all</b>	10	12.05	4	4.82	2	2.41	1	1.20	2	2.41	17	20.48	5	6.02
<b>Small</b>	17	20.48	5	6.02	4	4.82	2	2.41	4	4.82	19	22.89	9	10.84
<b>Some</b>	18	21.69	13	15.66	35	42.17	14	16.87	35	42.17	21	25.30	35	42.17
<b>Great</b>	12	14.46	15	18.07	20	24.10	27	32.53	20	24.10	9	10.84	14	16.87
<b>Very great</b>	12	14.46	35	42.17	9	10.84	28	33.73	9	10.84	10	12.05	12	14.46
<b>NA</b>	14	16.87	11	13.25	13	15.66	11	13.25	13	15.66	7	8.43	8	9.64
<b>All</b>	83	100.00	83	100.00	83	100.00	83	100.00	83	100.00	83	100.00	83	100.00



Note: the frequencies add up more than the total of surveys since people answered in more than one category

Fig. 4.11 Global perception of the extent of the projects

Table 4.13 shows the perception of the participants of the success of the different projects based on radicalness. Almost 90% of the respondents considered that projects being classified as continuous improvement had either partial success to total success.

Table 4.13 Perceived success score by perceived success and project goal

Goal \ Success	Total Failure	Some Success	Total Success	NA	All
<b>Continuous</b>	3	12	13	0	28
<b>Mean</b>	1.8333	3.3835	4.1495	--	3.573
<b>Median</b>	2	3.4394	4	--	--
<b>StDev</b>	0.7638	0.2533	0.3526	--	0.798
<b>Incremental</b>	3	3	0	2	8
<b>Mean</b>	1.5833	3.1548	--	--	2.369
<b>Median</b>	1	2.875	--	--	--
<b>StDev</b>	1.0104	0.4846	--	--	1.1149
<b>Radical</b>	1	5	14	0	20
<b>Mean</b>	2	3.2583	4.4452	--	4.0263
<b>Median</b>	2	3.1667	4.4167	--	--
<b>StDev</b>	--	0.2893	0.4082	--	0.7951
<b>NA</b>	0	0	0	27	27
<b>Mean</b>	--	--	--	--	--
<b>Median</b>	--	--	--	--	--
<b>StDev</b>	--	--	--	--	--
<b>All</b>	7	20	27	29	83
<b>Mean</b>	1.75	3.3179	4.3028	--	3.6071

According to table 4.13, almost 43% of the people participating in the study considered projects with an incremental approach – a combination of continuous improvement with radical or punctuated change- to be a complete failure. Despite this tendency, 75% of the people considered that radical –or real change- projects were successful. It is necessary to recall that only 8 people considered the projects to be radical, while 20 or more considered the projects to be either continuous or radical. In addition, 27 respondents – or about one third of the respondents - did not answer the corresponding questions (i. e., N. A.).

Table 4.14 shows the Pearson’s correlation between the goals or radicalness of the projects and the different types of projects. The higher the score on goals or radicalness the more radical the project is. These results indicate that people who saw the projects as adopting a new way of doing business also defined the projects to be radical. Conversely, people who defined the projects as adopting new functions and responsibilities also considered the projects to be continuous improvement. Thus, it is possible to conclude that while people considered the adoption of a new business as radical, adopting new functions and responsibilities was considered more as continuous improvement.

Table 4.14 Correlations between perceived results, goals and type of project

	<b>Results</b>	<b>New Procedures</b>	<b>New Systems</b>	<b>New Technology</b>	<b>New Functions and Responsibilities</b>	<b>New Business</b>
<b>Goals</b>	0.601 0.000	0.381 0.004	0.397 0.002	0.403 0.002	0.284 0.034	0.417 0.001
<b>Results</b>		0.438 0.001	0.474 0.000	0.333 0.333	0.327 0.016	0.401 0.003

Cell Contents: Pearson correlation  
P-Value

Furthermore, people perceive that the relationship between the radicalness and success of a change initiative is positive. Apparently respondents considered that the more radical the change higher the possibility of success. The previous result contradicts what the literature has been exposing. According to the literature, there is a greater failure rate in radical change efforts (e.g., Hammer and Champy, 1993, Walston, et al., 1999). A possible explanation of the results may be in the fact that most of the research conducted in this area includes different sectors but only one type of human element, basically either top level managers or individuals directly involved on the change process (see table 2.2 for a sample of different studies on radical change). In contrast, the present

research reaches different individuals within the organization, with a wider variety of opinions. The results may indicate different perceptions of both the definition of radical and the definition of success. This fact was confirmed by the interviews conducted after the survey was applied. For certain people it is possible to say that a project radically changed the perspectives or operations of the organization, while for others it was simply a new procedure that simplified operations. Additionally, some of the interviewees perceived the projects as being a total failure and others perceived the projects as being successful. This aspect confirms the findings from different studies (e.g., Kennedy 1994, Irani and Rausch, 2000) that considered communication within the organization as a critical factor of success. This supports the importance of defining specific measures to assess innovation and change effects in the organization (Johannessen, et al., 2001). Finally, certain moderating factors (Damanpour, 1991, Bhatt, 2000) such as type of organization, structure and leadership styles can influence the answers.

Table 4.15 shows the perception of people regarding the extent of the different projects and their expected goals. Since only 8 respondents classified the projects as incremental (table 4.13), table 4.15 shows only the total responses for “Some”, “Much” and “Very Much” for projects classified as either “Radical” or “Continuous”, not considering “Little” or “Not at all” for the different projects. As seen, about one third of the respondents either defined the projects as continuous, radical or did not answer the question.

Table 4.15 Frequency table: Project extent by goal

	Project extent									
	New process		New systems		New technology		New functions and responsibilities		New business	
Project goal	N	%	N	%	N	%	N	%	N	%
Continuous	22	37.29	20	35.10	10	22.73	20	35.10	23	38.33
Radical	17	28.81	17	29.80	14	31.82	17	29.80	17	28.34
NA	20	33.90	20	35.10	20	45.45	20	35.10	20	33.33
<b>Total</b>	59	100	57	100	44	100	57	100	60	100

Table 4.16 shows the results of a Two-way ANOVA to verify if there were significant differences among the individual cells defined on table 4.15. No significant differences were found between the groups “Goals” and “Project extent”. These results indicate that the respondents do not have a clear view of how radical the different projects are, which was confirmed by the interviews when respondents answered that there was a lack of communication about the goals, objectives and definition of the different projects.

Table 4. 16 Two-way ANOVA: Project goal by project extent

Source	DF	SS	MS	F	P
Goal	2	34.533	17.267	2.349	0.158
Project extent	4	56.400	14.100	1.918	0.201
Error	8	58.800	7.350		
Total	14	149.733			

A Pearson’s correlation analysis was performed to see if there was a statistically significant correlation between environmental and institutional factors and the different types of projects or span of the projects. Table 4.17 shows the correlation analysis between the perceived effect of the environmental and institutional factors and the extent

of the projects as perceived today by the respondents. Table 4.18 summarizes table 4.17 including only the environmental or institutional force and the projects that are significantly correlated to these factors. As seen, with the exception of government and retailers, all the other factors can be related to certain types of projects. These results lead to the conclusion that, for the Agency, it is important to consider different factors when a specific type of project is going to be initiated in order to improve the likelihood of success. Additionally, it is perceived that employees also have a great impact on any of the projects to be implemented.

In conclusion, the study revealed that despite the fact that the answers do not clearly relate radicalness with the type of projects, there is a clear empirical relationship between effect of environment and type of project and a partial theoretical confirmation that environmental factors lead to radical change while institutional forces lead to continuous change. Consequently, it is possible to affirm that the first proposition of this research is partially supported at the Agency.

**Proposition 2. Environmental and Internal forces will motivate radical change, while Institutional forces will induce innovation.**

To assess the validity of this proposition, it is important to recall the definitions of radical change and innovation. While radical change attempts to drastically modify one or more core elements of the organization, innovation is more oriented toward alteration of daily activities.

Table 4.17 Correlations between extent of projects and perception of environmental and institutional factors as today

Environmental and institutional factors	Extent of the projects				
	New procedures	New systems	New technology	New Functions and Responsibilities	New Business
Competitors	0.224	0.217	0.293	0.344	0.298
	0.100	0.111	0.030	0.010	0.027
Government	0.015	-0.028	0.018	0.097	0.045
	0.912	0.837	0.893	0.471	0.739
Similar agencies	0.311	0.348	0.374	0.261	0.331
	0.021	0.009	0.005	0.055	0.014
Management	0.323	0.216	0.208	0.352	0.325
	0.014	0.106	0.120	0.007	0.014
Employees	0.446	0.471	0.455	0.417	0.433
	0.000	0.000	0.000	0.001	0.001
Players	0.248	0.241	0.213	0.335	0.288
	0.060	0.068	0.109	0.010	0.029
Retailers	0.212	0.199	0.137	0.196	0.197
	0.107	0.130	0.303	0.136	0.136

Cell Contents: Pearson correlation  
P-Value

Table 4.18 Summary of the most significant relationships ( $p \leq 0.05$ )

Change Force	Project type	Radicalness
<b>Environmental</b>		
<ul style="list-style-type: none"> <li>Competitors</li> </ul>	New technology	Radical
	New functions and responsibilities	Radical
<ul style="list-style-type: none"> <li>Similar agencies</li> </ul>	New business	Radical
	New procedures	Continuous
<ul style="list-style-type: none"> <li>Players</li> </ul>	New systems	Continuous
	New technologies	Radical
<ul style="list-style-type: none"> <li>Retailers</li> </ul>	New functions and responsibilities	Radical
	New business	Radical
<b>Institutional</b>		
<ul style="list-style-type: none"> <li>Government</li> <li>Management</li> </ul>	No significant relationships	
	New procedures	Continuous
<ul style="list-style-type: none"> <li>Employees</li> </ul>	New functions and responsibilities	Radical
	New business	Radical
<ul style="list-style-type: none"> <li>Employees</li> </ul>	New procedures	Continuous
	New systems	Continuous
<ul style="list-style-type: none"> <li>Employees</li> </ul>	New technology	Radical
	New functions and responsibilities	Radical
<ul style="list-style-type: none"> <li>Employees</li> </ul>	New business	Radical

Table 4.19 shows a paired t-test performed to verify if there was a significant difference between today's perception of the influence of the environmental and institutional factors over the decision of change and the preferred degree of influence of the same factors. The respondents consider that both competitors and management are already influencing the decision to change and do not need to be altered. However, the influence of government and other lotteries should be reduced, while the effect of employees, players and retailers should increase in the decision of change.

Table 4.19 t-test for perception of change on environmental and institutional elements: Preferred vs. Today

Change on Variable:	N	Mean	StDev	95.0% CI	T	P
Competitors	61	0.180	1.42	( -0.183, 0.544)	0.99	0.325
Government	67	-1.149	2.888	( -1.854, -0.445)	-3.26	0.002
Similar agencies	64	-0.375	0.951	( -0.613, -0.137)	-3.15	0.002
Management	68	-0.118	1.388	( -0.454, 0.218)	-0.70	0.487
Employees	70	1.200	1.258	( 0.900, 1.500)	7.98	0.000
Players	69	0.638	1.098	( 0.374, 0.901)	4.83	0.000
Retailers	70	0.671	1.293	( 0.363, 0.980)	4.34	0.000

The integration of the definitions of radical change and innovation, with the perceived need for change on the different environmental elements shown in table 4.19, and the facts described in the previous section, support the second proposition. Continuous changes are more related to innovation and institutional forces motivate them, while environmental forces motivate radical changes, as depicted in table 4.18.

**Proposition 3. A need for change will induce a need for innovation.**

Recalling the definitions of transformational and transactional variables given in Chapter 2, transformational variables deal with core elements of the organization while

transactional variable deal with operational or peripheral elements. Therefore, these variables are directly related to radical change and innovation.

Following the concepts supported by several authors (Parasuraman et al., 1988, Larsson, et al., 2001) linking the difference between expectations and perceptions with the success or failure of organizational activities and programs, the need of change and innovation can be defined as the difference between the perceived and the expected levels of transformational and transactional variables. According to this definition, the larger and more positive the difference between the preferred and the current situation, the larger the need of change to a preferred situation. This difference will be always greater or equal to zero since the current situation will be at the best equal to the expected or preferred condition (Parasuraman et al., 1988).

To analyze proposition 3, two new variables, “change in transformational variables” and “change in transactional variables” were defined as the difference between the preferred and the current condition. Table 4.20 shows the results of a t-test performed to verify if the difference between the two scenarios is statistically significant. As seen, the means for both variables are greater than zero, indicating that people at the Agency consider that the current level (or extent at which transactional and transformational variables are) can improve.

Table 4.20 t-test for the difference between transformational and transactional variables today and preferred scenarios

<b>Variable</b>	<b>N</b>	<b>Mean</b>	<b>95.0% CI</b>	<b>T</b>	<b>P</b>
ChTrnsf_P_T	73	1.1960	(0.8920, 1.5000)	7.84	0.000
ChTransc_P_T	79	0.9743	(0.8045, 1.1441)	11.42	0.000

In a correlation analysis between both variables, it was found that the Pearson's correlation coefficient between them was 0.418, with significance of  $p = 0.000$ . Figure 4.12 depicts the behavior of change of transactional variables as a function of change in transformational variables, showing a positive correlation between both variables, and so indicating that the need to innovate is a function of the need for radical change, which supports the proposition.

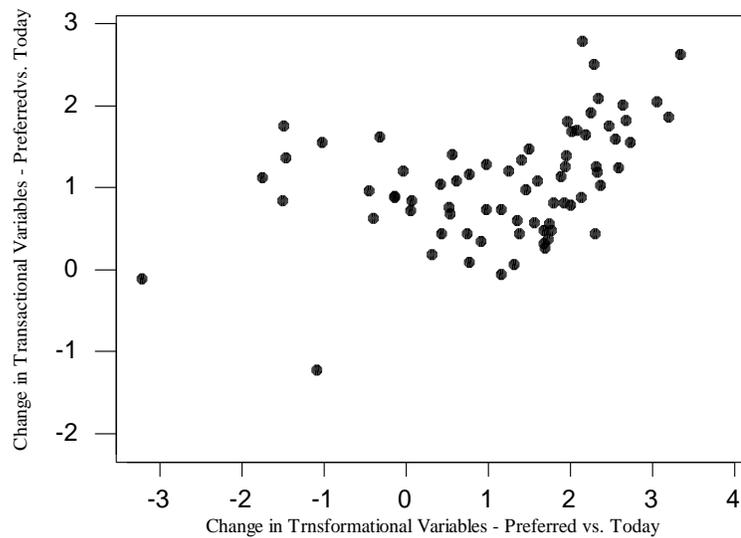


Fig. 4.12 Plot diagram of Change in Transformational vs. Change in Transactional Variables – Today vs. Preferred scenarios

**Proposition 4. Innovation will generate a change in transactional variables.**

To test this proposition a Pearson's correlation between goals or radicalness, type of projects and change in transactional variables was performed. In addition, the

correlation analysis was done using two different scenarios, today vs. a year ago and preferred vs. today.

Table 4.21 Pearson's correlation between change in variables and goals and type of projects

Type of projects	Change in variables: Today vs. A year ago		Change in variables: Preferred vs. Today	
	Transformational	Transactional	Transformational	Transactional
Goal	-0.053	-0.071	-0.1	0.169
	0.703	0.603	0.491	0.217
New process	-0.221	-0.101	-0.25	-0.068
	0.085	0.433	0.061	0.598
New systems	-0.214	-0.046	-0.264	-0.077
	0.095	0.72	0.047	0.551
New technology	-0.198	-0.03	-0.281	-0.057
	0.124	0.818	0.035	0.663
New functions	-0.272	-0.034	-0.206	-0.16
	0.032	0.789	0.124	0.213
New business	-0.206	-0.023	-0.286	-0.152
	0.108	0.858	0.031	0.239

Cell Contents: Pearson correlation  
P-Value

The results on table 4.21 show that there are not significant correlations between the variables. Despite these results, the interviews conducted indicate that people believe that successful projects that involved small changes or changes in day-to-day activities involved improvement in aspects like procedures, motivation and work climate. In conclusion, although the data do not support the proposition, the interviews did. This partially supports this proposition.

**Proposition 5. Radical change will generate change in transformational variables.**

Similarly to proposition 4, this proposition was tested using Pearson's correlations between change in transformational variables, goals and type of projects. Table 4.21

shows that the data does not support the proposition. Again, from the interviews people perceived that the projects with more significance to the Agency improved conditions such as strategies, organizational culture and, at least in part, leadership. The proposition is partially supported.

**Proposition 6. Transformational variables will change in a positive direction even if the change initiative fails.**

Tables 4.7 and 4.11 are used to test this proposition. Table 4.7 shows that people consider that there have been improvements in transactional variables from a year ago to today. In addition, table 4.11 shows that more than 50% of the people perceive that the projects have been successfully implemented. Moreover, the interviews confirmed the data from the surveys. It is not possible to relate change on transformational variables with failure, concluding that proposition 6 is not supported.

**Proposition 7. The success of a radical change initiative will be negatively influenced by the differences between employees' perceptions and expectations of the critical success variables influencing the change process.**

To verify this proposition a correlation analysis was performed between the hierarchical level measured in terms of the amount of people supervised and results, change in transformational and transactional variables as shown in table 22.

Table 4.22 Pearson's correlation between amount of people supervised and other variables

	<b>Amount of people supervised</b>
<b>Results</b>	-0.043 0.760
<b>Change in transformational variables: Today vs. a Year ago</b>	0.136 0.253
<b>Change in transactional variables: Today vs. a Year ago</b>	-0.003 0.981

Due to the amount of missing data –30 out of 83 data points - and the high collinearity among the variables the use of ANOVA to determine significant difference in results by hierarchical level and change in variables was eliminated. Regression among the same variables was performed –as shown in table 4.23.

Table 4.23 Regression model: Results vs. hierarchical level and change in transformational and transactional variables

<b>Predictor</b>	<b>Coef</b>	<b>SE Coef</b>	<b>T</b>	<b>P</b>
<i>Constant</i>	3.5912	0.1648	21.79	0.000
<b>Supervisory level</b>	-0.00511	0.0202	-0.25	0.802
<b>Change in transformational variables</b>	0.6125	0.7022	0.87	0.387

Both tables indicate no significant relationship between the variables in the proposition. As depicted in table 4.21 there are no significant correlations between the different variables. Furthermore, the regression model indicates lack of significance of the different terms of the model. The previous results indicate that there is no relationship

between the difference between the expectation and perception of the variables at the Agency with the success of the projects. This lack of relationship contradicts what the literature has exposed (e.g., Larsson, 2001). The large gap between perception and expectation of the current situation should influence the results of a change or administrative program.

From the interviews, an element that was found critical was communication. People considered the lack of communication critical when implementing programs. Employees believe that they do not have the opportunities or the empowerment to present ideas or contribute to any change initiative. There is a gap between what they expect to do and what they have to do. This gap affects the ability of the Agency to efficiently accomplish the different programs attempted. Thus, despite the data not having the statistical significance to support the proposition, the interviews help to partially support it.

**Proposition 8. The success of a radical change initiative will be negatively influenced by the difference between employees' perceptions and management expectations of the different critical success variables influencing the change process.**

From tables 4.22 and 4.23 it is possible to conclude the same as in proposition 7. The interviews again gave information that partially supported the proposition despite no significant differences among hierarchical levels, success, and change in variables.

**Proposition 9. Groups of people with similar perceptions and expectations of the critical success variables will positively influence radical change.**

Radical change is measured as the difference between transformational variables under today’s conditions and those a year ago. Table 4.24 shows the results for ANOVA for different groups of individuals at the Agency. Additionally, figure 4.13 shows various scattered plots for change in transformational variables for different groups.

Table 4.24 ANOVA of change in transformational variables –Today vs. Year ago- by different demographic characteristics.

Source	DF	Seq SS	Adj SS	Adj MS	F	P
Division	4	3.3629	2.1041	0.5260	0.63	0.643
Location	4	8.5119	3.9641	0.9910	1.19	0.334
Supervis	5	1.6431	1.4629	0.2926	0.35	0.877
Years at the Agency	4	2.9915	7.6438	1.9109	2.30	0.081
Years at current	5	5.8796	5.8796	1.1759	1.41	0.247
Error	31	25.7767	25.7767	0.8315		
Total	53	48.1657				

From table 4.24, with the exception of Years at Agency, there are no significant differences in the perceived change of these variables within individuals grouped by different demographic characteristics. Moreover, figure 4.13 does not show any clear pattern or correlation between change in transformational variables and different groups of people, even for category Years at Agency despite the relatively high significance depicted on table 4.24. Subsequent analysis eliminating points that outlay for the different groups confirmed the same trend. Finally, the interviews did not give any additional

information that could help in supporting or rejecting the proposition. Therefore, it is possible to conclude that proposition 9 is not supported by the data.

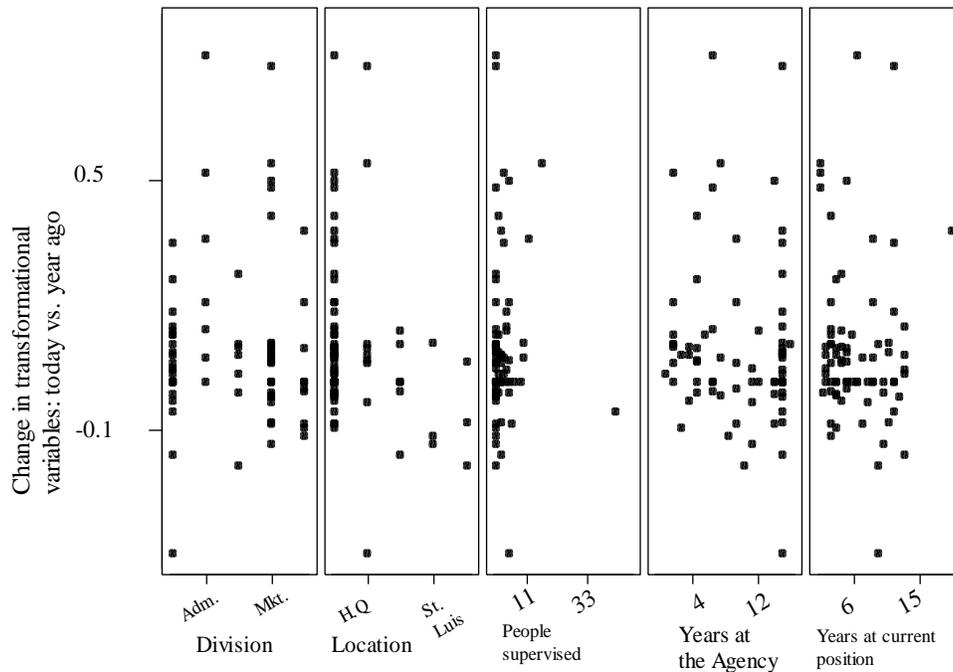


Figure 4.13 Scattered plots of change in transformational variables vs. different demographic characteristics

**Proposition 10. Length of employees’ tenure at the Agency time will positively influence the adoption of transactional change.**

This proposition asserts that the longer an individual has been working at the same place and/or at the same position, the greater the response to transactional change. Table 4.25 shows the correlation between change in transformational and transactional variables and both, the time at the Agency and the time in current position. Additionally, figure 4.14 shows scattered plots with similar information. The facts provided in table

4.25 and figure 4.14 demonstrate that there is not a significant relationship between the length of time people have been working at the Agency or at the current position and the change in transactional variables.

Table 4.25 Pearson's correlations between change in transformational and transactional variables and tenure time

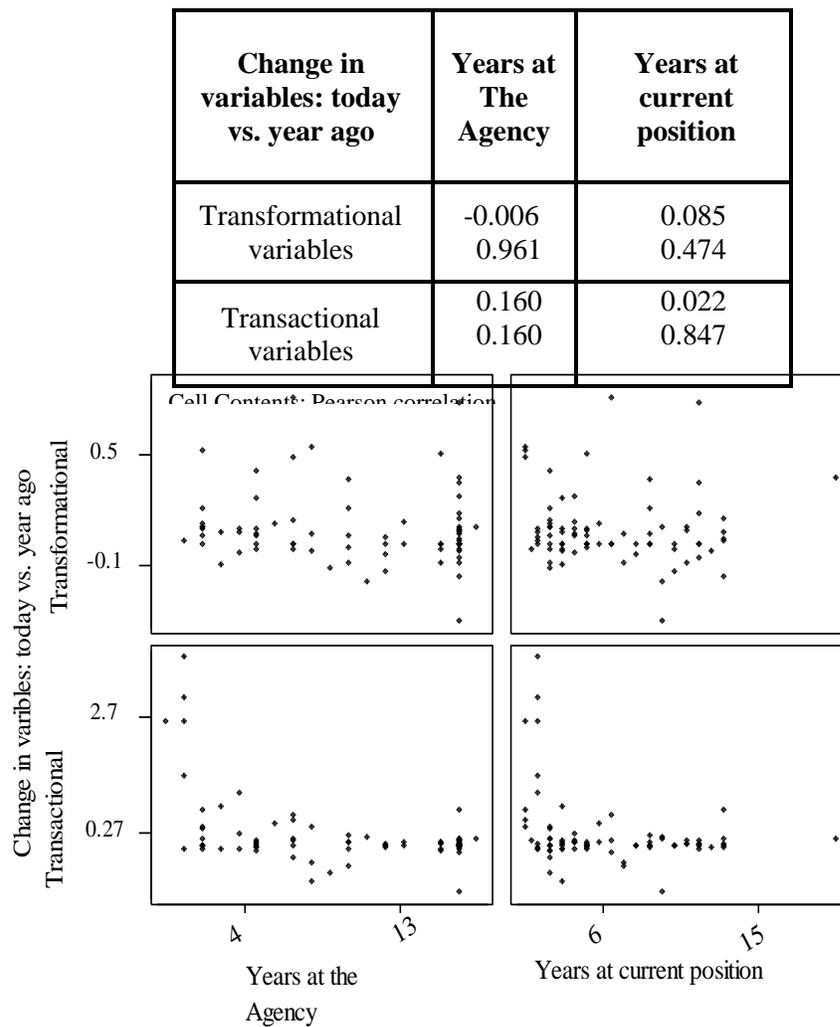


Figure 4.14 Scattered plots: change in transactional and transformational variables vs. tenure time

On the other hand, the interviews presented a different scenario. Interviewees agreed that the longer the time individuals have been working at the Agency, the more willing they would be to adopt innovations that would simplify their daily work. Consequently the proposition is partially supported.

**Proposition 11. Length of employees' tenure at the Agency time will negatively influence the adoption of transformational change.**

This proposition asserts that people's resistance to accepting transformational change is positively correlated to tenure time. Table 4.25 and figure 4.14 do not show statistical significance to support this proposition. However, the interviews lead to the conclusion that the participants consider that one of the main obstacles for radical change at the Agency is precisely the length of time the majority of the employees have been working at the Agency and at the same position. Interviewees consider that employees with long tenure do not accept radical change due to the comfortable environment that routine and tradition have created. In addition, they consider that there is a lack of motivation for employees with less time at the Agency to present ideas for change since "older" employees tend to reject them due to a lack of confidence in long term results and the influence that these results may have on their positions. Finally, interviewees believe that some employees feel that newcomers and their ideas may threaten both their job and authority. These results lead to a partial support of proposition eleven.

#### **4.5 Discussion**

The objective of this chapter was to present the results of the case study conducted at the Agency and to use the information gathered to assess the validity of the different

propositions that lead to this research. The first step was to determine the internal consistency and reliability of the instrument used in the survey. Information from previous strategic plans and organizational change projects, and interviews with top executives helped with preparation of the instrument.

CFA partially confirmed the internal consistency of the instrument. The apparent lack of consistency among the different variables and the two dimensions used in the study –transformational and transactional variables- is due mainly to the high collinearity existing between the variables. This phenomenon indicates cyclic relationships between variables that affect the results of CFA. In addition, although the response rate is relatively high – 47%- for this type of study, the absolute number of elements in the respondents is low – 83- thus limiting the results of the CFA.

The internal reliability of the instrument was tested using the Cronbach's alpha estimate. The estimate for the instrument was 0.8673 which allows the presumption of reliability since is greater than 0.7 (Nunnally and Berstein, 1994). To guarantee the validity of the instrument, a series of interviews were carried out to triangulate the responses. Semi-structured interviews with 21 different members of the organization, including top executives, middle managers and employees from different divisions and different tenure times were conducted. The information from the interviews was used for validation purposes and to help in the analysis of the different propositions.

Table 4.26 summarizes the results for the different propositions. As seen, with the exception of propositions 6 and 9 all the remaining propositions were either fully or partially supported. For the propositions partially supported the information from the interviews helped to assess the partial validity of the corresponding proposition.

Table 4.26 Summary table: Propositions validation

<b>Proposition 1</b>		
Radical change motivated by innovation is more difficult to implement than radical change motivated by strategic or environmental reasons	:	Partially supported
<b>Proposition 2</b>		
Environmental and Internal forces will motivate radical change, while Institutional forces will induce innovation.	:	Supported
<b>Proposition 3</b>		
A need for change will induce a need for innovation.	:	Supported
<b>Proposition 4</b>		
Innovation will generate a change in transactional variables	:	Partially supported
<b>Proposition 5</b>		
Radical change will generate change in transformational variables.	:	Partially supported
<b>Proposition 6</b>		
Transformational variables will change in a positive direction even if the change initiative fails.	:	Not supported
<b>Proposition 7</b>		
The success of a radical change initiative will be negatively influenced by the differences between employees' perceptions and expectations of the critical success variables influencing the change process	:	Partially supported
<b>Proposition 8</b>		
The success of a radical change initiative will be negatively influenced by the difference between employees' perceptions and management expectations of the different critical success variables influencing the change process.	:	Partially supported
<b>Proposition 9</b>		
Groups of people with similar perceptions and expectations of the critical success variables will positively influence radical change.	:	Not supported

The support of propositions 1, 2 and 3 implies that to implement change it is important to define if the change comes as a result of innovation or otherwise, and to develop the need for change before implementing innovations that would profoundly impact the way the organization conducts its daily business. For example, the Agency implemented several projects called the 4C's that resulted in a new way of performing business. As a consequence of these changes new technology, procedures and structures were adopted. Since the projects were implemented as part of a strategic initiative, employees were ready to accept the new adoptions and to comply with the new ways of conducting business. On the other hand, a BPR project, in which the researcher was involved, recommended implementation approaches to doing business and structural changes that required a more profound change than simply adopting new procedures. The recommendations implied merging processes executed in different divisions. The merger of processes and activities generated a power struggle between divisions that resulted in the partial adoption of the recommendations. Divisions were willing to adopt the new procedures only without losing control of some of the activities and employees involved in them. Hence, the adoption of new procedures required changes in core variables such as culture, leadership and organizational structure. This change was not previously induced and the recommendations did not have the expected impact.

Propositions 4 and 5 are more related to the procedural component of implementing change. It is important to initially determine the objectives and goals of the change project to pay special attention to the variables that are directly influenced by and at the same time directly influence change. Following the previous example, if the

BPR team had paid more attention to the transformational variables, in addition to the transactional variables, it would have had a better impact on the implementation of the recommendations.

The lack of support of proposition 6 gives the opportunity of studying with more detail two aspects involved in this proposition: the definition of what is really new and the definition of success for individuals in the organization. First, the effect of knowing not only what is new, but also for whom it is new, is extremely important. Despite the fact that top management must inspire change, it is necessary that people across the organization be conscious of the need of change, the span of the process and its depth. It can be argued that individuals in the organization will participate in the change process in the degree they believe change will affect them. Employees will respond differently depending on their understanding and perceptions of the change initiative. As different authors affirm (e.g., Ettlie, 2000, Dent and Goldberg 1999) people resist what they do not know or understand. If the change process is promoted from the top, but with the explicit participation of all the levels within the organization, the likelihood of success should increase. Second, it is important to define measures to assess change. The experience with this research indicates that for the Agency success is measured in terms of sales and revenues. If change is an integrated process throughout the organization, it is necessary to develop performance measures that assess the different dimensions of change (Barnett and Carroll, 1995, Kaplan and Norton, 1992): human, financial, customer satisfaction, and others.

Despite the lack of support of proposition 9, propositions 7, 8 and 9 are directly related with the concepts of perceptions and expectations and the coordination that should

exists between management's objectives and people's actions. From the experience at the Agency, *management should do what they say and employees should say what they do*. Employees see management improvising on actions and decisions even when top executives affirm that planning and goals have been taken into account. On the other hand, management considers that individuals do not do enough to achieve the proposed goals of change. In addition, people see that their ideas and suggestions are not taken into account because they believe that management does not have the confidence in their work and performance to accept ideas that might fail because people "do not know enough" to improve operations. Communication and assessing the individual's performance turn out to be critical elements for integration and coordination of activities, goals and execution.

Supporting propositions 10 and 11 implies that tenure time affects change. From the experiences obtained at the Agency it is possible to affirm that interviewees in general agree that employees with longer time in the position have a better understanding of the intricacies of their job and can be a great source of ideas and opinions. However, they view time length as an impediment to accomplishing change. Employees with long tenure time feel that routine becomes comfortable and do not want to profoundly modify their activities and responsibilities. The case study also indicates that individuals with longer time might feel threatened by new comers with new ideas, knowledge and willingness to learn.

The next chapter of this document analyzes with more detail the above aspects, from an integrated approach. The implications of the findings of this study can be examined from three points of views: the theorist, the researcher and the practitioner. For

the theorist it confirms that organizational change is not a discrete activity isolated from other aspects of the organization. Explaining organizational change implies integrating different dimensions of change -environmental, operational, human- that interact simultaneously during any organizational change process. These dimensions define a set of variables or elements that are also interrelated at different levels so change becomes an intricate network of activities and behaviors triggered by other interrelated networks of activities and behaviors.

For the researcher, it becomes necessary to develop and use research methodologies, tools and techniques that allow the analysis of these interrelated network without losing the perspective of the dynamic effect of change. The use of case studies is very effective since they allow the study of the change process from a holistic perspective. It is necessary to conduct meta-studies that allow the integration of commonalities of the change processes among different industries, sectors, cultures and temporal settings. It is necessary to detect the differences of change processes to improve the development of new theories, concepts and procedures. Studies have to be done across the organization, considering not only the perceptions of specific hierarchical levels but the perceptions and expectations of a representative sample of the organization.

The integration of multiple disciplines becomes important. Organizational and behavioral sciences help to set the contextual considerations and to structure the theories and necessary knowledge to understand organizational change. Systems and engineering approaches help in structuring and modeling the complex causal relationships that govern organizational change. Information technology aids in unifying all these concepts and the

myriad of data gathered in the different case studies in a more usable tool that explains what to change and how to perform it.

Finally, for the practitioner, it is important to consider the effect that the differences between perceptions and expectations of the change process have over the overall organization and the different change initiatives attempted. It is necessary to recognize that change is a function of both top management compromise and everyone's involvement. Communication, coordination and empowerment are basic elements that have to be considered when implementing any organizational change initiative. Finally, it is necessary to have the methods and tools to effectively and efficiently measure change so it is possible to define the success or failure of any initiative at any point of time. Feedback and control are not only aspects to consider at the end of any project but during every stage of it: definition, development and implementation.

The next chapter introduces the Influence Model for Organizational Change – IMOC- as a conceptual model that will unite the different views mentioned before and will serve as the framework for more detailed and profound research that, hopefully, will develop a more specific tool to model organizational change.

## **Chapter 5**

### **The Influence Model for Organizational Change**

#### **5.1 Introduction**

The goal of this research effort is to present a conceptual model that delineates the relationships involved in an organizational change process. The model represents the dynamic links and causalities presented in a complex social system such as an organization. This endeavor suggests the use of concepts and tools of systems dynamics and enterprise modeling to describe and model the different activities, relationships and effects produced during organizational change.

#### **5.2 Representation of Change**

Change implies a multidimensional approach that includes human, operational and environmental dimensions. Figure 5.1 depicts the intricate and complex relationships that are involved in multidimensional change. Human dimensions affect those variables directly related to the human component within the organization. Organizational change might be triggered by human considerations such as the need to develop programs to improve or enhance climate or culture within the organization.

Change directly affects the human component of the organization. Since complexity in the organization arises due to the intimate and complicated relationships existing between individuals within the organization, any change that disrupts these

relationships affects the quasi-equilibrium that exists within the different entities that form the organization.

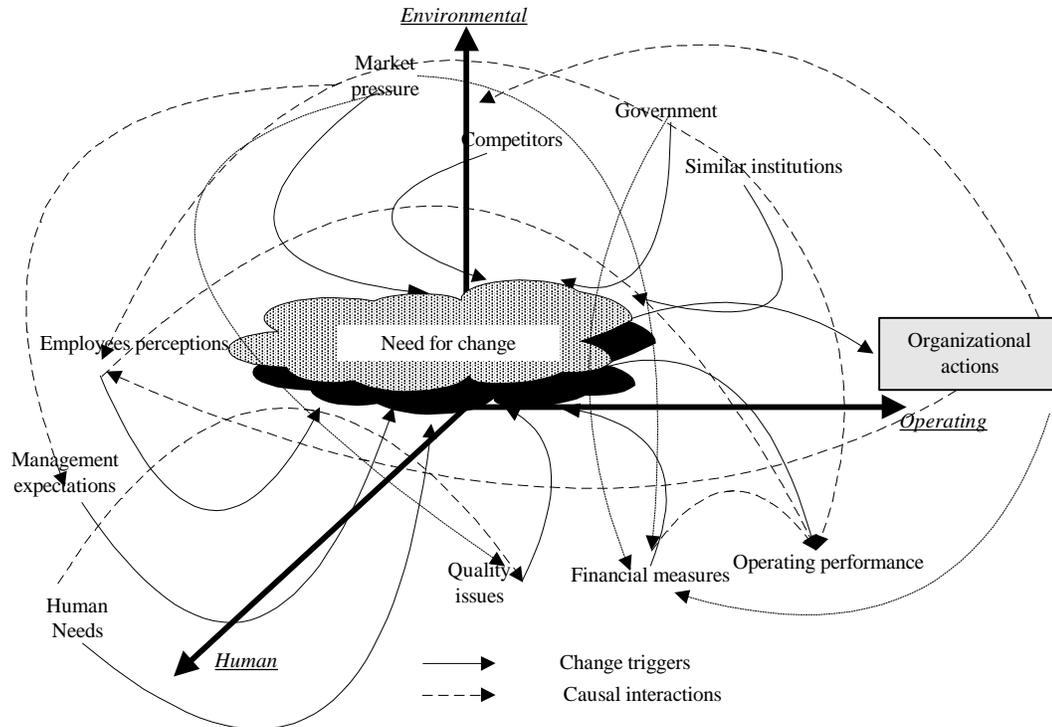


Fig. 5.1 Change as a multidimensional process

Change occurs when a punctuated event alters the current situation in the institution (Sastry, 1997, Kelly and Amburgey ,1991). Since these punctuated events are multiple, the human systems that compose the organization are constantly fluctuating (Mitleton-Kelly, 2000), and these fluctuations influence and are influenced by the change process.

Change also affects the normal procedures executed within the firm. Radical change implies the review and redesign of main business processes to attain better ways to perform business (e.g., Hammer and Champy, 1993). Appropriate performance measures would reflect a need for change in processes or reveal whether the change

resulted in improved business processes. Variables that are related to the way the organization performs business are part of the operational dimension of change. Again, a cyclical relationship exists between the need for change due to poor performance and the expected performance after change has been implemented.

Finally, the effect of the environment on change is also critical. Forces due to market, consumer expectations, government regulations or the effect of similar organizations on the firm are influential for change; however, lack of understanding of the purpose of change can have a negative influence over the environment. Environmental components such as consumer, market or society might, at some point, be negatively affected by the proposed change. They might reject the new approaches to conduct business since they may not be ready for what the organization is proposing or they do not understand the purposes and objectives of the change and have a different view of the final results.

An example of the multidimensional effect of change can be the implementation of a new ERP system in an organization. ERP requires a complete redefinition and change of organizational structures and procedures. Internal customers (or users) will be affected since procedures and processes will be different and will require a different approach in execution and performance evaluation. Furthermore, cross-functional processes resulting from the new definition of activities might be contrary to the traditional hierarchical structure of the organization, requiring a new approach to defining authority, functions integration and communication. Finally, customers and suppliers might not be ready to conduct business under the new rules and approaches, and might

need to change to adjust to the new requirements (e.g., Holland and Light, 1999, Umble and Umble, 2002, Crowe, et al., 2002, Powell. 2002).

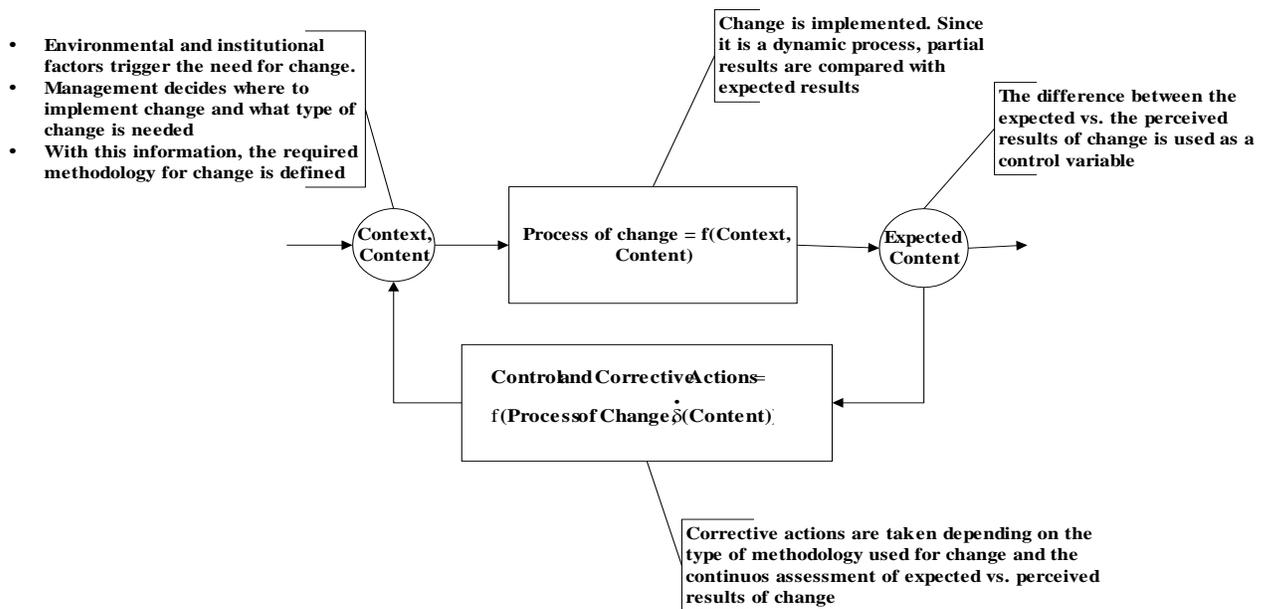
Table 5.1 shows a summary of the different critical variables, as defined in the literature, that affect and are affected by organizational change and how they can be classified depending on the different dimensions. As seen, the multidimensional effect of change is supported by the literature. Burke and Litwin (1992) defined transactional and transformational variables included in the dimensions, such as environment, culture, mission, procedures and performance measures. It becomes important to link the targeted variables to the environmental and internal conditions existing in the organization before initiating change. It is possible then to affirm that these links define the actions that have to be taken to perform the required change or the process of change.

Figure 5.2 describes organizational change using a closed-loop system's perspective (Ogata, 1992). Let  $\Theta_i(s)$  be the set of contextual conditions and strategic goals of change at a certain initial point of time. This set  $s$  is defined by measures that assess different aspects of the contextual conditions such as operational and financial measures, customer and supplier perceptions and organizational and internal measures.

Let  $\Theta_o(s)$  be the expected final results of the change initiative after a certain amount of time. The expected results are given in terms of new goals in the different areas that need to be improved or changed. These goals need to be assessed in some way to determine whether the results of the initiative are successful.

Table 5.1 Critical success variables classified by dimension of change

<b>Author</b>	<b>Human</b>	<b>Operational</b>	<b>Environmental</b>
Hammer and Champy, (1993)	Leadership, commitment, human implications	Integration, goals and objectives, process definitions, resources,	
Hall, et al. (1993)	Values and skills, leadership	Roles and responsibilities, span, extend, performance measures, structure, IT	
Talwar (1993)		Extent	
Kennedy (1994)	Teamwork, human implications		
Cooper and Markus (1995)	Empowerment, commitment		
Obeng and Crainer (1994)	Participating people, stakeholders		
Lee (1995)	Culture, leadership, commitment	Work environment, management systems, formalization	
Fagan (1995)	Creativity	Innovative environment	
Clemons (1995)	Political risks	Functional risks	
Kotter (1995)	Culture, teamwork	Strategic planning, communication, methodologies, time horizon	
Mauil, et al. (1995)	Human factors	Strategic planning, definition of purpose, performance measures, processes definition, IT	
Love and Gunasekaran (1997)	Skills, motivation, culture, teamwork	IT, structure, communication, integration	
Narasimhan and Joyaram (1998)	Involvement and commitment	Process management, performance measures, process ownership, methodology, data availability, systems view	Identification of customers' requirements and types
Guimaraes (1997)	Education and training, empowerment, culture, commitment	Efficient use of resources, project plan and management, integrated approach, IT, process definition, communication and integration	Customer orientation, outside consultant
Beugre (1998)	Individual justice	Procedural justice	
Jaffe and Scott (1998)	Leadership, commitment	Structure, system's approach, performance measures, flexibility, methodology	
McGarry and Beckman (1999)	Empowerment, motivation, culture, commitment	Product, expertise, process definition, IT, communication	Market, customers, environment
Wu (2000)			Customer orientation
Arora and Kumar (2000)	Human factors	Planning, data, IT, project definition and management, performance measures	Customer orientation
Thong, et al., (2000)	Empowerment, participation of neutral staff	Planning, methodology, communication	Public opinion, political and social influences



**Fig. 5.2 Closed-loop representation of the**

Using closed-loop system's properties (Ogata, 1992) it is possible to show that:

$$\Theta_o(t) = \frac{\text{Process of change}}{f(\text{Process of change, Control and Corrective actions})} \Theta_i(t_0) \quad (5.1)$$

Hence, expression 5.1 indicates that the results of the change process are a function of the process of change, the corrective actions taken during the change initiative and the initial conditions of the systems. Clearly, it is necessary to develop a complete diagnosis of the initial conditions of the organization before attempting to change, and to track the partial results of the change with the appropriate measures. The results of this diagnosis will indicate not only the set of initial conditions of the system, but will also define the expected results and the processes needed to generate change. Monitoring the results of the different change projects will provide the necessary information to perform

control and corrective actions proactively. Thus, in addition to defining the content and process of change, the definitions of the initial contextual conditions and monitoring systems are necessary, but not sufficient, elements for change. The experience at the Agency indicated that a previous knowledge of the overall situation and readiness for change would have been important to increase the acceptance of the different changes recommended by the BPR group hired to redesign different processes in the firm. This previous knowledge would have been the initial point on which to base the different proposals and, in addition, would have been an indicator of which areas were the more critical for accepting change and innovation at the Agency.

However, the process of change is not a discrete and easily predictable activity. Although previous experiences create a possible pattern of decisions in the change context (Amin, et al., 2000), individuals accept change as a conscious choice after a learning and adaptation process (Mitleton-Kelly, 2000). Thus, decisions and actions concerning organizational change can be defined as a process where decisions are based on past experiences and past results.

Figure 5.3 depicts the stochastic behavior of change. Using the three-stage model developed by Lewin (1951), it is possible to argue that each stage of the model defines a series of actions and results.

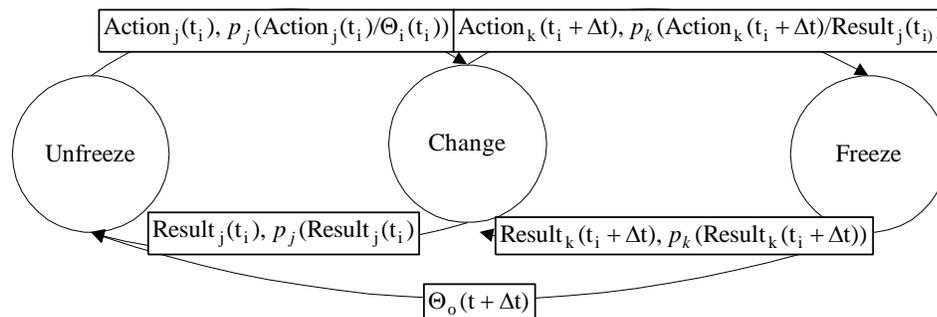


Fig.5.3 Organizational change as a stochastic process

After the initial conditions described by  $\Theta_i(s)$  define the necessary goals and actions to be executed, the physical process of change initiates. Lewin's model describes this step as unfreezing or creating motivation and readiness to change (Burke, 1992). Actions resulting from this stage will be a function of the initial conditions. Thus, Action  $j$  will be taken at time  $t_i$  with a probability  $p$ , which is a function of previous conditions that similar actions have been taken for similar initial conditions. Specific Action  $j$  to unfreeze will generate Result  $j$  with a probability  $p_j$  as a function also of previous patterns of resulting actions. Result  $j$  will either provoke a redefinition of the unfreeze action or result in a set of changing actions, called here Action  $k$ . The probability of taking Action  $k$  is a function of previous experiences after having Result  $j$ . Finally, changing actions will result either in a final condition  $\Theta_o(s)$  or in a feedback process consisting of corrective actions. Inputs corresponding to the different critical success factors motivate the adoption of change initiatives tending to redesign specific projects. These projects, coordinated and applying different techniques, will be part of a more complete change process ending in a total organizational transformation.

To understand organizational change, two characteristics that describe the process of change have to be considered: the disequilibria induced by change and the interdependence of actions and results. Since change is induced through a disruption in the organizational routine, equilibrium is broken. Adjusting to the new situation becomes critical because of the necessity of diminishing the disrupting effects of change in the long term; however the actions taken to implement change are a function of the immediate results of previous actions. Thus, independence between the different stages in

figure 5.3 cannot be assumed, making it difficult to model change using traditional stochastic approaches.

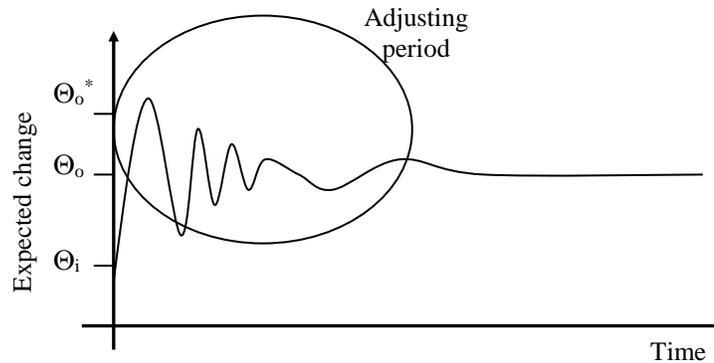


Fig. 5.4 Critical elements in organizational change

Sterman (2000) affirms that policy resistant organisms behave as damped systems. This behavior is shown in figure 5.4. There is a transition or adjusting period during which new policies are adopted or, in the case of organizational change, change is implemented. The objective of the change process is to minimize the difference between the desired and the resulting change behaviors. In figure 5.4  $\Theta_0$  represents the resulting changes after the initiative has been implemented and  $\Theta_0^*$  represents the set of desired conditions and behaviors expected after the change initiative has been implemented. The objective of the change process is to minimize the difference  $\Theta_0^* - \Theta_0$ .

The control and corrective actions serve as feedback for the actions taken to accomplish change. It can be argued that these actions produce instability during the change period. The instability generates an adjusting period that, as seen in figure 5.4, can be described as the disequilibria induced by radical change within the organization. The response of the system would be of adjusting and evolving towards the new behavior. However, this adjusting period can be seen as an erratic and chaotic period that, if not foreseen and planned, can be frustrating to the organization (Burke, 1992).

When managing change it is important to minimize both the time and effect of the adjusting period. At the same time, change management should aim for optimizing the expected results of the change process. These activities need to be performed continuously during the life of the projects and then as a routine activity in the organization.

The experiences at the Agency indicate that despite constant management monitoring of different variables, the primary performance measures used to assess the results of a project are sales and revenue. Data from other aspects such as customer perception and personnel analysis is not efficiently used to assess the level of success of the different initiatives. Communication between divisions has been a major difficulty during the implementation of different initiatives causing not only a high level of redundancy of the information, but the lack of integration needed to implement and follow up the projects.

### **5.3 Characteristics of the Influence Model For Organizational Change**

Since organizational change is a complex set of competing processes that integrate different elements of the organization, it is important to develop a model that not only includes the elements that are involved in the change processes, but that integrates the dynamic behavior of change, the context in which organizational change is developed and the pertaining measures of organizational change (Zayas-Castro, et al., 2002).

Such a task needs the help of several tools that have been developed and oriented to model organizations and their behavior. As Vernadat (1996) mentioned, any modeling

methodology is characterized by the definition or purpose of the model, the aspects to be covered by the model and the detailing levels of the model. As a consequence, it is possible to posit that modeling methodologies oriented towards the modeling of manufacturing or business process are useful to model organizational change.

First, critical systems thinking helps to describe problems in terms of social systems. Jackson (2001) defined critical systems thinking as an approach to analyze and solve complex societal problems through a combination of concepts derived from social theories and systems thinking. Complexity arises from the interrelationships of elements within a system and between the system and its environment. It provides a framework to see how intricate the interrelationships and interconnectivity between individuals, ideas, technology and behaviors are, and the environment that surrounds the organization (Mitleton-Kelly, 2000). Systems theory outlines the need of a holistic view of the organization including the most important relationships and feedbacks that are present across it (e.g. Barnett and Carroll, 1995, Ackerman, et al. 1999, Gharajedaghi, 1999, Wu, et al., 2000, Sterman, 2001).

Second, the concepts of enterprise modeling help to develop the different levels of explanation that IMOC proposed in this research. Radical change affects the traditional relationships of the different elements of the organization. At the same time it brings the organization to a condition of disequilibria, which requires the organization to seek different alternatives and strive for survival (Mitleton-Kelly, 2000). IMOC integrates the functional, structural and dynamic views of the organization, which permits the complete representation of the intricacies of organizational change process considering the functional and behavioral elements embedded in the enterprise. These three views can be

analyzed in terms of both a physical system that includes the variables that are dynamically related, and a control system that models the decisions and information needed to control and operate the physical system. DeTombe's (2001) Compram methodology to solve complex societal problems will be used as a guideline to model organizational change from the three different views proposed in enterprise modeling. The semantic model presents a global view of the physical system that defines the different actions involved in the decision of initiating a change project from a functional level. The causal model includes a series of sub models that present a more detailed view of the different relationships and feedbacks involved in the decisions of initiating change. These sub models are presented using a structural approach that describes with more detail the information and decisions needed to generate the change. The representation of the dynamic model is conceptual with the use of several sub models detailing the causalities described in the previous layer.

Finally, system dynamics models the different relationships, feedbacks and causalities that are present in a complex system. System dynamics models are suited to present social systems without the limitation of traditional mathematical models (Klabber, 2000). Conceptually the different layers of IMOC use the methodologies developed by Forrester (1961) and explained by Sterman (2000) among others to present the dynamicity and causality that characterize complex systems, rather than more concrete, organizational change. The model goes from a general or global view to a more detailed view, linking the different levels in order to show that organizational change is not an isolated process but a set of coordinated and integrated activities and competing processes all oriented towards the same objective.

Social theories and change models provide the theoretical background of the proposed Influence Model for Organizational Change. The literature review presented in previous chapters described different concepts and theories that form the basis for organizational change. Two lines of thought are used as a theoretical framework for the proposed model. The Structural Inertia Theory developed by Tushman and Romanelli (in Sastry, 1997) and the inertia model for organizational change presented by Kelly and Amburgey (1991), provide the theoretical support to propose that radical change is a punctuated action that overcomes organizational inertia and that resistance to change appears when core elements of the organization are disturbed. Secondly, the Burke and Litwin (1992) conceptual model provides the concepts of transformational and transactional change and the relationship between transactional and transformational variables with the outcomes of change. In addition, systems thinking responds to the need for viewing the organization, and the different activities, decisions and results as a complex combination of relationships and causalities in the context of a social environment.

IMOC dynamically links the context and processes of organizational change with the organizational outcomes during and after the change initiatives have been conducted. The Organizational Model for Organizational Change is characterized by the following elements:

- **Dynamic System:** The model represents a dynamic system that is constantly changing over time. This change is multidimensional and occurs simultaneously in the human, operational and environmental dimensions of the organization. Customers, society and employees are affected by change (Powell, 2002) and they are

active elements in the multidimensional boundaries of change. The model uses causal loop diagrams to show the constant feedbacks existing among the different variables and elements involved in the different change processes that are present at any moment in an organization. Feedback and control are part of a dynamic system and strategy integral to any change initiative (Barnett and Carroll, 1995, Ackerman, et al. 1999, Larsen and Lomi, 1999, Winch, 1999, Sterman, 2001). These feedbacks correct any factor whose level is less than the appropriate (Burke and Litwin, 1992, Barnett and Carroll, 1995, Ackerman, et al., 1999). It is necessary to acquire both qualitative and quantitative data to assess the changing process and to discover new opportunities for improvement and learning.

- **External Forces:** External forces motivate organizational change (Porter, 1998, McAdam and Mitchell, 1998, Barnett and Carroll, 1995, Amburgey, et al., 1993, Ettlie and Reza, 1992, Burke and Litwin, 1992) and are inputs for the radical change effort (Barnett and Carroll, 1995). External Factors are: institutional environment, market volatility, competition, technology (Barnett and Carroll, 1995), external environment (Burke and Litwin, 1992), other similar organizations going through change, and organizations getting too similar (Bloodgood, et al.2000), among others.
- **Internal forces:** Internal factors also motivate organizational change (Ackerman, et al., 1999, McAdam and Mitchell, 1998,GSA, 1996, Barnett and Carroll, 1995, Amburgey, et al., 1993, Ettlie and Reza, 1992, Burke and Litwin, 1992), and can be considered as inputs for the continuous transformation efforts (Barnett and Carroll, 1995). Burke and Litwin (1992) define mission and strategy, leadership, and culture as transformational factors that affect change at the organizational level. In addition

they define organizational structure, management practices, climate, systems, task requirements and individual skills, individual needs and values and motivation as the transactional factors that are based on the current climate of work and are directed to modify or change specific activities or processes.

- Outcomes: Outcomes measure the content of the change, that is, what actually changed in the organization (Barnett and Carroll, 1995). It is necessary to have tools to measure the process of change and its results (Barnett and Carroll, 1995). A performance system must integrate all the areas of the organization and capture the interdependence between processes. Literature about performance measures defines 5 dimensions: financial performance, operational performance, human resources, customer satisfaction and innovation and change. Performance measures must link both transactional (processing) issues and transformational issues (Waggoner, et al. 1999, Burke and Litwin, 1992, Kaplan and Norton, 1992) with the outcomes of the changing processes (Ackerman, et al. 1999).
- Internal processes: Hall, et al. (1993) propose that in order to be successful a radical change initiative has to consider both the breadth and depth of the projects. The breadth is concerned with how broadly the processes have to be redesigned in order to improve performance across the entire business unit. Depth is related to the degree to which the core of the organization is affected. Hall (1993) defined core elements as roles and responsibilities, measurements and incentives, organizational structure, information technology, shared values and skills. Core elements are those structures that are embedded in the organization's culture and routines and that are elements that, subject to change, increase the probability of failure in the organization as stated

by the structural inertia model (Barnett and Carroll, 1995, Amburgey, et al., 1993, Kelly and Amburgey, 1991).

This new model is a different approach to change, in that it attempts to explain how change can be implemented successfully instead of describing what to do in order to achieve change. The model presumes that a diagnosis of the organization has been done and that the elements necessary to guarantee a successful transition have been taken into consideration. Diagnosis is not a unique tool and it needs to be used in conjunction with other tools so that it is possible to define not only what is necessary, but also how to do it (Armenakis and Bedeian, 1999).

#### **5.4 The Semantic Model: The Global View of the Model**

The first level of the Influence Model for Organizational Change models the global physical view of the change process. It presents organizational change as a set of different change initiatives that are managed through different methodologies, but all coordinated towards the same purpose, which is a revised business. The changing effort will be limited by both internal and external factors and will be constantly monitored by a set of performance measures that will serve not only as indicators of the resulting change, but also will serve as feedback in the continuous changing process. Organizational characteristics limit the change process to the organization, and environmental factors would shape the change process depending on the motivational forces that generate the need for change. These performance measures must be able to present a holistic view of the organization, integrating multifunctional process and their interrelationships and at

the same time continuously monitoring the levels of the different critical factors affecting the change effort.

Figure 5.5 shows a causal loop representation of the first level IMOC considering the different dimensions involved during the change process. In addition, table 5.2 defines the different variables depicted in the model.

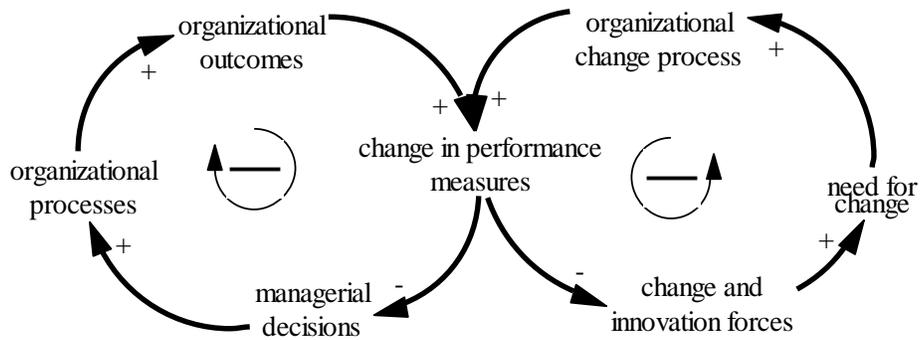


Fig. 5.5 The Influence Model for Organizational Change. A causal loop representation of the global physical view.

From figure 5.5 it is possible to express the different causal relationships implied in the first level of IMOC:

$$\text{Change in performance measures} = f(\text{organizational change processes}) + f(\text{organizational outcomes}) \quad (5.2)$$

$$\text{Organizational change processes} = f(\text{need for change}) \quad (5.3)$$

$$\text{Need for change} = f(\text{Change and innovation forces}) \quad (5.4)$$

$$\text{Change and innovation forces} = - f(\text{change in performance measures}) \quad (5.5)$$

$$\text{Organizational outcomes} = f(\text{organizational processes}) \quad (5.6)$$

$$\text{Organizational processes} = f(\text{managerial decisions}) \quad (5.7)$$

$$\text{Managerial decisions} = - f(\text{change in performance measures}) \quad (5.8)$$

Table 5.2 Variables definition: The semantic model

Variable	Definition and Key Elements
Organizational outcomes	They are the results from the different activities executed by the organization. Organizational outcomes can be seen in terms of products and/or services offered, internal processes and other activities that the organization executes in order maintain business.
Change in performance measures	It is the change over time of the performance measures used to assess the productivity of the organization. Depending on the type of measure a positive change may indicate an improvement in the results compared from previous period. On the other hand a negative change may indicate also an improvement in the actions that generate results. As an example a positive change on sales and a negative change on costs, both indicate an improvement in results.
Managerial decisions	They are the set of decisions taking by management as a response to the detected performance measures. The decisions trigger actions tending to modify, improve or maintain the current performance.
Organizational Processes	They are the processes and actions routinely executed by the organization as part of its activities. Among them are activities that involve customer's supply chain, provider's supply chain, internal supply chain and managerial processes.
Organizational change process	They are the processes tending to achieve organizational change. Among them are organizational restructuring, organizational redesign, process modification, process redesign using continuous, incremental or radical change processes.
Need for Change	It is the existing perception among the members of the organization that change is needed in some way. It is due to poor performance, lack of effectiveness, lack of consistency among others.
Change and innovation forces	They are the forces that pressure and motivate change. They can be external and internal forces, and can be defined as coming from customers, market, similar institutions, government, employees and management, among others.

As seen in figure 5.5, change and innovation forces, both internal and external, trigger the need for change (expression 5.4). This need for change generates strategic and tactical change processes (expression 5.3). The greater the need for change the greater the

impact on the change processes defined by the organization. Success in change generates changes in performance measures (expression 5.2). If change improves the execution of the activities of the organization, a positive change in performance measures would be noticed. Conversely, if the change initiative fails, it is possible to argue that decremental performance may be obtained. Thus, a negative effect on the corresponding performance measures will appear.

Furthermore, organizational outcomes have a positive feedback on performance measures (expression 5.2). Recalling the definition of a positive feedback, it occurs when an increment or reduction of the cause generates an increment or reduction in the effects. If organizational outcomes change, the corresponding performance measures should show the change. As a consequence of the feedback, managerial decisions are made accordingly either to improve a decreasing performance or to keep current performance levels. Performance measures have a negative feedback on management decisions concerning change (expression 5.8). Thus, good performance may decrease management's desire to take new actions since the organization feels comfortable with the results. Decisions from management will influence organizational processes since they decide actions, policies and activities (expression 5.7). If managerial decisions diminish because of good organizational performance, an effect in the same direction will affect organizational processes, which, in turn will have a direct effect on outcomes (expression 5.4).

Since it is important to develop appropriate performance measures to track the partial results of any change initiative, it is important to understand the different elements that influence performance measures as a variable in the change process. Figure 5.6

shows a cause tree<sup>2</sup>, showing the variables that have a direct influence on a dependent variable. In this case the need for change, organizational processes, outcomes and change processes directly influence performance measures.

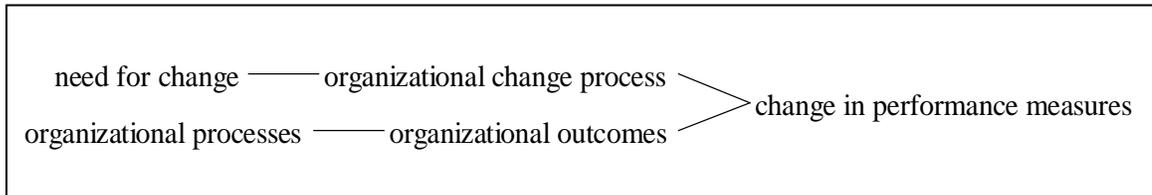


Fig. 5.6 Causal relationships for change in performance measures

Two important aspects of measurement are depicted in figure 5.6: measures of objectives and goals and measures for assessing performance and operations. It has been found that organizations have inconsistencies between the measures used for setting objectives and goals and the measures used to evaluate organizational performance from a more traditional approach, such as financial measures (Crandall, 2002). To successfully implement change it is necessary not only to develop the appropriate performance measures according to the organization and its characteristics, but also it is necessary to use them. Measures need to be local so that they can be applied to different layers of the organization, but in addition, they need to be related globally with the performance of the organization (Crandall, 2002). At the Agency, for example, sales and revenues are the main goals of the organization. It is necessary to develop measures that map the operational results to the main goals and to define key indicators that can explicitly explain variations in sales and revenue, as well as other indicators that indirectly offer information, to understand the behavior of the key performance variables. The use of

<sup>2</sup> For more information on this and other operational concepts on System Dynamics, please refer to the Vensim<sup>®</sup> PLE User's guide.



Change and innovation forces motivate and press for change creating a need for it. The need for change is translated into a change initiative classified either as radical change or innovation.

Table 5.3 Variables definition: The causal model

<b>Variable</b>	<b>Definition and Key Elements</b>
Radical Change	A deliberate attempt to modify the entire organization, or one if its mayor components
Innovation	Adoption of technologies, administrative systems or procedures that will modify everyday activities
Transformational Variables	Variables concerned with core areas of the organization and their alterations are likely caused by interactions with environmental forces. Change in transformational variables would require an entire new behavior from the organization. The transformational variables are external environment, mission and strategies, leadership and organizational culture.
Transactional Variables	Variables related to those elements that define the procedures and systems that execute the day-to-day transactions within the organization and between the organization and its environment. The primary ways of alterations of transactional variables are via short-term relationships and internal forces. They are structure, management practices, systems climate, tasks requirement, individual needs and values, motivation and performance measures.
Change Outcomes	They are the expected results of any change initiative. The expected outcomes can be improved. Outcomes can be improving customer services, shorter cycle times, better quality of services and products, improved organizational responsiveness, costs optimization and new products and services, among others.

The model proposes that while environmental and internal forces are more likely to motivate organizational change, institutional forces would tend to motivate specific innovations within the organization. According to the model, once the need for change has been identified, the need for innovation is created. During the case study and for the purpose of this study, forces such as competitors, other agencies, players and retailers were classified as environmental, while government, management and employees were

defined as institutional. Internal forces are a combination of institutional forces that can push the organization to strategic actions. In the case of the Agency, participants in the study considered that management and government have triggered the adoption of new procedures and actions that have been applied in other agencies as a reaction to specific situations. These actions are taken without strategically linking them with what the environment (market, customers, etc.) needs. New games, promotions and internal procedures that have been adopted are considered total or partial failures because of the apparent lack of consistency between goals and objectives and current policies and decisions. In the end, the adoption of new systems results in different ways of performing the same tasks, without really introducing innovation to the business. This fact was confirmed in chapter 4. It was shown that there was not significant difference among the perceptions of the extent of the different projects. The same proportion of respondents perceived changes as ranging from new processes to new business, which indicates that there is not a clear definition of the goals and purposes of the different projects.

A plan for implementing change has to determine whether radical or incremental change is needed. Radical changes involve changes of transformational variables that will, as part of the process of change, generate transactional changes. Finally, the results of the change and innovation process will be shown in the performance of the organization. As an example, the Agency planned for more than a year the introduction of a new product that was rejected by the state legislature at some point. Because of specific economic situations, the product had to be developed and implemented in a short period of time. The product required a new approach from the Agency since it implied the use of innovative technologies. The previous strategic and tactical development of

the product smoothed its introduction and implementation, with excellent results in sales and attractiveness.

Change can generate a need for innovation. It is proposed that innovation, without real change, will influence transactional variables in the organization, resulting in changes in daily routine and operational performance. In certain cases the adoption of a new system or procedure implies a more profound change in the organization, so once an attempt to adopt an innovation has been carried out, it is necessary to create detailed strategies to induce transformational change while the transactional change is attempted. The model proposes that inertia allows the organization to continue operating with the new adoption, even without implementing the necessary radical change. However, after a short time the organization will show diminishing performance.

The following situation from the case study exemplifies the behaviors explained before. As part of the recommendations of a BPR team the Agency developed a new process for recruiting and licensing new retailers. A new group formed by individuals of different divisions executed the new activities. Initially, the group performed well, streamlining the licensing process, reducing the amount of steps and forms needed. The new process won the Missouri governor's award for productivity in 2000 and was considered by retailers a success. Internally, however, the new group generated a power struggle between divisions and responsibilities since the necessary cultural changes were not induced. In conclusion, two years after the group was created there is uncertainty about its survival, group members have low motivation and their work is being considered of low priority for the Agency.

Figure 5.8 depicts the causes for change in transformational and transactional variables. The IMOC proposes that transformational variables change both from the need for innovation and because of radical change.

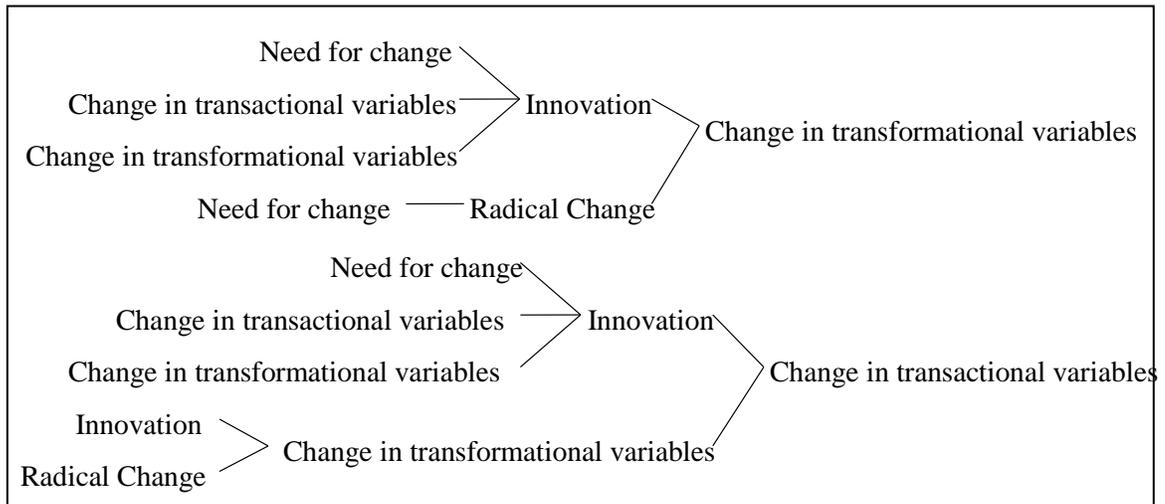


Fig. 5.8 Cause trees: Change in transformational and transactional variables

Additionally, change in transactional variables is directly related to the need for innovation and the change in transformational variables. These relationships can be expressed as follows:

$$\text{Change in transformational variables} = f(\text{Innovation}) + f(\text{Radical Change}) \quad (5.9)$$

$$\text{Change in transactional variables} = f(\text{Innovation}) + f(\text{Change in transformational variables}) \quad (5.10)$$

Expression 5.9 shows the direct effect innovation and radical change have on core variables in the organization. Expression 5.10 shows that change in transformational variables is also influential on change in transactional variables. This cyclic relationship is only one example of the complexity of change and the problematic tasks involved in modeling it. The previous example illustrates this fact. The creation of the new group resulted in the modification of certain procedures that used to be performed by different

divisions. The adoption of these new procedures required at the same time profound change in the way the different divisions viewed functions, responsibilities and power.

Several sub models are derived from this view of IMOC. These sub models are defined connecting the different propositions tested in Chapter Four. The sub models in IMOC link variables that are present in both the semantic model presented in the previous section, and variables defined in the global control view depicted in figure 5.7. Furthermore, the sub models include additional elements common to system dynamics models such as stocks and flows to better explain the relationships and propositions.

Figure 5.9 depicts the causal dynamic relationships proposed in proposition 1 of the research effort: **Radical change motivated by innovation is more difficult to implement than radical change motivated by strategic or environmental reasons.**

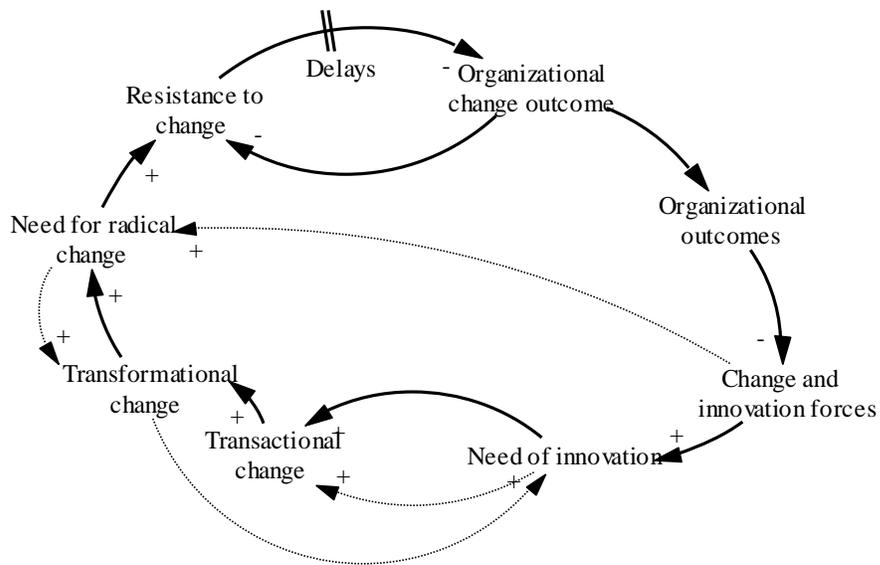


Fig. 5.9 Causal relationships for proposition 1

Dark lines indicate the possible actions and causalities defined by this proposition. Organizational outcomes should induce change. If this change induces innovation, then a transactional change of some sort may be necessary. Furthermore, this transactional change may induce a more profound change that could trigger a need for a more radical change. In this case the adoption of the initiative may lead to negative results, which will generate resistance to change due to the negative perception of the past experience. This resistance will delay possible change actions and affect the expected results. The expected results of the change initiative will affect organizational outcomes, which then influence the forces of change.

The variable resistance to change was introduced in this stage of the model due to the responses of the participants in the case study. The majority of the interviewees agreed that the effect of previous experiences affected their attitude toward participating in new change initiatives. Their experiences indicated that most of the projects were generated as a reaction to specific situations and were developed and implemented without the appropriate communication. Individuals did not have the knowledge or the ability to adapt to the new systems and situations.

Dotted lines indicate a different course of action. A need for change must first be analyzed from a transformational perspective before attempting the adoption of an innovation. If the innovation is needed without a required transformational change, then the process will follow the needed transactional adjustments. But if a radical change is needed it is necessary to develop the required structures to achieve change before attempting the adoption of the innovation. The diagram suggests that this process induces a positive causal relationship on organizational outcomes, which will reduce

resistance to change, accelerating the process of change and increasing the likelihood of success for the change process.

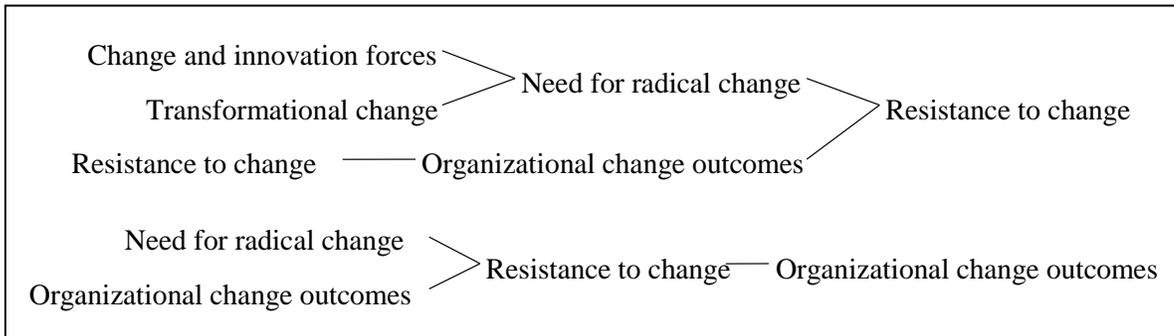


Fig. 5.10 Cause tree for resistance to change

Figure 5.10 shows the effect of different variables on resistance to change, and on the outcomes of the organizational change process. As shown, previous experiences directly influence resistance to change. This resistance then influences the expected outcomes of the change process. This supports that fact that it is necessary to constantly monitor the outcomes of the change process to immediately analyze and implement the possible actions to correct it, as depicted in figures 5.2 and 5.4. The anticipated result of the change process can be expressed as:

$$\text{Organizational change outcome} = f(\text{Resistance to change}) \quad (5.11)$$

Replacing Resistance to change by an expression that includes other relevant variables can modify expression 5.11. This new expression can be stated as:

$$\text{Organizational change outcome}_t = f(\text{Change and innovation forces}_t, \text{Transformational change}_t, \text{Organizational change outcomes}_{t-1}) \quad (5.12)$$

Expression 5.11 shows the time dependence of the process of change. Outcomes of the change process are directly influenced by previous results. Recalling from expression 5.1 that  $\Theta_o(t)$  denotes the anticipated final results of the change effort and

$\Theta_I(t_0)$  expresses the set of initial conditions at a certain point of time, it is possible to combine both expression 5.1 and 5.11 such that:

$$\Theta_o(t) = f(\Theta_I(t_0), \text{Change and innovation forces}_t, \text{Transformational change}_t, \text{Process of change}_t, \text{Control and corrective actions}_t) \quad (5.12)$$

Expression 5.12 indicates that the anticipated or expected results of a change process are a function of elements such as current and previous results, the process of change being used to implement the change initiative, the control and corrective actions taken to minimize the adjusting effects of change, the extent to which transformational change has been accomplished and the motivation forces that triggered the change initiative. Experiences at the Agency corroborate this relationship. Interviewees in the case study indicated that among the different factors necessary to successfully implement change are a diagnosis of the organization, efficient feedback mechanisms, planning and definition of the change process, and communications during and after the implementation process. Furthermore, as seen in chapter 4, respondents of the survey considered that employees' perceptions are an important mechanism to trigger change and that their participation is essential to successfully develop organizational change. Thus, factors defined in expression 5.12 are essential components for change effort.

Proposition 2 of the research effort states that **environmental and internal forces will motivate radical change while institutional forces will motivate innovation**. As an extension of this, proposition 3 asserts that **a need for change will induce a need for innovation**. Moreover, proposition 4, **innovation will generate a change in transactional variables**, is also a result of proposition 2. Figure 5.11 depicts the relationships derived from the interconnectivity of these propositions. The need for

change grows as the pressure of change increases due to innovation and change forces. These forces are the result of existing influences from the environment, internal forces and decisions concerning the need to be similar to either competing or akin organizations.

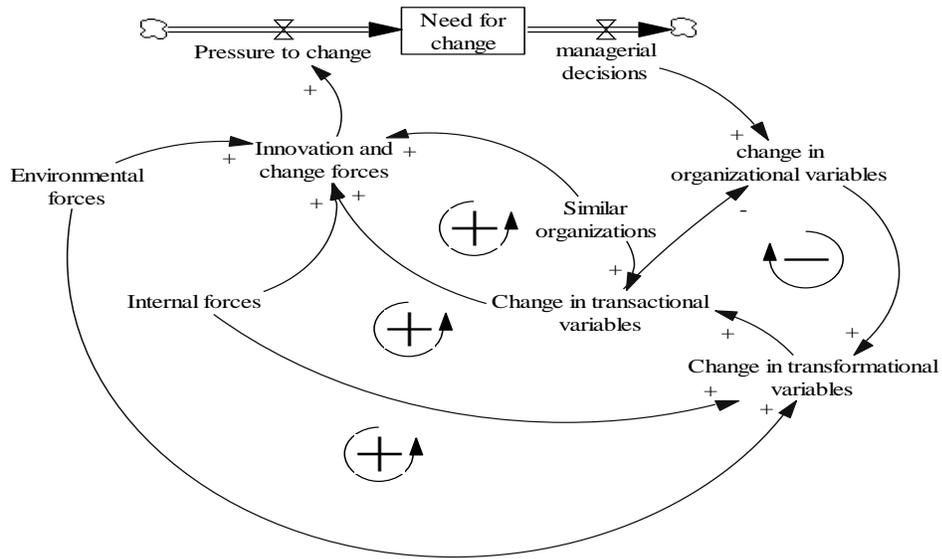


Fig. 5.11 Causal relationships for propositions 2, 3 and 4

The need for change is reduced by managerial decisions concerning change. These decisions affect both transformational and transactional variables that at the same time affect innovation and change forces. Furthermore, similar organizations generate the urgency of adopting innovations to accelerate the goals of becoming similar to other institutions. The adoption of innovations without a planned change will motivate changes in transformational variables that will negatively influence the adoption of the innovation, adversely affecting the innovation and change forces.

Figure 5.12 shows that institutional, internal or environmental forces are not limited to defining the forces that trigger innovation and change. Alterations in procedures and routine activities influence change.

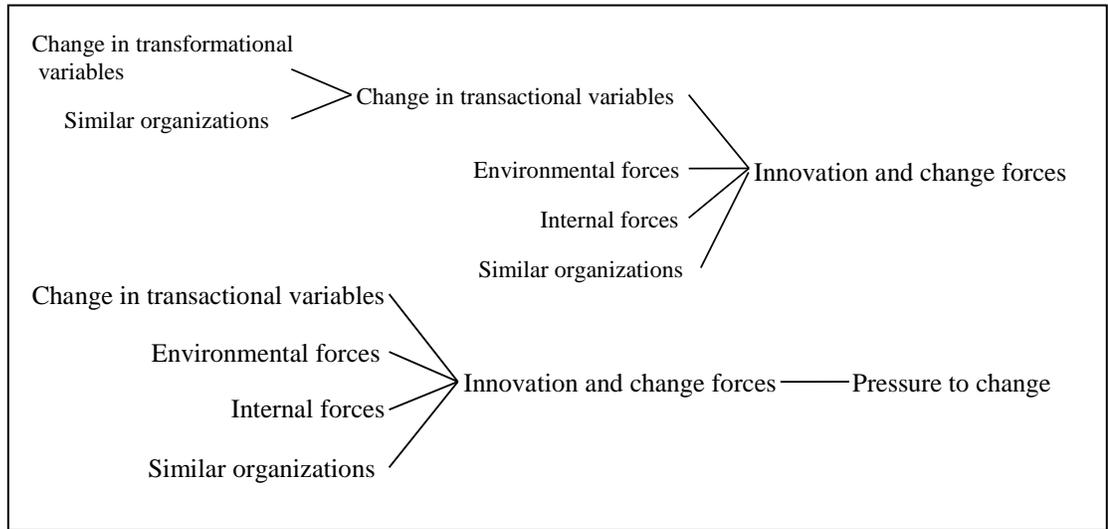


Fig. 5.12 Cause tree for innovation and change forces

According to the figure, the adoption of an innovation that requires changes in procedures and routines could provoke the need for a more radical change. In addition, the influence of similar organizations in the adoption of an innovation could again, require a more profound change to make the innovation successful. As an example, the Agency adopts games and projects that have been successfully adopted by similar agencies in other states. The Agency attempts to adopt these projects after a study of the experiences in other agencies but without analyzing the effects of these adoptions on the Agency and on the retailers and players. So far most of the adoptions have resulted in some success. However several games adopted in the past have been discarded because of the lack of attractiveness for the public. Finally, according to the interviewees most of the adoptions tend to be related to daily activities or games and not more profound adoptions that will have effects over the way the organization conducts business as a state agency.

Propositions 5 and 6 are also related. Proposition 5 asserts that **radical change will generate change in transformational variables**. In addition, proposition 6 expands



The case study helps to clarify these relationships. Despite the fact that from the recommendations made by the BPR team only one was originally implemented, and that currently this initiative is being endangered due to the lack of change in transformational variables that would have made possible the adoption of cross-functional processes, currently the Agency is implementing some of the other recommendations using multidivisional teams to plan, develop and implement the necessary changes and activities that would finalize the different projects being attempted.

Propositions 7, 8 and 9 are important to accomplish a change initiative. Proposition 7 posits that **the success of a radical change initiative will be negatively influenced by the differences between employees' perceptions and expectations of the critical success variables influencing the change process.** In addition proposition 8 hypothesizes that **the success of a radical change initiative will be negatively influenced by the difference between employees' perceptions and management expectations of the different critical success variables influencing the change process.** Finally, proposition 9 establishes that **groups of people with similar perceptions and expectations of the critical success variables will positively influence radical change.** Figure 5.14 shows the complex causalities resulting from the previous propositions.

Both expectations and perceptions of change directly affect the perception of need for change from both management and employees. If there is a difference between employees and management perceptions and expectations, this difference will negatively affect the results of a change initiative since both perceive the necessity for change in a different manner.

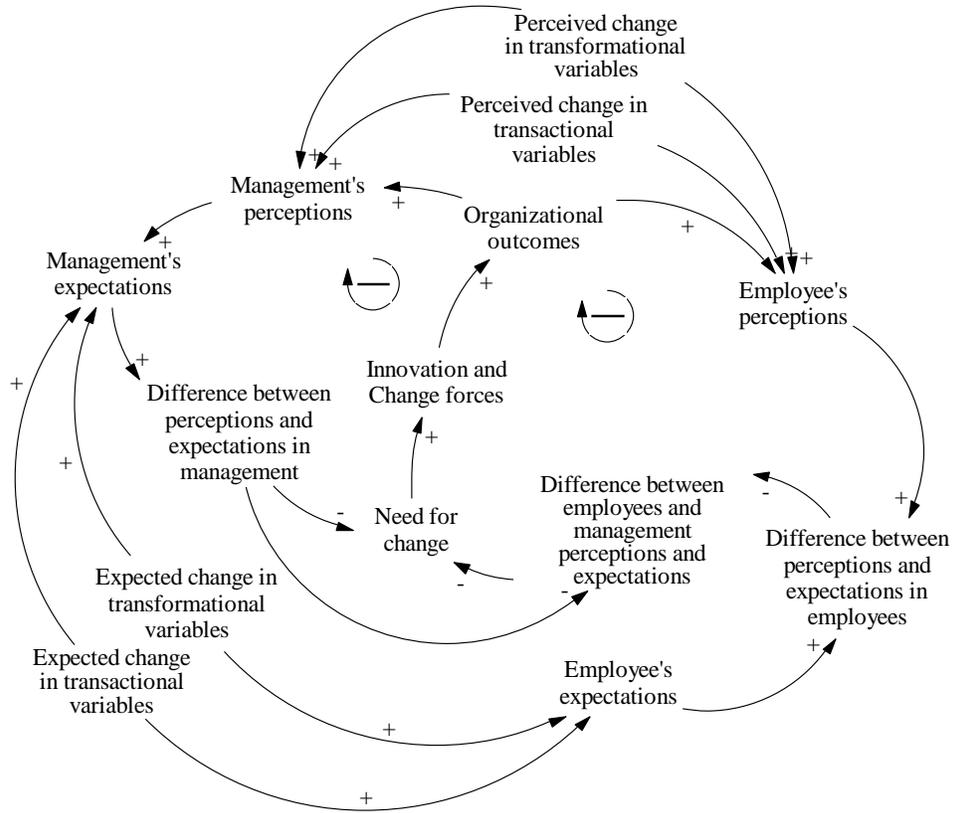


Figure 5.14 Causal relationships for propositions 7, 8 and 9

Several important aspects can be extracted from these relationships. First, it is necessary to develop the tools and mechanisms to measure the expectations and perceptions of people. This relates to the need for measuring the effects of any change initiative across the organization and to relate these effects to the firm's performance and objectives. Furthermore, expectations and perceptions are related to these objectives and the expected results of the change process.

Figures 5.15 and 5.16 show that management's and employees' perceptions and expectations are function of what they anticipate and identify. If their views of change are different, then the gap between employees' and management's views of the change process increases and no unified goal can be reached. In addition, if there is no feedback

mechanism that reports the outcomes from the change and innovation processes, individuals within the organization cannot relate the change process with the expected goals of the organization.

This presents the second aspect to be considered. The necessity of having wide and open communication channels is a primary goal of any change process in the organization. Besides having the necessary measures and information, the results must be communicated; people within the organization will not dedicate their energy to actions blindly. Additionally, lack of coherence between what management says and does leaves individuals lost in a dark room.

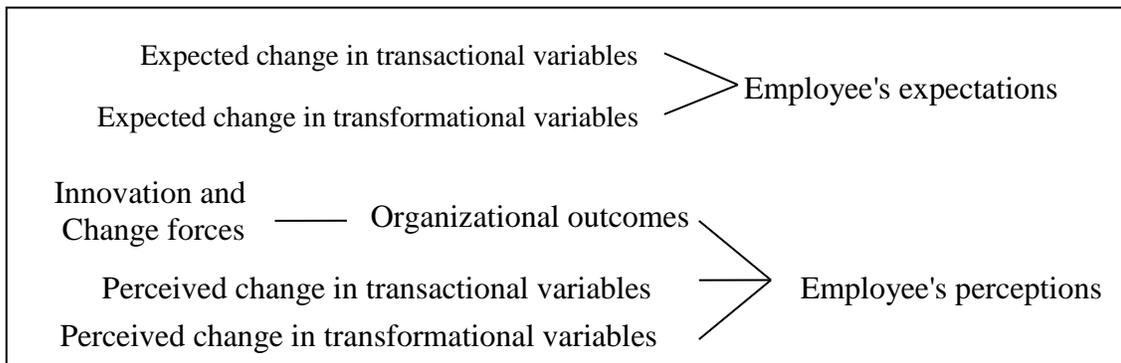


Fig. 5. 15 Cause tree for employees' perceptions and expectations

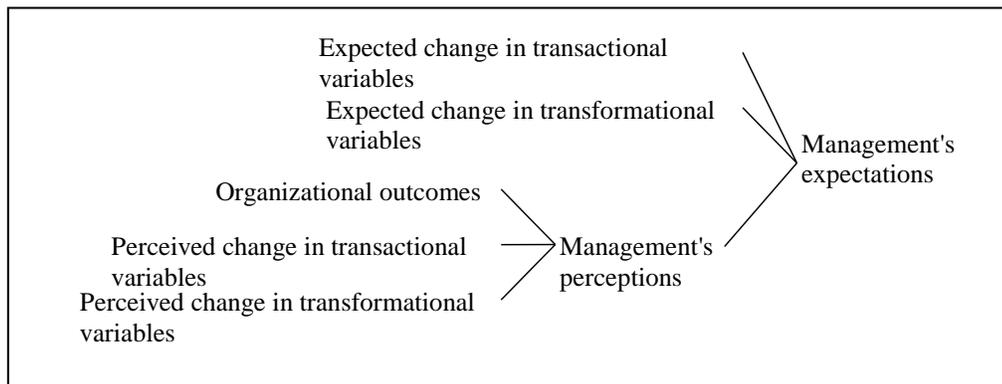
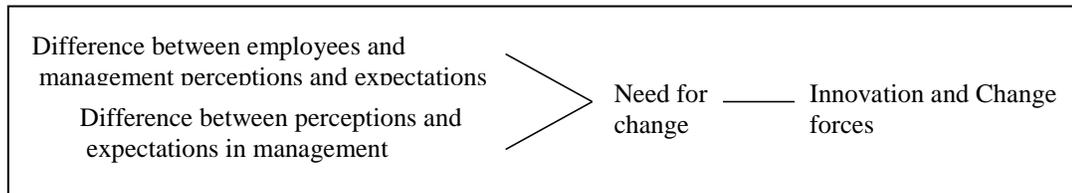


Fig. 5.16 Cause tree for management's perceptions and expectations

Figure 5.17 shows the need of change as a function of the differences between expectations and perceptions of management and employees. However, if there is uniformity of expectations and perceptions, the need for change becomes a unique goal within the organization. Unified criteria for change will result in a united effort triggering the appropriate mechanisms for change and optimizing the results of the effort.



**Fig. 5.17 Innovation and Change forces as a function of perceptions**

A third aspect to be considered from the relationships between the propositions is the effect of groups of people within the organization. Despite the fact that proposition 9 was not verified it is possible to argue that clusters of people with similar criteria or perceptions might be critical for the change process. Thus, a complete organizational diagnosis may be relevant to detect these clusters. If it is possible to detect clusters that favor the change process, it would be possible to benefit from their ideas, views and perceptions, which could lead the change process within their working units. On the other hand, the detection of clusters that might resist the change process would give information on how to approach them and the amount of effort needed to positively influence these clusters.

The above was partially detected at the Agency during the BPR project. Individuals in the different working units that were critical to the operational success of the recommendations were proposed to be part of the new cross-functional groups.

However, the BPR team did not consider the perceptions of and expectations for the change process of important individuals in the organization and the resulting implementation lacked the support of these individuals. In contrast, the organization is currently using a more integrated approach to implement other recommendations made by the BPR team, but still lacks the overall diagnosis that would provide knowledge about the perceptions and expectations of the change process within the organization.

The last two propositions on which IMOC is based are concerned with the effect of tenure time over the adoption of change and innovation. Proposition 10 suggests that **length of tenure time will positively influence the adoption of transactional change.** In addition, proposition 11 posits that the **length of tenure time will negatively influence the adoption of transformational change.** Figure 5.18 describes the causal relationships existing between tenure time and the organizational outcomes that result after change is attempted.

Tenure time has a direct effect on transactional variables. As experienced during the case study, the longer individuals have been working at the Agency, the more likely they are to accept change in daily activities that will streamline or facilitate their routine. However, the longer the tenure the harder to adopt changes that would radically modify their environment and functions.

As shown in figure 5.18 the rejection of radical change results in a negative effect on transformational variables. Instead of improving conditions such as culture, structure and leadership, tenure time increases the resistance to change.

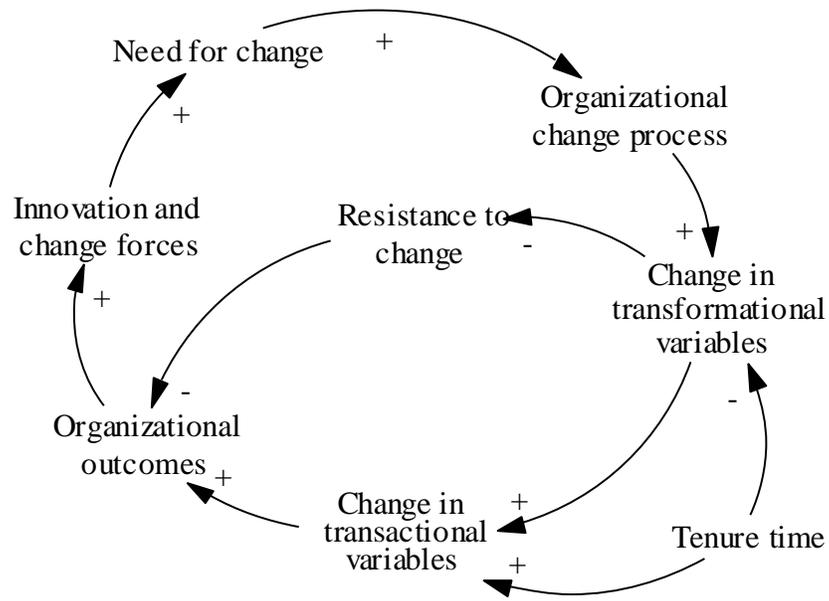


Fig. 5. 18 Causal relationships for propositions 10 and 11

Resistance to change delays the organizational change process (Fig. 5.9), which has a negative effect on organizational outcomes. These influences are shown with more detail in the cause trees depicted in figure 5.19.

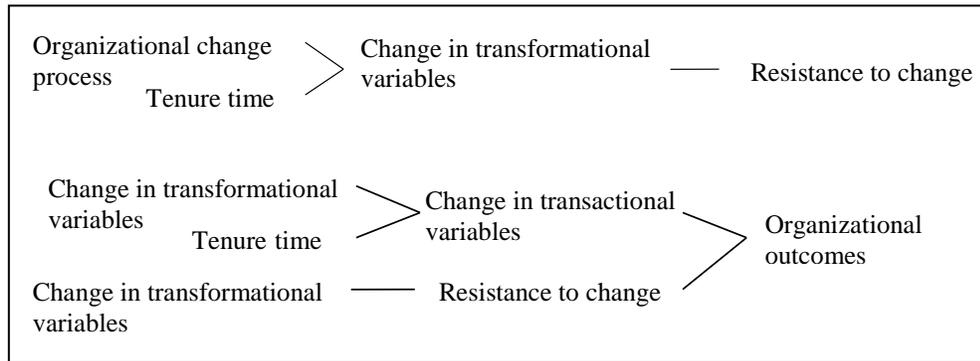


Fig. 5.19 Cause trees for organizational outcomes

During the interviews at the Agency it was possible to detect a propensity to reject radical change from employees with seniority versus employees with relatively short tenure time (less than 5 years). Employees with seniority indicated that radical changes

would only disturb the way the Agency has been operating and since they have continuously been increasing sales over time, major changes are not needed.

Finally, figure 5.20 presents an integrated view of IMOC. The figure depicts the different sub models as separate diagrams showing the different interrelations defined by the propositions presented in this research effort. In addition, the figure shows the interrelations between the different views and sub models presented previously. As shown, the process of modeling change through IMOC starts with the semantic model. It depicts a holistic explanation of organizational change. The macro variables that govern change are represented in this view connected with causal relationships. These relationships model the behavior of the different variables with respect to the other variables, creating a cyclic representation. The theorist, researcher or analyst selects one of the variables and can perform a backward or forward analysis to study how the selected variable affects other variables and how it is affected in the relationship.

Once a variable is selected it is possible to go to the next level and see with more detail how this factor influences change. Figure 5.20 shows the different sub models developed to represent the propositions of this research including the macro variables originally defined in the semantic model.

Thus, it is possible to go back and forth between the sub models and observe how the selected variable or variables influence change. As an example, the analysis might select the variable Organizational Outcomes and do a level-by-level analysis to assess how this variable influence change, and which variables it affects.

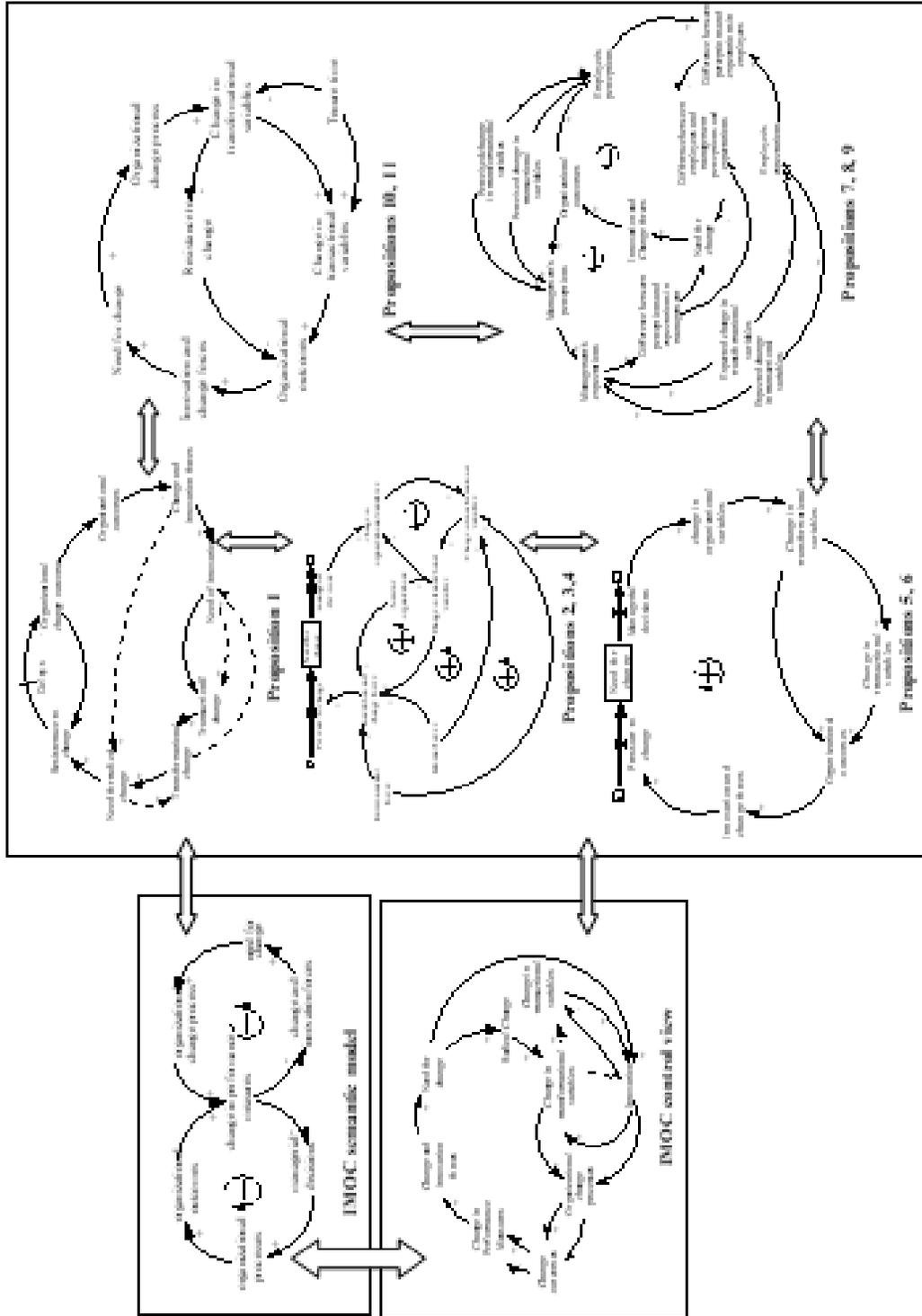


Fig. 5.20 Integrated view of IMOC

The next sections of this chapter contain detailed aspects of the sub models. These include a preliminary simulation, the discussion of this experiment and a discussion of the type of variables, information and relationships needed to develop a complete and detailed simulation of IMOC.

### **5.6 The Simulation Model. A Detail View of the Change Process**

To operationalize IMOC it is necessary to be able to construct more formal expressions that represent the causal relationships presented in the previous sections of this chapter. Even though the main objective of this research effort was to develop a conceptual model for organizational change, to construct these expressions this section presents an attempt to simulate independent entities of the model.

The study of organizational change requires the analysis of processes and states that are dynamic and in disequilibria. (Larsen and Lomi, 1999). To model these characteristics it is necessary to distinguish between state variables, which represent the condition of the system at a certain point of time (Ogata, 1992), and variables that represent rate of change over time (Sastry, 1997). Despite the capacity of causal loop diagrams to model interdependencies and feedback processes, their main limitation is that they are not capable of modeling stock and flows, and hence unable to define the state of the system and the rate of change on it (Sterman, 2000).

Ogata (1992) defines the state of a system at any time  $t$  as uniquely defined by the smallest set of state variables at  $t_0$  and the input to the system at  $t \geq t_0$ . If at least  $n$  variables are needed to completely describe the behavior of a dynamic, then once the input is given for  $t \geq t_0$  and the initial state is specified for  $t_0$ , the future state of the system

can be determined. Consider the dynamic system shown in figure 5.21, where  $u_i$  is the set of  $m$  different inputs,  $S_j$  is the set of  $n$  state variables and  $f_k(S_j, u_i)$  the set of  $r$  outputs.

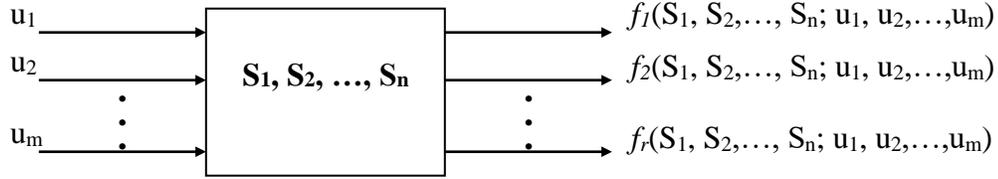


Fig. 5.21 A typical dynamic system

Adapted from Ogata (1992)

At any time  $t$ , the outputs of the system can be defined as  $f_k(S_1, S_2, \dots, S_n; u_1, u_2, \dots, u_m, t)$ , and the rate of change of the system is defined then as:

$$\frac{\partial S_j}{\partial t} = \frac{\partial f(S_1, S_2, \dots, S_n; u_1, u_2, \dots, u_m; t)}{\partial t} \quad (5.13)$$

The following paragraphs are extracted from Sterman (2000) and they explain with more detail aspects about stocks and flows that are essential in the development of the different expressions and relationships that govern IMOC.

Stocks are accumulations that characterize the state of a system. They accumulate past events and their content can only be changed through an inflow or outflow. These inflows and outflows that characterize stocks provide the systems with inertia and memory since without a variation in the flows the stock does not change.

Let  $\text{Inflow}(t)$  and  $\text{Outflow}(t)$  be the value of inflows and outflows that control the level of the stock at any time  $t$  respectively. Figure 5.21 shows the corresponding system dynamics diagram for the stock and flow. It shows the effect of inflows and outflows over the stock. Inflows accumulate certain input over time in the stock, while outputs decrease the amount of stock over time. The difference  $\text{Inflow}[t-t_0] - \text{Outflow}[t-t_0]$  indicates the rate of change of the particular state variable. The behavior of inflows and

outflows can be exemplified by inventories. Final inventories at the end of a period of time are a function of the initial inventory, the new inventory added and the amount of product that has been consumed over the period of time under analysis.

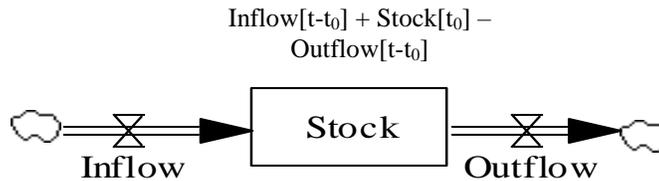


Fig. 5.22 Stocks and flows

The behavior of a stock can be expressed by the following equations:

$$\text{Stock}(t) = \int_{t_0}^{t_1} [\text{Inflow}(t) - \text{Outflow}(t)] dt + \text{Stock}(t_0) \quad (5.14)$$

$$\frac{d\text{Stock}}{dt} = \text{Inflows}(t) - \text{Outflows}(t) \quad (5.15)$$

Equation 5.14 shows the accumulation of the stock between times  $t_0$  and  $t_1$  while equation 5.15 expresses the rate of change of a given state variable at any time  $t$ , which is equivalent to the net inflow of the stock.

System dynamics captures changes over time by the simulation of circular changing behaviors where variables influence and respond to each other. System dynamics expresses causality in terms of positive or negative loops. A positive loop expresses a positive feedback into a variable. A positive feedback of variable  $X$  into variable  $Y$  such that  $X \rightarrow^+ Y$  implies that  $\frac{\partial Y}{\partial X} > 0$ .

It is possible to show that a positive loop causes an exponential growth of a state variable  $S$ . A state variable is defined by a stock. In addition, the state variable  $S$  is a function of  $t$ , such that  $S = f(t)$ . A system dynamics model is said to be of order  $n$  if it has  $n$  state variables ( $n$  stocks) to describe the state of the system. On the other hand, it is linear if the rate equation or net system is a linear combination of the state variables.

Define  $\mathbf{S} = (S(t)_1, S(t)_2, \dots, S(t)_n)$  as the vector of  $n$  state variables describing the state of the system at time  $n$ . Let  $a_i$  and  $b_j$  be constants. Thus, the rate equation or net inflow of the system can be expressed as:

$$\frac{\partial \mathbf{S}}{\partial t} = \sum_{i=1}^n a_i S_i + \sum_{j=1}^m b_j u_j \quad (5.16)$$

Assume a first-order linear system with a positive feedback loop. In this case, the rate equation can be expressed as:

$$\frac{\partial S}{\partial t} = g > 0 \quad (5.17)$$

Let  $S_0$  be the initial stock for  $t_0$ , then solving for  $S$ , it is possible to express the net value of the stock at any time  $t$  as:

$$S(t) = S_0 e^{gt} \quad (5.18)$$

Equation 5.17 shows an exponential growth of the state variable. If the system is left without any control, the state variable will grow forever. To limit this growth it is necessary for a dynamic system to present a damping or balancing behavior that will equilibrate this exponential growth. In real life, this balancing behavior is represented by a policy resistant system where “policies are delayed, diluted, or defeated by the unforeseen reactions of other people or nature (p.3).” The balancing behavior shows an exponential decay and is generated by a negative feedback loop  $X \rightarrow Y \rightarrow X$  such that implies that  $\frac{\partial Y}{\partial X} < 0$ .

For a first-order linear negative feedback loop system:

$$\frac{\partial S}{\partial t} = -c < 0 \quad (5.19)$$

Once more, solving for  $S$ , defining  $S_0$  the state for  $t_0$ :

$$S(t) = S_0 e^{-ct} \quad (5.20)$$

The equilibrating effect of the negative loop can be assumed as :

$$S(t)^* = S_0 e^{gt} - S_0 e^{-ct} \quad (5.21)$$

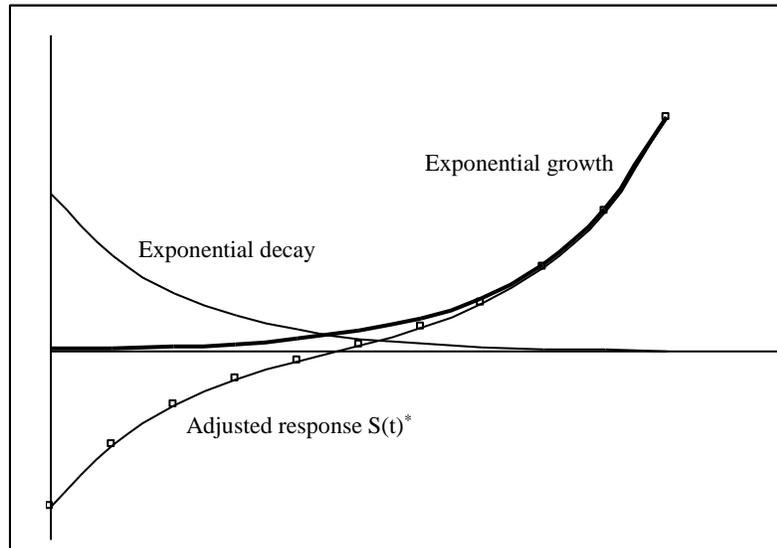


Fig. 5.23 Adjusting behavior of positive and negative feedback loops

The resulting adjusted effect  $S^*$  is shown in figure 5.22, where the exponential is somewhat controlled by the opposing effect of the two loops. The behavior of  $S(t)^*$  is a function of the variables  $g$ ,  $c$  and  $S_0$  that are determined by the initial diagnosis of the organization.

### 5.6.1 Components of the Simulation Model

To explore the formal expressions that govern the causal sub models presented above, several of these sub models were structured to conduct a dynamic simulation. The sub models selected are those corresponding to proposition 1 and propositions 7, 8 and 9. These sub models are shown in figure 5.24 (which repeats figures 5.9 and 5.14).

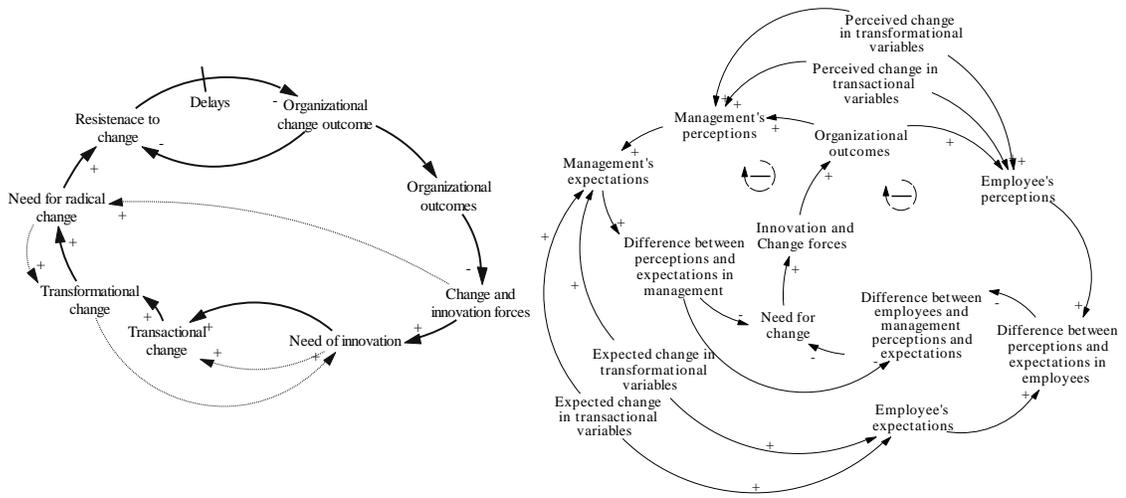
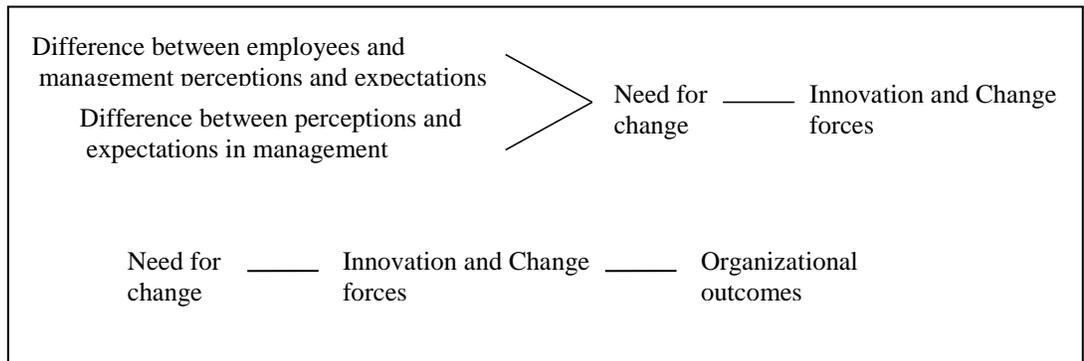


Figure 5.24 Causal relationships for propositions 1, and 7, 8 and 9



**Fig. 5.25 Organizational outcomes as function of innovation and change forces. need for change and perceptions and**

According to figure 5.25 once the need for change appears, it influences the innovation and change forces that govern the change process, which concludes with the desired outcomes. The need for change is influenced by the difference between perceptions and expectation among management and employees. Both, employees and management perceive change in response to the current outcomes. On the other hand, the expectations of the change process are a function of the forces that are triggering change. The difference between these expectations and perceptions create more need for change.

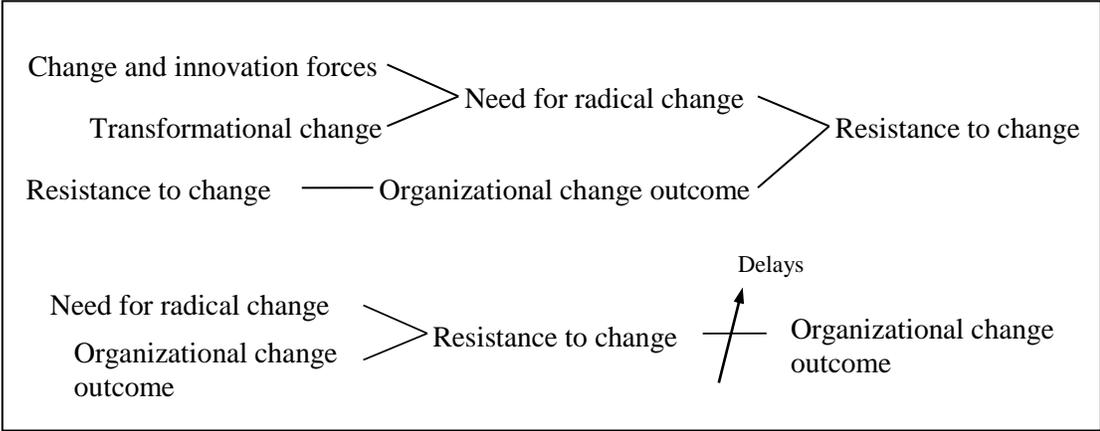


Fig. 5.26 The effect of resistance to change on change outcomes

Figure 5.26 shows the implications of resistance to change on the change process. As shown, resistance to change is influenced by aspects such as change in transformational variables, change and innovation forces and previous experiences. Furthermore, resistance to change delays the process of change. Thus, change is influenced not only by the effects of forces that trigger it, but is delayed by the effect that these forces had over previous experiences.

Figure 5.27 shows the dynamic model resulting from integrating the two causal models shown in figure 5.24. External and internal innovation forces influence the need for change and the process of change. External forces influence the need for change by modifying the perception that the organization has of its environment. Internal forces influence the process of change by participating in the different activities involved in the change processes. The current need for change is affected by the difference between the perception that individuals have about the current condition of critical variables within the organization, and the conceived preferred condition that they have about them. If the preferred level is higher than the current level of the variables, there is an indication that

a need for change exists. The larger the gap between the preferred and the current conditions, the larger the scale of change needed.

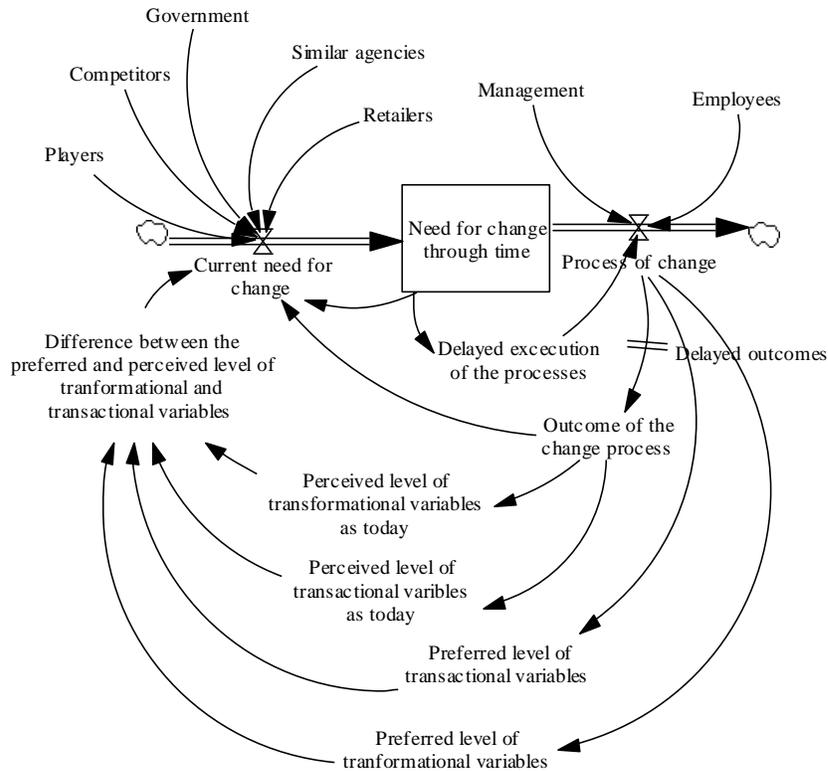


Fig. 5.27 Integrated dynamic model

Figure 5.27, shows the variable need of change as a state variable. It defines the accumulation of need for change in the organization through time. This need for change can grow indefinitely if no actions are taken. Internal innovation forces as mentioned above motivate these actions. Additionally, the effect of past results and the level of need for change increase the current need for change. However, the decisions over the process and the results of the change processes are delayed due to resistance to change

The different variables used in the model are defined in table 5.4, including the potential measures used to represent them. As seen, most of the measures are based on regression equations derived from the data collected during the case study at the agency.

Despite the fact that for this research the lack of sufficient data, the high variability of the responses and the collinearity among variables makes regression models of low validity for the prediction of causal effects; they were used as a first attempt to model the dynamic relationships and behaviors present in organizational change. In addition, random numbers generated using the empirical distributions shown in table 5.5 model the effect of the different change and innovation forces over the need and process of change. Responses on the extent to which each force influences the change process at the Agency vary from 1 to 5 based on a Likert scale. Since the responses are discrete and the probability distribution that governs these responses is not known, empirical distributions were developed after a frequency analysis of the responses for the different forces.

Finally, table 5.6 shows the equations used in the dynamic model developed in this section. These equations are used to obtain simulated behaviors of the need for change in different scenarios, as explained in the next section.

## **5.7 Simulating Organizational Change**

Vensim ® PLE was used to perform the simulation of the model. The Personal Learning Edition of Vensim® is “a visual modeling tool that allows to conceptualize, document, simulate, analyze and optimize models of dynamic systems (Vensim® PLE user’s manual, p. 3.)” The simulation was performed under the following conditions:

- State variable: the variable to be analyzed in the simulation study is need for change through time. The initial condition for the variable is 3, and is defined as

the average of the responses for the need for change as detected from the case study and explained in table 5.4.

Table 5.4 Variable definitions and potential measures

Variable	Definition	Potential Measures
Process of change	They are the processes tending to achieve organizational change. Among them are organizational restructuring, organizational redesign, process modification, process redesign using continuous, incremental or radical change processes.	The regression equation that models the different processes of change as a function of the need of change. Process of change is defined in the questionnaire based on a range going from continuous to radical. The delay in the decision-making of the execution of the change process is represented by the function DELAY defined in Vensim ® PLE. Please refer to the manual for more information.
Outcomes of the change process	They are the expected results of any change initiative. The expected outcomes can be improved. Outcomes can be improving customer services, shorter cycle times, better quality of services and products, improved organizational responsiveness, costs optimization and new products and services, among others.	Regression equation of results vs. process of change. The delay in the decision-making and results is represented by the function DELAY defined in Vensim ® PLE. Please refer to the manual for more information.
Innovation and change forces	They are the forces that pressure and motivate change. They can be external and internal forces, and can be defined as coming from customers, market, similar institutions, government, employees and management, among others.	The effect of each of the individual forces is represented by a random number generated based on the empirical distribution that govern each variable.
Need for change	It is the existing perception among the members of the organization that change is needed in some way. It is due to poor performance, lack of effectiveness, lack of consistency among others. The variable has two components. Current need for change, which models the need of change at any point of time. Need for change through time is a state variable that models the perceived need for change of the organization through time	The current need for change is modeled by the regression equation of the need of change assessed by the open questions of the questionnaire vs. perceived and expected change in transformational and transactional change, and the effect of previous results. A scale from 1 to 5 was used to determine the level of need for change, being 1 the lowest and five the highest. The change of time through time is modeled based on the definition of stocks and flows as the difference between current need and process plus the accumulated need for change.
Perceived level of transformational and transactional variables	It is the perception that individuals have on how core and operational variables are currently at the organization.	It is defined by the average of the perceived level of transformational and transactional variables as of today.
Preferred level of transformational and transactional variables	It is the perception that individuals have on how core and operational variables should be at the organization.	It is defined by the average of the preferred level of transformational and transactional variables.
Difference between preferred and perceived levels of transactional and transformational variables	It is the existing gap between the preferred and the perceived levels of critical variables in the organization. The larger and positive the difference, the greater the existing need for change.	The average of the differences of preferred and perceived levels of transactional and transformational change.

- Units: the different measures are dimensionless since they represent assessed levels of dimensionless variables.
- Time units: the simulation time unit is months. A 100-month horizon was selected to be consistent with the fact that radical change projects can take between 6 months to 3 years (Skarke, et al., 1995), and to have more flexibility in the use of delays and their effect on time.
- Scenarios: different scenarios were developed to compare simulations and the effect of the different scenarios on the need for change through time. The scenarios selected include an ideal situation where no forces and delays are considered and different cases changing the effect of forces and delays.

Table 5.5 Empirical cumulative probability distributions

Perceived extent	External and internal change and innovation forces						
	Competitors	Government	Similar Agencies	Management	Employees	Players	Retailers
	Cumulative probabilities						
1	0.145	0.056	0.029	0.014	0.224	0.000	0.067
2	0.391	0.125	0.086	0.042	0.474	0.176	0.187
3	0.652	0.306	0.586	0.236	0.750	0.635	0.653
4	0.826	0.514	0.871	0.611	0.868	0.811	0.840
5	1.000	1.000	1.000	1.000	1.000	1.000	1.000

The next sections cover the different scenarios used for the simulation experiment and the corresponding analysis. The reader is reminded that the equations that govern the model are only for the purpose of the experiment and that the results are applicable to the specific situation of the Agency. The information used to develop these equations is based on the data gathered during the case study.

Table 5.6 Equations for the simulation model

Variable	Potential equations
Process of change	$3.36 - 0.216 * \text{Management} + 0.227 * \text{Employees} + 0.142 * \text{Need for change}$
Outcome of change process	$3.52 + 0.037 * \text{Process}$
Innovation and change forces	Individual random functions depending on the characteristic empirical cumulative distribution that governs each force, i. e., for competitors: IF THEN ELSE(RANDOM UNIFORM(0,1,0) <=0.145,1,IF THEN ELSE( RANDOM UNIFORM(0,1,0) <=0.391 ,2,IF THEN ELSE(RANDOM UNIFORM(0,1,0) <=0.652,3,IF THEN ELSE (RANDOM UNIFORM(0,1,0) <=0.826,4,5 ) ) ) )
Need for change	$3.37 + 0.135 * \text{Result} + 0.071 * \text{Total difference} - 0.147 * \text{Competitors} + 0.066 * \text{Government} + 0.088 * \text{Similar agencies} - 0.455 * \text{Players} + 0.273 * \text{Retailers} + \alpha * \text{need for change through time. } \alpha \text{ is a scaling factor for the feedback effect of the need for change and can be explained as the weight of this effect on the current need for change.}$
Perceived level of transformational and transactional variables	Transf t = $2.37 + 0.112 * \text{Result}$ Trnst t = $2.88 + 0.0401 * \text{Result}$
Preferred level of transformational and transactional variables	Transf p = $3.86 + 0.054 * \text{Process}$ Trnst p = $3.58 + 0.124 * \text{Process}$
Difference between preferred and perceived levels of transactional and transformational variables	$((\text{Transf p} - \text{Transf t}) + (\text{Trnst p} - \text{Trnst t})) / 2$

### 5.7.1 The First Scenario: the Base Model

The first scenario that was modeled corresponds to a closed and ideal system. In this case, there are no effects from external or internal forces and there are no delays.

Furthermore, the model assumes that there is no feedback effect from pre-existing conditions for need for change.

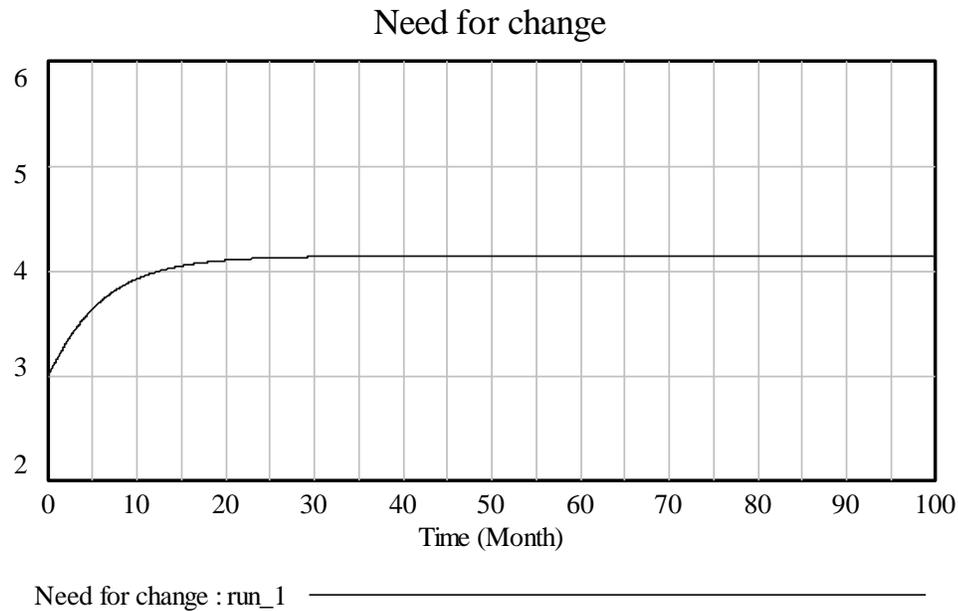


Fig. 5.28 Behavior for Need for Change through time

As seen from figure 5.28, the need for change grows from its initial condition to a point where the need for change stabilizes. This is true for this system since no external variable or delay is involved in the simulation and the change over time is due only to the behavior of stocks over time (exponential growth).

### 5.7.2 The Second and Third Scenarios: Introduction of Innovation and Change Forces

To observe the influences of innovation and change forces over the need for change this section shows two different situations. The first is the case when only internal forces that influence the process of change are integrated. In this case, the effects of management and employees are included in the model.

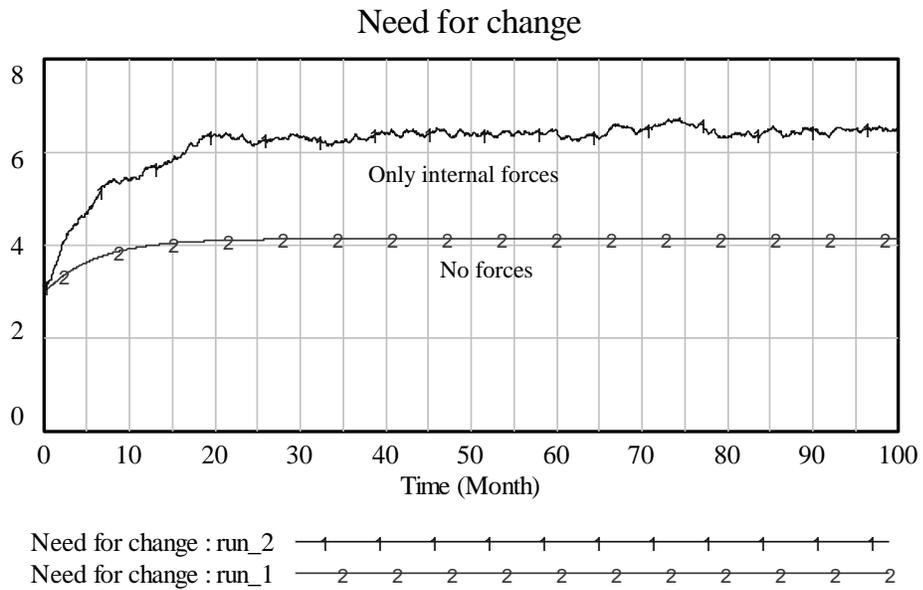
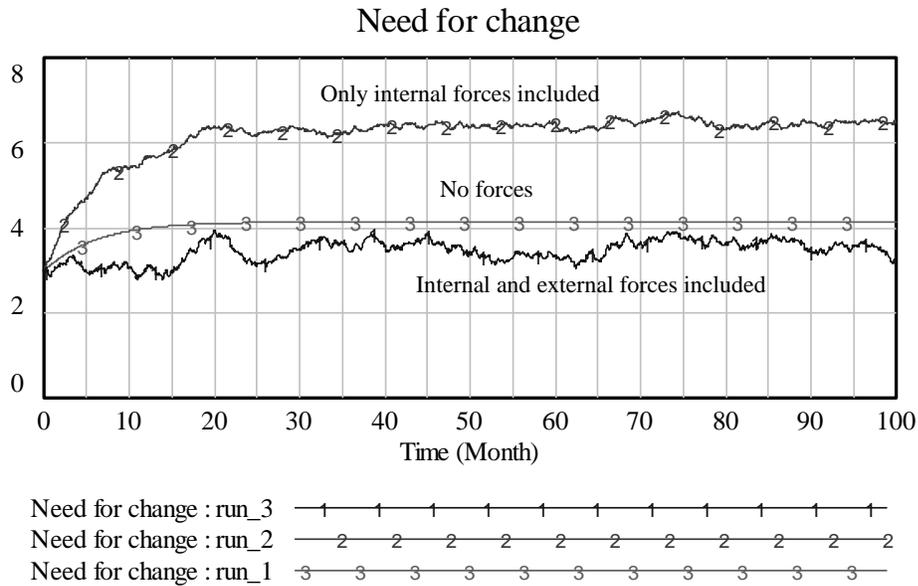


Fig. 5.29 Need for change if internal forces are included

Figure 5.29 compares the situation for the first scenario (run\_1) depicted by line 2 and the scenario when only internal forces are incorporated (run\_2) depicted by line 1. As shown, the inclusion of these factors increases the need for change, which agrees with the experiences gathered through the case study. Decisions considering only internal implications and managerial needs would produce, in the long term, the undesired effect of increasing dissatisfaction and lack of motivation, which in turn, creates a greater need for change.

The second case is shown in figure 5.30 and depicts the integration of all the internal and external innovation and change forces. The simulated behavior depicted by line 1 (run\_3) shows that if all the change and innovation forces are considered the effect over the need for change is of reducing the total need over time to a value that, even though not as stable as the two other simulations, is smaller, at any time, than the different values obtained previously.



**Fig. 5.30 Need for change when all the innovation and**

Once more, the simulated behavior agrees with the experiences from the Agency. The interviewees and participants on the survey agreed that it is necessary to consider not only employees and management needs and priorities, but also it is required to consider other environmental elements in the implementation of any change program. Moreover, the literature (e.g., table 5.1) also agrees with the fact that external and internal factors must be considered to successfully implement change, hence diminishing the need for change in the organization.

### 5.7.3 The Fourth and Fifth scenarios: Introducing Delays in Actions

An additional important effect to be considered is the impact that the delays in policies and actions can cause over the system. Figure 5.31 depicts the effect that different delay lengths in initiating the process of change have over the behavior of need for change through time. Curve 2 (run\_4) depicts the situation when the delay in









change through time tends to decrease thanks to the modified effect of management and employees despite the effect of the feedback  $\alpha$ .

The experiences at the Agency corroborate the results of the simulation. The frustration accumulated due to past experiences and discomfort would diminish if employees are empowered and management gives them more flexibility in their actions and decisions. Therefore, the simulation model corroborates that an equilibrated participation of management and employees in the change process is essential to successfully accomplish organizational transformation.

## **5.8 Validation and Generalization of IMOC**

The objective of this chapter was to present the conceptual foundations and the different elements and levels that compose the Influence Model for Organizational Change - IMOC. In addition, a simulation experiment was performed to verify if the relationships suggested by IMOC can be supported. Two aspects are necessary to analyze the validity and possibility of generalization for IMOC.

### **5.8.1 Validation of IMOC**

Barlas (1996) affirms that although the majority of researchers see a model as an objective representation of a real system, it is possible to see a model as one of many possible ways to describe a system. Thus, it is not possible to posit that a model is correct or incorrect once it is compared with empirical facts from reality since the modeler's views and ideas are present in it.

Vennix (1996) defines the validation of a model as the “degree to which the base model input: output relations map on those of the real system (p. 323)”. Traditional validation is based on the predictability, historical independence and deterministic nature of the problems. On the other hand, system dynamics models have the goal of describing complex social systems and for that reason they are incomplete, relative and partly subjective (Klabbers, 2000); hence traditional procedures are not suited for validating them. The usefulness of the model rather than aspects such as elegance, realism or reproducibility should lead the validation process of a system dynamics model (Taylor and Karlin, 1994).

As suggested by Klabbers (2000) the validation of IMOC should cover the validity of the internal structures of the model and the validity of the system behaviors. Finally, it is necessary to study the usefulness of the model in terms of possible solutions, ideas and actions to successfully implement organizational change.

Recalling the information presented in previous chapters of this document, IMOC is built on propositions that were founded on theoretical concepts supported by different sources found in the literature. Moreover, IMOC is founded on a series of multidisciplinary concepts and tools described at the beginning in this chapter. A case study was conducted to verify these propositions and to gather information, observations and experiences that would help to develop the causal relationships that govern IMOC. Finally, a series of causal sub-models were developed based on the relationships and experiences from the case study. Therefore, the internal structures that support IMOC are validated by theoretical concepts and tools, and additionally by empirical findings and experiences.

The validity of IMOC's behaviors is supported to some extent by a more detailed dynamic simulation model constructed in the previous section. A series of simulation experiments were conducted to ensure that the relationships developed could explain some behaviors that were found during the case study. The dynamic model lacked comprehensiveness due to the complexity of the relationships and the scarcity of information from different sources. Nonetheless, the simulation experiments confirmed some of the strategies, actions and policies that are recommended by the literature to increase the likelihood of success of a radical change initiative. More specifically, the results from the scenarios modeled confirmed the importance of considering the different dimensions of the model - human, environmental and operational- and to integrate them in more efficient and holistic administrative and strategic policies in the organization. In addition, the simulation showed the importance of having a feedback system that could measure and control the different dimensions of the organization in a timely manner. It is necessary to develop and apply measures that integrate the objectives of the organization with the objectives of the change process to effectively assess the results of the different change initiatives. Moreover, these measures must be capable of assessing the critical core and operational variables necessary for a successful change.

Finally the usefulness of the model can be related with the two previous factors – internal structures and system's behaviors - given the possibility of deriving actions and policies from IMOC. If a new BPR project were implemented at the Agency the following aspects should be taken into consideration in order to improve the likelihood of success:

- Perform a diagnostic study of the organization considering not only the current situations but also management and employees' expected or preferred situations. The information from the diagnostic study would define the organization's initial situation and would help in developing strategies, goals and activities to improve, if necessary, some of the variables assessed by the study. For the Agency, this initial condition would have provided with the assessment of transformational and transactional variables, perceptions about previous projects and demographic information that increases understanding of where the organization is in terms of the profile of its human resources.
- Clearly define the goals and objectives of the change initiative and develop the necessary metrics to assess the results. To assess the results of the change initiative, it is necessary to define and use specific metrics that are related to the goals and objectives of the organization. These metrics should provide an integrated performance view of the different dimensions of the organization, i. e., operational, human and environmental. Furthermore, these metrics facilitate the comparison of the results of the different stages of the change initiative.
- Define the means for feedback and follow-up for the projects. It is necessary to monitor and assess the partial results of the projects. Additionally, projects do not end when the change has been implemented. A follow-up strategy is necessary to detect, analyze and correct deviations from the original expectations. The feedback and follow-up mechanisms use the different metrics mentioned above as guidelines in the control of the different change projects.

- Communicate the need for change. Communication, coordination and integration of working units are essential to increase the likelihood of success of any change initiative, as perceived in the case study. Participants in the change projects and stakeholders must know the reasons for implementing change; otherwise their effort might not be directed toward the expected objectives. Moreover, the partial results detected by the feedback mechanisms have to be communicated to better fine tune and implement the new systems, activities and climate due to the change initiatives.
- After defining the processes that need review or redesign, establish a task force composed of people from the different working units affected by the change initiative, to develop an implementation plan. Participation of individuals from the affected areas in the change process is influential in determining the effect of the proposed changes on the operation, administration and power structure of the different divisions involved in the initiative. Furthermore, the input from the team members would help develop change strategies and activities that might reduce uncertainty and resistance to change.

### **5.8.2 Generalization of IMOC**

Up to this point the development of IMOC allows the verification of the change processes at the Agency and the prediction results based on previous information from the organization. In addition, IMOC allows developing strategies, tactics and internal policies that can help in achieving successful change. The next step is to generalize the findings and concepts of IMOC to different settings.

To extend IMOC's validation to more general settings, a meta-study of the results, methodologies and critical variables in organizational change and innovation is necessary. Bal and Nijkamp (2001) suggest the use of a meta-analysis that will integrate knowledge from different sources and transfer it; hence it is possible to conform the information to common rules and theories. According to their definition a meta-analysis consists of a series of studies and investigations from the literature and organizational settings that will provide sufficient data to analyze complex societal problems and to validate common theories and problem solving methodologies.

Meta-analyses on organizational change are not new. For instance Damanpour (1991) performed a meta-analysis of different case studies reports and articles to find causes and moderators of innovation adoption. This study has been used as fundamental for other studies and more specific research on organizational change (e.g., Barnett and Carroll, 1995, Armenakis and Bedeian, 1999)

The proposed meta-analysis would include a longitudinal and a cross-sectional study of different sectors and types of organizations within the sectors. These studies would consider different aspects to help determine expressions, relationships and conditions to validate the different propositions of this study under specific settings. The different levels and sub-models of IMOC have to be tested under these settings to find three elements: commonalities, differences and uniqueness of the individual organizations, sectors and conditions.

Figure 5.36 shows the process concerning the meta-analysis. Through a series of case studies information is collected regarding demographics, critical variables, outcomes, performance measures and previous experiences with change. The case

Government State Federal Local	Profit	Lotteries Consulting Transportation	Geographic location	Size	Age
	Nonprofit	Regulatory Service Military Justice Education			
Private	Manufacturing	Automobile Chemical Defense Electronic Pharmaceutical			
	Service	Financial Health care Food and Lodging Entertainment Transportation Consulting Computing and Data Processing Education			
Information from the case studies: Demographics Change experiences Change Processes Critical Variables Performance measures Outcomes					

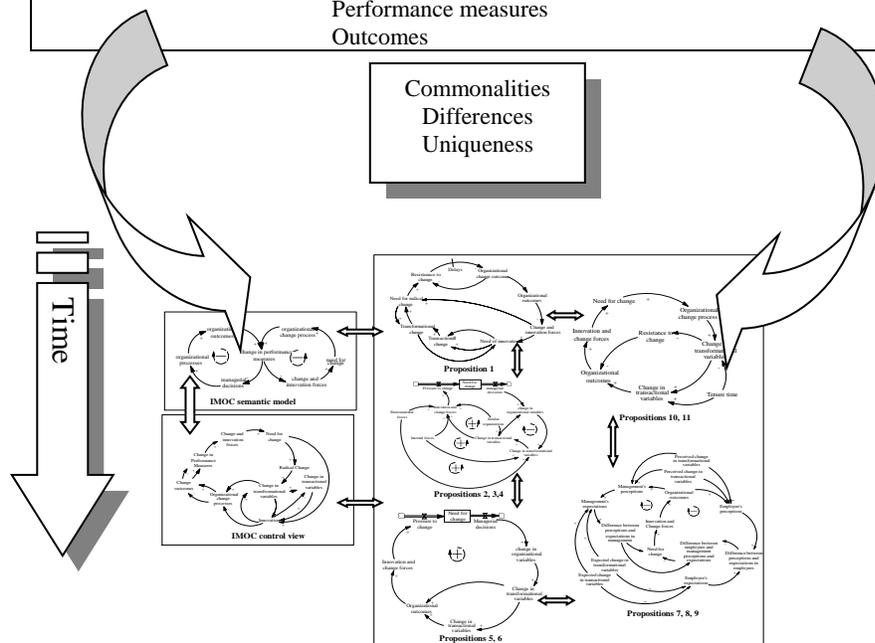


Fig. 5.36 IMOC validation meta-analysis

studies should be cross-sectional, considering different areas, processes and function within the different organizations. At the same time, the case studies should be longitudinal, considering the variation of the information through time to effectively assess change. The meta-analysis should consider organizations in different sectors and different sizes, locations and age. The information collected through these case studies should be compared with IMOC's sub-models to validate, reconstruct or complete them.

The analysis should provide the necessary information to complete the different expressions shown throughout this chapter, helping define the type and form of the expressions, the constants in them, and their relationship with time to represent a more realistic model. In addition, it should help in finding the commonalities and differences of the change processes among sectors. Moreover, the study should help with discovering the unique characteristics of the different change processes and comparing them to see the possibilities of including them in the final model.

The final result should present IMOC as a series of layers serving as shells for describing the change process in different settings and environmental conditions, but flexible enough to accommodate the particularities and uniqueness of the change process in specific types of organizations. The dynamic simulation model should have the capability of adjusting to the different conditions presented in the organizations, with expressions and relationships that could represent the causalities between the model's variables.

IMOC is not a panacea to solve the problems of implementing successful organizational change. The purpose is to create an integrated model that can help in predicting responses and actions to achieve change but does not perform the activities or

provide the willingness, commitment and leadership necessary to succeed. IMOC is part of the tools that can be used to develop strategic and internal policies to create change but needs to be used in concordance with objectives and plans and not as an isolated instrument for change.

The next chapter of this document summarizes the accomplishments of this research and delineates future research activities promoted by this endeavor.

## Chapter 6

### Conclusions and Future Research

#### 6.1 Introduction

Organizational change can be described as a series of activities oriented towards modifying behaviors and structures within the organization. This series of activities is interconnected internally and externally and is affected by human, operational and environmental factors that dynamically influence decisions and processes in the organization. This research effort was born with the main objective of using multidisciplinary knowledge and tools to explore a new model for organizational change combining the dynamic aspects of change and innovation and the causal relationships that govern an organization's activities to promote and implement change. More specifically the goals of this research were:

- a. To develop and explore a new model for organizational change called The Influence Model for Organizational Change that dynamically links the content, context and processes of change with the organizational outcomes during and after the change initiatives have been conducted.
- b. To conduct a case study with the objective of describing and explaining the change processes that have been attempted at the Agency and to use data, information and conclusions to corroborate, reject or explore different aspects that are linked to the different propositions on which IMOC is based.

- c. To generate a series of assertions explaining the experiences and conclusions found in the case study that may be extended, for future research, to other entities.

The next sections of this chapter are dedicated to expressing the conclusions and future research derived from this work in terms of the objectives and goals presented above.

## **6.2 Summary of Results**

The main conclusion derived from this research effort is a disagreement with what Lewin proposed in the early 1950s, that change is a discrete series of activities towards the achievement of with a unique goal. On the contrary, as proposed by different authors (e.g, Burke, 1992, Burke, 1994, Pettigrew, et al., 2001) and as demonstrated by the case study conducted in this research, change can be defined as a complex set of elements, process and related activities, that evolve as time advances. The results of a particular set are multidimensional and consist of particular and unique behaviors that continually serve as input to it. Change does not occur individually, but as a parallel series of activities competing for limited resources and strongly influenced by human attitudes and beliefs.

Thus, it is possible to argue that in order to model change it is necessary to view it as a system not as a process. IMOC is presented in this research effort as an attempt to model the system of change. To develop IMOC, eleven propositions were established and verified through a case study in a state agency. Table 6.1 shows the results of the proposition validation.

Table 6.1 Summary table: Propositions validation

<b>Proposition 1</b> Radical change motivated by innovation is more difficult to implement than radical change motivated by strategic or environmental reasons	:	Partially supported
<b>Proposition 2</b> Environmental and Internal forces will motivate radical change, while Institutional forces will induce innovation.	:	Supported
<b>Proposition 3</b> A need for change will induce a need for innovation.	:	Supported
<b>Proposition 4</b> Innovation will generate a change in transactional variables	:	Partially supported
<b>Proposition 5</b> Radical change will generate change in transformational variables.	:	Partially supported
<b>Proposition 6</b> Transformational variables will change in a positive direction even if the change initiative fails.	:	Not supported
<b>Proposition 7</b> The success of a radical change initiative will be negatively influenced by the differences between employees' perceptions and expectations of the critical success variables influencing the change process	:	Partially supported
<b>Proposition 8</b> The success of a radical change initiative will be negatively influenced by the difference between employees' perceptions and management expectations of the different critical success variables influencing the change process.	:	Partially supported

Only two of the propositions could not be supported by the case study. It is possible to argue that it was mainly because of the lack of definitions for success, newness and objectives and goals of the change program. Despite the fact that people

want change, they did not know what was planned and how to do it well in advance to successfully and efficiently accomplish it.

IMOC proposes the need for an initial diagnosis to define the conditions on which the change process is going to be based and to compare final results. In addition IMOC proposes the need of a feedback and control system to continuously monitor the process of change and to trigger corrective actions as soon as they are needed or even in a proactive manner, predicting possible flaws before they occur.

As part of the feedback and control system, a complete set of performance measures is needed. The measures should be in accordance with the objective of the organizations and should be developed so they can be used across the organization, providing information to all levels and to all units of the firm. The measures have to be capable of integrating the different dimensions that are affected and that affect change – human, operational, environmental- and should be capable of measuring change through time. Finally, information technologies are necessary to collect, manage and report the information needed and provided by the performance measures to the different levels and responsibility centers throughout the organization.

IMOC supported the fact that it is necessary to know and understand the different forces that motivate and trigger change. Considering these forces in the change process should help in controlling the future need for change and should be part of the proactive vision that every organization should have. It is equally important to consider the feedback effect from previous experiences and the delays in deciding and implementing change processes. The feedback effect from previous experiences increases resistance to change to such a degree that the need for change becomes so extensive that it goes out of

control, generating a crisis within the organization. It is necessary to diminish this feedback effect by motivation, training and communication to minimize its effect on the organization. Delays in the decisions and implementation of the change process become critical as time goes on. If the time between the moment the need of change is detected and the decision to implement it is large enough, it becomes a triggering factor that can make the need for change out of control. Time between the decision and the implementation is also an important factor in decreasing future need for change and as a result, in increasing the likelihood of success for future change initiatives.

Finally, the effect of internal forces –employees and management- was found to be of great impact on the change process. IMOC shows that increasing empowerment and balancing the role of management would help in controlling the process through decreasing the need for change. Thus, these factors are crucial for the success of a change initiative.

From the methodological point of view, two aspects are worth mention here, that change has to be studied from a multidisciplinary approach, and the importance of case studies. This research demonstrated that it becomes an urgent necessity to integrate knowledge from social and organizational sciences, management science, engineering and systems methodologies in order to better understand and explain change. Modeling organizational change becomes an incredibly complex and immense task that can be accomplished only with the participation of people from different areas, all of them aware of the importance of the different areas of knowledge within the modeling process and with the acceptance that this is a team effort rather than an effort of isolated islands of knowledge.

Case studies provide the knowledge and experiences needed to really understand, describe, explain and possibly predict change. Through observation, documentation, surveys and interviews the veil that covers the uniqueness and particularities of different change processes can be uncovered. This understanding will permit a generalization of IMOC to be developed with sufficient flexibility to accommodate particularities, commonalities and differences.

### **6.3 Contributions of this Research Effort**

This research contributes to the fundamental understanding of organizational change and innovation in two different ways, through fulfilling the need for more multidisciplinary research, and through developing a new model to explain, analyze and predict the results of an organizational change initiative. The Influence Model for Organizational Change uniquely presents change as a complex system of multiple interrelated tasks and multidimensional variables. The three levels that compose the model present a different view of change in terms of causal relationships that are generated from and for the units to the organization as a whole.

The use of system dynamics as a tool to develop and explain IMOC allows the analysis of the effects that variables, defined in this study and in the literature (e.g., Burke and Litwin, 1992, Barnett and Carroll, 1995, Armenakis and Bedeian, 1999) as critical for success in organizational change, have over the change system. In addition, IMOC, through system dynamics simulation, allows the study of change over time. Change has to be analyzed not only from the point of view of the discrete influence of critical variables over the system, but also as time dependant. The incorporation of time in social

and organizational studies has been proposed by different authors (Ancona, et al., 2001, Ofori-Dankwa and Julian, 2001) and is included in IMOC since it is implicit in any system dynamics model.

Although the literature mentions the need for multidisciplinary research in social and organizational sciences (e. g., Bal and Nijkamp, 2001, van Dijkum, 2001, Jackson, 2001), there is a lack of studies in organizational change that supported this trend. Organizational change involves more than single activities oriented towards modifying specific behaviors. These activities and the results are often taken for granted, assuming that the participants can clearly define the direction of change (Quattrone and Hopper, 2001). The integration of multidisciplinary concepts and tools to understand organizational change allows practitioners, participants and researchers to understand the process of change (Scherer and Smid, 2000). IMOC presents a novel attitude towards research in engineering and social and organizational sciences. The trend presented in this research effort is to integrate people, knowledge and ideas in a common ground with a common objective. It integrates theories, concepts and tools from organizational sciences, engineering and management sciences to develop a framework for analysis and understanding of the process of organizational change and innovation from a holistic perspective.

#### **6.4 Future Research**

The refinement, extension and generalization of IMOC are the next steps in future research. The meta-analysis proposed in Chapter 5 is the framework for the future steps. This meta-analysis has to be performed using multiple disciplines and tools and is a long-

term effort. It should take between 3 to 5 years to accomplish the data gathering and analysis necessary to complete it. The final objective is to develop an integrated model that "... is rich enough to be useful, simple enough to be tractable, and that uses data that can obtain without excessive investment of time or money (Grossman, 2002, p. 43)".

The meta-analysis should provide enough information to develop more realistic expressions relating the causal relationships between critical variables, context and results. The meta-analysis should be able to address issues related to the type and form of the relationships, their stochasticity and how these relationships behave with respect to time. For example, it would be important to address the effect of  $\alpha$  as a measure of frustration and resistance to change and how this factor influences current needs for change, i.e., if its effect is additive or multiplicative or if this effect has a stochastic behavior over time.

Of equal importance, is knowing the relationship between having and using the right performance measure and the perception of success of the change process. Issues such as what is a right set of performance measures, and how this rightness affects the perception of the change processes are important to consider since one of the important elements proposed by IMOC is the control and feedback systems that should constantly provide information about performance and results of the change process.

Finally, the use of system dynamics presents an interesting tool to understand different processes that involve complex human and technological relationships. For example, modeling multiple tier supply chains with stochastic behaviors could be an application for system dynamics. Adapting IMOC to this structure would show how different levels and related variables could affect decisions on policies or strategies.

From the conclusions it can be seen that IMOC presents a different approach to modeling organizational change since it is based on dynamic and causal structures and analyzes change from a systemic point of view. Much has to be done in this area and it is time to continue with this effort. Even though surviving change is an important goal in organizations, the returns on all the effort in time and financial resources dedicated to it seem to be low (e. g., Lahoti, 2002, Samuelson, 2002). Events in the past years have demonstrated that organizations are not flexible enough to accommodate change. New rules and political developments are showing that traditional approaches to change and adaptation might not be enough to cope with uncertainty (Brant and Isikoff (2002), Clausen, et al., 2001, Horner, 2002, Gaboury, 2001). As said before IMOC is not the panacea to cure organizations but is a first step in a more systematic and multidisciplinary approach to understand change and to increase the likelihood of accomplishing the ideals and goals of people and organizations.

## References

- A Vision of Change for America* (1993) Executive Office of The President of The United States of America. February 17, H-Doc. 103-49.
- Ackerman, F., L. Walls, R. van der Meer, and M. Borman (1999) "Taking a Strategic View of BPR to Develop a Multidisciplinary Framework," *The Journal of the Operational Research Society*, v. 50, n. 3, March, pp. 195-204.
- Agogino, Alice M. (1999) "Management of Uncertainty with Influence Diagrams," *Working Paper No. 85-0703-6, University of California at Berkeley* (<http://best.me.berkeley.edu/~aagogino/me290m/s99/IDES/IDES.html>)
- Aguinis, Herman (1993) "Action Research and Scientific Method: Presumed Discrepancies and Actual Similarities," *Journal of Applied Behavioral Science*, v. 29, n. 4, December, pp. 416-431.
- Ahire, Sanjay L., and Sarv Devaraj (2001) "An Empirical Comparison of Statistical Construct and Validation Approaches," *IEEE Transactions on Engineering Management*, v. 48, n. 3, August, pp. 319-39.
- Al-Mashari, Majed, and Mohamed Zairi (2000) "Creating a Fit Between BPR and IT Infrastructure: A Proposed Framework for Effective Implementation," *International Journal of Flexible Manufacturing Systems*, v. 12, n.4, October, pp. 253-274.
- Allan, C., J. Sommerville, P. Kennedy, and H. Robertson (2000) "Driving Excellence Through Environmental Performance Improvements," *Total Quality Management*, v. 11, n. 4/6, July, pp. S602-S607.
- Amburgey, Terry L., Dawn Kelly, and William P. Barnett (1993), "Resetting the Clock: The Dynamics of Organizational Change and Failure," *Administrative Science Quarterly*, v. 38, n. 1, pp. 51-73.
- Amin, Nadia, Pat Hall, and Mathew Hinton (2000) "Understanding Change: Using the Pattern Paradigm in the Context of Business Domain Knowledge," in Henderson, Peter (Ed.), *Systems Engineering for Business Process Change*, Springer, New York.
- Ancona, Deborah G., Gerardo Al. Okhuysen, and Leslie A. Perlow (2001) "Takin Time to Integrate Temporal Research," *Academy of Management Review*, v. 26, n. 4, pp. 512-529.
- Anderson, Phillip (1999) "Complexity Theory and Organization Science," *Organization Science*, v. 10, n. 3, May-June, pp. 216-232.

- Anderson, Philip, Alan Meyer, Kathleen Eisenhardt, Kathleen Carley, and Andrew Pettigrew (1999) "Applications of Complexity Theory to Organization Science," *Organization Science*, v. 10, n. 3, May-June, pp; 233-236.
- Anderson-Rudolf, M. Kathryn (1996) *A Longitudinal Study of Organizational Change: How Change in Individual Perceptions of Transformational and Transactional Constructs Predicts Change in Organizational Performance*, Columbia University Doctoral Dissertation.
- Armenakis, Achille, and Arthur Bedeian (1999) "Organizational Change: A Review of Theory and Research in the 1990s," *Journal of Management*, v. 25 n. 3, pp. 293-315.
- Armenakis, Achilles A., Stanley G. Harris, and Hubert S. Field (1999) "Making Change Permanent. A Model for Institutionalizing Change Interventions," *Research in Organizational Change and Development*, v. 12, pp. 97-128.
- Arora, Sant, and Sameer Kumar (2000) "Reengineering: A Focus on Enterprise Integration," *Interfaces*, v. 30, n. 5, pp. 54-71.
- Bal, Frans, and Peter Nijkamp (2001) "In Search of Valid Results in Complex Economic Environment: The Potential of Meta-Analysis and Value Transfer," *European Journal of Operational Research*, v. 128, n. 2, pp. 364-384.
- Barlas, Yaman (1996) "Formal Aspects of Model Validity and Validation in System Dynamics," *System Dynamic Review*, v. 12, n. 3, Fall, 183-201.
- Barlas, Yaman, and Stanley Carpenter (1990) "Philosophical Roots of Model Validation: Two Paradigms," *System Dynamics Review*, v. 8, n. 2, Summer, pp. 148-166.
- Barnett, William P., and Glenn R. Carroll (1995) "Modeling Internal Organizational Change," *Annual Review of Sociology*, v. 21, pp. 217-236.
- Bauer, Andreas, Gerald Reiner, and Rudolf Schamschule (2000) "Organizational and Quality Development: An Analysis Via a Dynamic Simulation Model," *Total Quality Management*, v. 11, n. 4-5-6, pp. S410-S416.
- Because You Are Important* (1998) Missouri Lottery, Internal Document.
- Ben-Arieh, David, and Eric D. Carley (1994) "Qualitative Intelligent Modeling of Manufacturing Systems," in Joshi, Sanjay B., and Jeffrey S. Smith (Eds.). *Computer Control of Flexible Manufacturing Systems. Research and Development*, Chapman & Hall, New York.

- Beugre, Constant D. (1998) "Implementing Business Process Reengineering: The Role of Organizational Justice," *Journal of Applied Behavioral Science*, v. 24, n. 3, pp. 347-360.
- Bhatt, Ganesh (2000) "Exploring the Relationship Between Information Technology, Infrastructure, and Business Process Reengineering," *Business Process Management Journal*, v. 6. n. 2, pp. 130-163.
- Biazzo, Stefano (1998) "A Critical Examination of the Business Process Re-engineering Phenomenon," *International Journal of Operations and Production Management*, v. 18, n. 9/10, pp. 1000-1016.
- Bielza, Concha, Sixto Ríos-Insua, and Manuel Gómez (1999) "Influence Diagrams for Neonatal Jaundice Management," in Horn, Werner, Yuval Shahar, Geger Lindberg, Steen Andreassen, and Jeremy Wyatt, (Eds.), *Artificial Intelligence in Medicine – Proceedings of the Joint European Conference in Artificial Intelligence in Medicine and Medical Decision Making, AIMDM '99-Aalborg, Denmark*, Springer, New York.
- Bisson, Barbara, Valerie Folk, and Martin Smith (2000) "Case Study: How to Do a Business Process Improvement," *The Journal for Quality and Participation*, v. 23, n. 1, January/February, pp. 58-63.
- Bloodgood, James M., and J. L. Morrow (2000) "Strategic Organizational Change Within an Institutional Framework," *Journal of Managerial Issues*, v. 12 n. 2, Summer, pp. 208-226.
- Bourque, Linda B., and Eve P. Fielder (1995) *How to Conduct Self-Administered and Mail Surveys*, Sage Publications, U. S. A.
- Brannen, Julia (1992) *Mixing Methods: Qualitative and Quantitative Research*, Averbury, U. S. A.
- Brant, Martha, and Michael Isikoff (2002) "Going After Greed," *Newsweek*, July 12, pp. 20-24.
- Brudney, Jeffrey, Ted Hebert, and Deil Wright (1999) "Reinventing Government in American States: Measuring and Explaining Administrative Reform," *Public Administration Review*, v. 59 n. 1, pp. 19-37.
- Burke, W. Warner (1992) *Organization Development. A Process of Learning and Changing*. Addison Wesley, New York.
- Burke, W. Warner (1994) "Diagnostic Models for Organization Development," in Ann Howard and Associates (Ed.), *Diagnosis for Organizational Change: Methods and Models*, The Guilford Press, New York.

- Burke, W. Warner (1997) "The New Agenda for Organizational Development," *Organizational Dynamic*, v. 26, n. 1, Summer, pp. 7-20.
- Burke, Warner W., Celeste A. Coruzzi, and Allan H. Church (1996) "The Organizational Survey as an Intervention for Change," in Allen I. Kraut (Ed.), *Organizational Surveys: Tools for Assessment and Change*, Jossey-Bass Publishers, San Francisco.
- Burke, W. Warner, and George H. Litwin (1992) "A Causal Model of Organizational Performance and Change," *Journal of Management*, v. 18, n. 3, pp. 523-545.
- Burke, W. Warner, and William Trahant (2000) *Business Climate Shifts: Profiles of Change Makers*, Butterworth-Heinemann, U. S. A.
- Camp, Robert C. (1989) *Benchmarking: The Search for Industry Best Practices That Lead To Superior Performance*, ASQC Quality Press, U. S. A.
- Campbell, Bruce (1998) "Process Failure in a Rapidly Changing High-Tech Organization: A System Dynamics Approach," in Ling, Tok Wang, Sudha Ram and Mong Li Lee (Eds.), *Conceptual Modeling - ER'98. Proceedings of the 17<sup>th</sup> International Conference on Conceptual Modeling-Singapore*, Springer, New York.
- Cantamessa, Marco, and Emilio Paolucci (1998) "Using Organizational Analysis and IDEF0 for Enterprise Modeling in SMEs," *International Journal of Computer Integrated Manufacturing*, v. 11., n. 5. pp. 416-429.
- Castle, Dian K., and Michael Sir (2001) "Organization Development: A Framework for Successful Information Technology Assimilation," *Organization Development Journal*, v. 19, n. 1, Spring, pp. 59-71.
- Caudle, Sharon L. (1994) "Reengineering Strategies and Issues," *Public Productivity and Management Review*, v. 18, n. 2, Winter, pp. 149-162.
- Cheyunski, Fred, and Jamie Millard (1998) "Accelerated Business Transformation and the Role of Organizational Architect," *The Journal of Applied Behavioral Science*, v. 34, n. 3, September, pp. 268-285.
- Chmiel, Nick (2000) *Introduction to Work and Organizational Psychology*, Blackwell Publishers, Massachusetts.
- Clarke, Steve, Tony Ellman, and Brian Lehaney (2000) "Reengineering an Information System: A Case Study in Risk Reduction," *International Journal of Flexible Manufacturing Systems*, v. 12, n. 4, October, 305-320.
- Clausen, Jens, Jasper Hansen, Jasper Larsen, and Allen Larsen (2001) "Disruption Management," *ORMS Today*, v. 28, n.5, October, pp. 40-43.

- Clemons, Eric K. (1995) "Using Scenario Analysis to Manage the Strategic Risk of Reengineering," *Sloan Management Review*, Summer, pp. 61-71.
- Cook John D., Susan J. Hepworth, Toby D. Wall, and Peter B. Warr (1981) *The Experience of Work – A Compendium and Review of 249 Measures and their Use*, Academic Press, New York.
- Cook, Thomas D., and Donald T. Campbell (1979) *Quasi-Experimentation. Design & Analysis for Field Settings*, Houghton Mifflin Company, Boston.
- Cooke, Robert A., and Denise M. Rousseau (1988) "Behavioral Norms and Expectations – A Quantitative Approach to the Assessment of Organizational Culture," *Group and Organizational Studies*, v. 13, n. 3, September, pp. 245-273.
- Cooper, Randolph D. (2000) "Information Technology Development Creativity: A Case Study to Attempt Radical Change," *MIS Quarterly*, v. 24, n. 2, June, pp. 245-376.
- Cooper, Robin, and Lynne Markus (1995) "Human Reengineering," *Sloan Management Review*, Summer, pp. 39-58.
- Coyle, R. G. (1996) *System Dynamics Modeling: A Practical Approach*, Chapman and Hall, New York.
- Crandall, Richard E. (2002) "Keys to Better Performance Measurement," *Industrial Management*, v. 44, n. 1, January – February, pp. 19 – 24.
- Creswell, John W. (1998) *Qualitative Inquiry and Research Design: Choosing Among Five Traditions*, Sage Publications, U. S. A.
- Crowe, Thomas J., and Joseph D. Rolfes (1998) "Selecting BPR Projects Based on Strategic Objectives," *Business Process Management Journal*, v. 4 n. 2, pp.114-136.
- Crowe, Thomas J., Sangwook Kim, Pek Ying Fong, Ravindra Kalantri, and Humberto R. Alvarez (2000) *Business Process Engineering At a 'Profit-Driven' Non-Profit Organization: A Final Report to the Missouri Lottery*, The University of Missouri and Missouri Lottery, Internal Document.
- Crowe, Thomas J., José L. Zayas-Castro, and Sompop Vanichsenee (2002) "Readiness Assessment for Enterprise Resource Planning," *Proceedings of the 11th International Conference on Management of Technology*, Miami, April 17-21, 8 pages, CD-ROM published.
- Cryer, Jonathan D., and Robert B. Miller (1991) *Statistics for Business: Data Analysis and Modeling*, PWS-Kent Publishing Co., Boston.

- D'Aunno, Thomas, Melissa Succi, and Jeffrey A. Alexander (2000) "The Role of Institutional and Market Forces in Divergent Organizational Change," *Administrative Science Quarterly*, v. 45, n. 4, December, 679-703.
- Damanpour, Fariborz (1991) "Organizational Innovation: A Meta-Analysis of Effects of Determinants and Moderators," *Academy of Management Journal*, v. 34, n. 3, pp. 555-580.
- Damanpour, Fariborz, and Shanti Gopalakrishnan (1999) "Organizational Adaptation and Innovation: The Dynamics of Adopting Innovation Types," in Brockhoff, Klaus, Alok K. Chakrabarti and Jürgen Hauschildt, (Eds.), *The Dynamics of Innovation: Strategic and Managerial Implication*, Springer –Verlag, N. Y.
- Dangerfield, B. C. (1999) "System Dynamics Applications to European Health Care Issues," *Journal of the Operational Research Society*, v. 50, n. 4, pp. 345-353.
- Daniel, Wayne W. (1990) *Applied Nonparametric Statistics*, PWS-KENT Publishing Co., Boston.
- Davenport, Thomas H., and James E. Short (1990) "The New Industrial Engineering: Information Technology and Business Process Redesign," *Sloan Management Review*, v. 11, n. 4, Summer, pp. 11-27.
- Davidson W. H. (1999) "Beyond Re-engineering: The Three Phase of Business Transformation," *IBM Systems Journal*, v. 38, n. 2/3, pp. 485-499.
- DeCanio, Stephen J., Catherine Dibble, and Keyvan Amir-Atefi (2000) "The Importance of Organizational Structure for the Adoption of Innovation," *Management Science*, v. 46, n. 10, October, pp. 1285-1299.
- De Haas Marco, and Ad Kleingeld (1999) "Multilevel Design of Performance Measurement Systems: Enhancing Strategic Dialogue Throughout the Organization," *Management Accounting Research*, v. 10, n. 3, pp.233-261.
- Deluga, Ronald (1988) "Relationship of Transformational and Transactional Leadership With Employee Influencing Strategies," *Group and Organizational Studies*, v. 13, n. 4, December, pp. 458-467.
- Dent, Eric B., and Susan Galloway Goldberg (1999) "Challenging Resistance to Change," *The Journal of Applied Behavioral Science*, v. 35, n. 1, March, pp. 25-41.
- DeTombe, Dorien J. (2001) "Compram, A Method for Handling Complex Societal Problems," *European Journal of Operational Research*, v. 128, n. 2, pp. 261-266.

- Doumeings, Guy, Yves Ducq, Bruno Vallespir, and Stephane Kleinhans (2000) "Production Management and Enterprise Modeling," *Computers in Industry*, v. 42, n. 2-3, pp. 245-263.
- Drew, Stephen (1994) "BPR in Financial Services, Factors for Success," *Long Range Planning*, v. 27, n. 5, October, pp. 25-41.
- Dulton, Jane E., Susan J. Ashford, Regina M. O'Neill, and Katherine A. Lawrence (2001) "Moves That Matter: Issue Selling and Organizational Change," *Academy of Management Journal*, v. 44, n. 4, pp. 710-736.
- Duffy, Jo Ann M., and Alice A. Ketchand (1998) "Examining the Role of Service Quality in Overall Service Satisfaction," *Journal of Managerial Issues*, v. 10, n. 2, Summer, pp. 240-255.
- Dutta, Amitava, and Rahul Roy (2002) "System Dynamics," *ORMS Today*, v. 29, n. 3, June, pp. 30-35.
- Edwards, Tim (2000) "Innovation and Organizational Change: Developments towards an interactive process perspective," *Technology Analysis and Strategic Management*, v. 12, n. 4, December, pp. 445 – 464.
- Eisenberg, Howard (1998) "Reengineering and Dumbsizing: Mismanagement of the Knowledge Resource," *IEEE Engineering Management Review*, Fall, pp. 78-86.
- Elion, Samuel (1993) "Managing Change," *Omega. The International Journal of Management Science*, v. 21, n. 1, January, pp.3-5.
- Ettlie, John E. (2000) *Managing Technological Innovation*, John Wiley & Sons, Inc., New York.
- Ettlie, John E., William P. Bridges, and Robert D. O'Keefe (1984) "Organization Strategy and Structural Differences for Radical Versus Incremental Innovation," *Management Science*, v. 30, n. 6, June, pp. 682 – 693.
- Ettlie, John E., and Ernesto M. Reza (1992) "Organizational Integration and Process Innovation," *Academy of Management Journal*, v. 35, n. 4, pp. 795-827.
- Fagan, Mary Helen (1995) *Business Process Redesign: Individual and Organizational Factors*, University of Texas at Arlington, Doctoral Dissertation.
- Falletta, Salvatore (1999) *Assessing the Statistical Conclusions and Predictive Validity of a Diagnostic Model and Survey of Organizational Performance and Change*, North Carolina State University, Doctoral Dissertation.

- Farias, Gerard, and Homer Johnson (2000) "Organizational Development and Change Management. Setting the Record Straight," *The Journal of Applied Behavioral Science*, v. 36, n. 5, September, pp. 376-379.
- Farias, Gerard, and Arup Varma (2000) "Integrating Job Characteristics, Sociotechnical Systems and Reengineering, Presenting a Unified Approach to Work and Organization Design," *Organization Development Journal*, v. 18, n. 3, Fall, pp. 11-23.
- Finkelstein, Sydney (1992) "Power in Top Management Teams: Dimensions, Measurement and Validation," *Academy of Management Journal*, v. 35, n. 3, pp. 505-538.
- Forrester, Jay W. (1961) *Industrial Dynamics*, The M. I. T. Press – Massachusetts Institute of Technology and John Wiley & Sons, Inc., U. S. A.
- Fox, Mark S, and Michael Gruninger (1998) "Enterprise Modeling," *AI Magazine*, v. 19, n. 3, Fall, pp. 109-121.
- Fox, Mark S., Mihai Barbucenau, and Michael Gruninger (1996) "An Organization Ontology for Enterprise Modeling: Preliminary Concepts for Linking Structure and Behavior," *Computers in Industry*, v. 29, n. 1-2, July, pp. 123-134.
- Frank, Kenneth A., and Kyle Fahrbach (1999) "Organization Culture as Complex System: Balance and Information in Models of Influence and Selection," *Organization Science*, v. 10, n. 3, May-June, pp. 253-277.
- French, Wendell L., and Cecil H. Bell Jr. (1999) *Organization Development. Behavioral Science Interventions for Organization Improvement*, Prentice-Hall, New Jersey.
- French, Bill, and Carl E. DeVilbiss (2000) "Measuring Systematic Unity in a Learning Organization," *Journal of Management in Engineering*, v. 16 n. 4, July/August, pp. 39 - 46.
- Gabouri, Jane (2001) "Working Through the Pain," *IIE Solutions*, v. 33, n. 11, November, pp. 33-35
- George, Stephen, and Arnold Weimerskirch (1994) *Total Quality Management: Strategies and Techniques Proven at Today's Most Successful Companies*, John Wiley and Sons, New York.
- Gharajedaghi, Jamshid (1999) *Systems Thinking: Managing Chaos and Complexity. A Platform for Designing Business Architecture*, Butterworth – Heinemann, Boston.

- Giaglis, George M. (2001) "A Taxonomy of Business Process Modeling and Information Systems Modeling Techniques," *The International Journal of Flexible Manufacturing Systems*, v. 13, n. 2, pp. 209-228.
- Gopalakrishnan, Shanti, and Fariborz Damanpur (2000) "The Impact of Organizational Context on Innovation Adoption in Commercial Banks," *IEE Transactions on Engineering Management*, v. 47, n. 1, February, p. 14-25.
- Gordon, Shelley S., Wayne H. Stewart Jr., Robert Sweo, and William A. Luker (2001) "Convergence Versus Strategic Reorientation: The Antecedents of Fast-paced Organizational Change," *Journal of Management*, v. 26, n. 5, pp. 911- 945.
- Gorsuch, Richard L. (1983), *Factor Analysis*, Lawrence Erlbaum, New Jersey.
- Greve, Henrich R., and Alva Taylor (2000) "Innovations as Catalysts for Organizational Change: Shifts in Organizational Cognition and Search," *Administrative Science Quarterly*, v. 45, n. 1, March, pp. 54-80.
- Grossman Jr., Thomas A. (2002) "Student Consulting Projects Benefit Faculty and Industry," *Interfaces*, v.32, n. 2, March-April, pp.42-48.
- Grover, Varun (1999) "From Business Process Reengineering to Business Process Change Management: A Longitudinal Study of Trends and Practices," *IEEE Transactions on Engineering Management*, v. 46, n. 1, February, pp. 36-46.
- Grover, Varun, Seung Ryul Jeong, William J. Kettinger, and James T. C. Teng (1995) "The Implementation of Business Process Reengineering," *Journal of Management Information Systems*, v.12, n. 1, Summer, pp. 109 – 144.
- Guimaraes, Tom (1997) "Empirically testing the antecedents of BPR success," *International Journal of Production Economics*, v. 50, n. 2-3, pp.199-210.
- Gummesson, Evert (1991) *Qualitative Methods in Management Research*, Sage Publications, U. S. A.
- Gunasekaran, A., and J. Adebayo (2000) "GEC Alsthom learns many lessons from BPR," *Production and Inventory Management Journal*, v. 41, n. 3, Second Quarter, pp. 9-13.
- Gupta, Bhuwesh, Thomas J. Crowe, and James S. Noble (1999) "Business Process Reengineering," in Webster, John E. (Ed.), *Encyclopedia of Electrical and Electronic Engineering*, v. 2, pp. 645-657.
- Hage, J. T.(1999) "Organizational Innovation and Organizational Change," *Annual Review of Sociology*, v. 25, pp. 597-622.

- Hall, Gene, Jim Rosenthal, and Judy Wade (1993) "How to Make Reengineering Really Work," *Harvard Business Review*, v. 71, n. 6, November – December, pp. 119 – 131.
- Hammer, Michael (1990) "Reengineering Work: Don't Automate, Obliterate," *Harvard Business Review*, c. 68, n. 4, pp. 104 – 112.
- Hammer, Michael, and James Champy (1993) *Reengineering the Corporation – A manifesto for Business Revolution*, Harper Collins Publishers, U. S. A.
- Harrison, Michael I. (1994) *Diagnosing Organizations: Methods, Models and Processes*, Sage Publications, London.
- Harrison, Michael I., and Arie Shirom (1999) *Organizational Diagnosis and Assessment*, Sage Publications, California.
- Hartman, Sandra J., Augusta C. Yrle, Michael C. White, and William H. Friedman (1998) "Theory Building: Issues and an Agenda," *International Journal of Public Administration*, v. 12. n. 15, pp. 723 – 754.
- Heller, Trudy (2000) "'If Only We'd Known Sooner: Developing Knowledge of Organizational Changes Earlier in the Product Development Process," *IEEE Transactions on Engineering Management*, v. 47, n. 3, August, pp. 335 – 344.
- Herda, Ellen A (1999) *Research Conversations and Narrative*, Praeger, Conn.
- Hillier, Frederick S., and Gerald J. Lieberman (1990) *Introduction to Operations Research*, McGraw-Hill, New York.
- Holland, Christopher P., and Ben Light (1999) "A Critical Success Factors Model for ERP Implementation," *IEEE Software*, May – June, pp. 30-35.
- Horner, Peter (2002) "Looking Out for No. 1," *ORMS Today*, v. 29, n.1, February, pp.28-33.
- Hosking, D. M., and N. R. Anderson (1992) *Organizational Change and Innovation: Psychological Perspectives and Practices in Europe*, Routledge, London.
- Howard, George S. (1985) *Basic Research Methods in the Social Sciences*, Scott, Foresman and Company, U. S. A.
- Hurley, Robert F (1998) "Managing Change: An Ethnographic Approach to Developing Research Propositions and Understanding Change in Sales Organizations," *Selling and Sales Management in Action*, v. 18 n. 3, Summer, pp. 57-71.

- Irani, Zahir, and Erwin Rausch (2000) "Empirical Testing of a Leadership and Planning Model for Reengineering Business Processes," *International Journal of Flexible Manufacturing Systems*, v. 12, n. 4, October, 341-357.
- Isabella, Lynn A. (1990) "Evolving Interpretations as Change Unfolds: How Mangers Construe Key Organizational Events," *Academy of Management Journal*, v. 33, n. 1, p. 7 - 41.
- Jackson, Mike C. (2001) "Critical Systems Thinking and Practice," *European Journal of Operational Research*, v. 128, n. 2, pp. 233-244.
- Jaffe, Dennis T., and Cynthia D. Scott (1998) "Reengineering in Practice: Where are the People? Where is the learning?," *Journal of Applied Behavioral Science*, v. 34, n. 3, pp. 250-267.
- Jang, Wooseung, Thomas J. Crowe, and Cerry M. Klein (1999). "Applying Business Process Reengineering to Realize Supply and Demand Chain Management," *Proceedings of the 4<sup>th</sup> annual International Conference on Industrial Engineering Theory, Applications, and Practice*, November, San Antonio, Texas.
- Jarrar, Yasar F., and Elaine M. Aspinwall (1999) "Integrating Total Quality Management and Business Process Re-engineering: Is it enough?," *Total Quality Management*, v. 10, n. 4/5, pp. 584-593
- Jensen, Kurt ((1996) *Colored Petri Nets: Basic Concepts, Analysis Methods and Practical Use*, Springer-Verlag, New York
- Jiang, James J., Marion G. Sobol, and Gary Klein (2000) "Performance Ratings and Importance of Performance Measures for IS Staff: The Different Perceptions of IS Users and IS Staff," *IEEE Transactions on Engineering Management*, v. 47, n. 4, November, pp. 424-434.
- Johannessen, Jon-Arild, Bjørn Olsen, and G. T. Lumpkin (2001) "Innovation as Newness: What is New, How New, and New to Whom?," *European Journal of Innovation Management*, v. 4. n. 1, pp. 20-31.
- Kamath, Manjunath (1994) "Recent Developments in Modeling and Performance Analysis Tools for Manufacturing Systems," in Joshi, Sanjay B., and Jeffrey S. Smith (Eds.), *Computer Control of Flexible Manufacturing Systems. Research and Development*, Chapman & Hall, New York.
- Kaplan, Robert S., and David P. Norton (1992) "The Balanced Scorecard – Measures That Drive Performance," *Harvard Business Review*, v. 70, n. 1, February, pp. 71-79.

- Keen, Peter G. W. (1997) *The Process Edge*, Harvard Business School Press, Boston, MA.
- Kelly, Dawn, and Terry L. Amburgey (1991) "Organizational Inertia and Momentum: A Dynamic Model of Strategic Change," *Academy of Management Journal*, v. 34, n. 3, pp. 591-612.
- Kessler, Thomas G (1998) "IT will take more than strategic plans to create 21<sup>st</sup> century government organizations," *The Public Manager: The New Bureaucrat*, v. 27 n. 3, Fall, pp. 21-22.
- Kennedy, Carol (1994) "Re-engineering: The Human Costs and Benefits," *Long Range Planning*, v. 27, n. 5, October, pp. 64-72.
- Kettinger, William J., James T. C. Teng, and Subashish Guha (1997) "Business Process Change: A Study of Methodologies, Techniques and Tools," *MIS Quarterly*, v. 21, n. 1, March, pp. 55 – 79.
- Kettl, Donald F. (2000) "Relentless Reinvention," *Government Executive*, v. 32, n. 1, January, pp. 25-29.
- Kiel, L. Douglas (1994) *Managing Chaos and Complexity in Government. A New Paradigm for Managing Change, Innovation, and Organizational Renewal*, Jossey-Bass Publishers, San Francisco.
- Kim, Hee-Woong (2000) "Business Process Versus Coordination Process in Organizational Change," *International Journal of Flexible Manufacturing Systems*, v. 12, n. 4. October, pp. 275-290.
- Kirikova, Marite (2000) "Explanatory Capability of Enterprise Models," *Data & Knowledge Engineering*, v. 33, n. 2, pp. 119-136.
- Klabbers, Jan H. G. (2000) "Learning as Acquisition and Learning as Interaction," *Simulation & Gaming*, v. 31, n. 3, September, pp. 380-406.
- Klein, Mark M. (1993) "IEs Fill Facilitator Role in Benchmarking Operations to Improve Performance," *Industrial Engineering*, v. 25, n. 9, September, pp. 40-42.
- Kotter, John P. (1995) "Leading Change: Why Transformation Efforts Fail", *Harvard Business Review*, March-April, pp. 59-67.
- Kueng, Peter (2000) "Process Performance Measure System: A Tool to Support Process-Based Organizations," *Total Quality Management*, v. 11, n. 1, January, pp. 67-85.

- Larsen, E. R., and A. Lomi (1999) "Resetting the Clock: A Feedback Approach to the Dynamics of Organizational Inertia, Survival and Change," *Journal of the Operational Research Society*, v. 50, n. 4, pp. 206 – 221.
- Larsson, Pär, Jan Löwstedt, and A. B. (Rami) Shani (2001) "IT and the Learning Organization: Exploring Myths of Change," *Organizational Development Journal*, v. 19, n. 1, Spring, pp. 73-90.
- Lapsley, Irvine, and June Pallot (2000) "Accounting, Management and Organizational Change: A Comparative Study of Local Government," *Management Accounting Research*, v. 11, n. 2, pp. 213-229.
- Lee, Jaejung (1995) *An Exploratory Study of Organizational/Managerial Factors Influencing Business Process Reengineering Implementation: An Empirical Study of Critical Success Factors and Resistance Management*, University of Nebraska – Lincoln, Doctoral Dissertation.
- Leeuw, Franz L., Ray C. Rist, and Richard C. Sonnichsen (1994) *Can Governments Learn?*, Transaction Publishers, U. S. A.
- Lewin, Kurt (1951) *Field Theory in Social Science: Selected Theoretical Papers*, Dorwin Cartwright, (Ed.), Greenwood Press, U. S. A.
- Libbey, Meryl G. (1994) "Reengineering Public Innovation," *Public Productivity and Management Review*, v. 18, n. 2, Winter, pp. 163-175.
- Lin, Fu-Ren, Gek Woo Tan, and Michael J. Shaw (1999) "Multiagent Enterprise Modeling," *Journal of Organizational Computing and Electronic Commerce*, v. 9, n. 1, pp. 7-32.
- Loehlin, John C. (1998) *Latent Variable Models. An Introduction to Factor, Path, and Structural Analysis*, Lawrence Erlbaum Associates, Publishers, New Jersey.
- Love, P. E. D., and A. Gunasekaran (1997) "Process Reengineering: A Review of Enablers," *International Journal of Production Economics*, v. 30, n. 2/3, pp. 183-197.
- López, Miguel (1994) "Decision Influence Diagrams with Fuzzy Utilities," in Bouchon-Meunier, Bernadette, Ronald R. Yager and Lotfi A. Zadeh (Eds.), *Advances in Intelligent Computing – IPMU '94, Selected papers 5<sup>th</sup> International Conference on Information Processing and Management of Uncertainty in Knowledge-Based Systems-Paris*, Springer, New York.
- Lu, Hsi-Peng, and Da-Chin Yeh (1998) "Enterprises' Perceptions on Business Process Re-Engineering: A Path Analytic Model," *Omega, International Journal of Management Science*, v. 26, n. 1, pp. 17-27.

- Lu, Stephen C. Y., and Jian Cai (2001) "Collaborative Design Process Model in the Sociotechnical Engineering Design Framework," *Artificial Intelligence for Engineering Design, Analysis and Manufacturing*, v. 15, n. 1, pp. 3-20.
- Luthans, Fred, Dianne H. B. Welsh, and Lewis A. Taylor III (1988) "A Descriptive Model of Managerial Effectiveness," *Group and Organization Studies*, v. 13, n. 2, June, pp. 148-162.
- Marshak, Robert J. (1993) "Lewin Meets Confucius: A Re-View of the OD Model of Change," *Journal of Behavioral Science*, v. 29, n. 4, December, pp. 393-415.
- Martinez, Erwin V. (1995) "Successful Reengineering Demands IS/Business Partnerships," *Sloan Management Review*, Summer, pp. 51-61.
- Mauil, R. S., A. M. Weaver, S. J. Childe, P. A. Smart, and J. Bennett (1996) "Current Issues in Business Process Reengineering," *International Journal of Operations and Production Management*, v. 15, n. 11, pp. 37-52.
- Mayer, Roger C., and F. David Schoorman (1992), "Predicting Participation and Production Outcomes Through a Two-Dimensional Model of Organizational Commitment," *Academy of Management Journal*, v. 35, n. 3, pp.- 671-684.
- Mayo, Michael C., and Gordon S. Brown (1999) "Building a Competitive Business Model," *Ivey Business Journal*, v. 63, n. 3, Mar./Apr., pp. 18-23.
- McAdam, Rodney (2000) "The Implementation of Reengineering in SME's: A Grounded Study," *International Small Business Journal*, v. 18, n. 4, July – September, pp. 29-45.
- McAdam. Rodney, and Neil Mitchell (1998) "Development of a Business Process Reengineering Model Applicable to the Public Sector," *Total Quality Management*, v. 9, no. 4/5, July, pp. S160-S163.
- McAfee, R. Bruce, and Paul J. Champagne (1987) *Organizational Behavior: A Manager's View*, West Publishing Co., U. S. A.
- McCormack, Kevin, and Bill Johnson (2001) "Business Process Orientation, Supply Chain Management, and the e-Corporation," *IIE Solutions*, v. 33, n. 10, October, 33-37.
- McGarry, Nina, and Tom Beckman (1999) *Business Reengineering at a Large Government Agency*, Idea Group Publishing, Pennsylvania.
- McLeod Jr., Raymond (1998) *Management Information Systems*, Prentice Hall, U. S. A.

- McNanus, Kevin (2002) "Investment in Futility," *IIE Solutions*, v.34, n. 1, January, pp. 21-22.
- Mechling, Jerry (1994) "Reengineering Government: Is There a "There" There?," *Public Productivity and Management Review*, v. 18, n. 2, Winter, pp. 189-197.
- Mitleton-Kelly, Eve (2000) "Complexity: Partial Support for BPR?," in Henderson, Peter (Ed.), *Systems Engineering for Business Process Change*, Springer, New York.
- Miyazaki, Anthony D., Ann Hansen, and David E. Sprott (1997) "A Longitudinal Analysis of Income-based Tax Regressivity of State-sponsored Lotteries," *Journal of Public Policy & Marketing*, v. 17 n. 2, Fall, pp. 161-178.
- Moosbruker, Jane B., and Ralph D. Loftin (1998) "Business Process Redesign and Organization Development. Enhancing Success by Removing Barriers," *Journal of Applied Behavioral Sciences*, v. 34 n.3, September, pp. 286-304.
- Morel, Benoit, and Rangaraj Ramanujam (1999) "Through the Looking Glass of Complexity: The Dynamics of Organizations as Adaptive and Evolving Systems," *Organization Science*, v. 10, n. 3, May-June, pp. 278-293.
- Morecroft, John D. W. (1988) "System Dynamics and Microworlds for Policymakers," *European Journal of Operational Research*, v. 35, p. 301-320.
- Morse, Janice M., and Peggy Anne Field (1995) *Qualitative Research Methods for Health Professionals*, Sage Publications, U. S. A.
- Murgatroyd, I. S., A. Hodgson, and R. H. Weston (1998) "Enterprise Modeling in Support of Business Process Visualization and Improvement," *Proceedings of the Institution of Mechanical Engineers*, v. 212, Part B, pp. 621-633.
- Murray, Mary Ann, H. Richard Priesmeyer, Lawrence F. Sharp, Rhonda Jensen, and Gwenneth Jensen (2000) "Nonlinearity as a Tool for Business Process Reengineering," *Business Process Management*, v. 6. n. 4, pp. 304 – 313.
- Myles, Raymond E., Charles C. Snow, Alan D. Meyer, and Henry Coleman, Jr. (1991) "Organizational Strategy, Structure and Process," in Organ, Dennis W. (Ed.), *The Applied Psychology of Work Behavior*, Irwin, Illinois.
- Nader, Frederick P., and Alan G. Merten (1998) "The Need to Integrate and Apply Knowledge From Three Disciplines – Business Process Reengineering, Information Technology and Organizational Development," *The Journal of Applied Behavioral Science*, v. 34, n. 3, September, pp. 246-249.

- Nadler, David A., and Michael L. Tushman (1999) "The Organization of the Future: Strategic Imperatives and Core Competencies for the 21<sup>st</sup> Century," *IEEE Engineering Management Review*, v. 27 n. 4, Winter, pp. 96-107.
- Nadler, David A. and Michael L. Tushman (1983) "A General Diagnostic Model for Organizational Behavior: Applying a Congruence Perspective," in Hackman J. Richard, Edward E. Lawler III and Lyman E. Porter (Eds.), *Perspectives on Behavior in Organizations*, MacGraw-Hill, New York.
- Narasimhan, Ram, and Jayanth Jayaram (1998) "Reengineering service operation: a longitudinal case study," *Journal of Operations Management*, v. 17, December, pp. 7-22.
- Neter, John, Michael H. Kutner, Christopher J. Nachtsheim, and William Wasserman (1996) *Applied Linear Statistical Models*, McGraw-Hill, U. S. A.
- Nielsen, Morgens, and Dan Simpson, (Eds.), (2000) *Application and Theory of Petri Nets 2000*, 21<sup>st</sup>. International Conference, ICATPN 2000, Springer, New York.
- Nolan, Richard (2002) "Average Rarely Exists," *IIE Solutions*, v. 34, n. 2, February, p.24.
- Nord, Walter R., and Sharon Tucker (1987) *Implementing Routine and Radical Innovations*, Lexington Books, Massachusetts.
- Nørreklit, Hanne (2000) "The Balance of the Balanced Scorecard. A Critical Analysis of Some of its Assumptions," *Management Accounting Research*, v. 11, n. 2, pp. 65 – 88.
- Nunnally, Jum C., and Ira H. Bernstein (1994) *Psychometric Theory*, McGraw-Hill, New York.
- O'Hara, Margaret T., Richard T. Watson, and C. Bruce Kavan (1999) "Managing the Three Levels of Change," *Information Systems Management*, v. 16, n. 3, Summer, pp. 63-70.
- O'Connor, Ellen, S. (2000) "Plotting the Organization. The Embedded narrative as a Construct for Studying Change," *The Journal of Applied Behavioral Science*, v. 36, n. 2, June, pp. 174-192.
- Obeng, Eddie, and Stuart Crainer (1994) *Making Reengineering Happen*, Pitman Publishing, England.
- Odrey, Nicholas G., Jonathan D. Green, and Adrienne Appello (2001) "A Generalized Petri Net Modeling Approach for the Control of Re-entrant Flow Semiconductor Wager Fabrication," *Robotics and Integrating Manufacturing*, vol. 17, n. ½, pp. 5-11.

- Ofori-Dankwa, Joseph, and Scott D. Julian (2001) "Complexifying Organizational Theory: Illustration Using Time Research," *Academy of Management Journal*, v. 26, n. 3, 415-430.
- Ogata, Katsuhiko (1992) *Systems Dynamics*, Prentice-Hall, Inc., U. S. A.
- Parasuraman, A., Valerie A. Zeithaml, and Leonard L. Berry (1988) "SERVQUAL: A Multiple-Item Scale for Measuring Consumer Perceptions of Service Quality," *Journal of Retailing*, v. 64, n. 1, Spring, pp. 12-40.
- Pine, B. Joseph (1993) *Mass Customization: The New Frontier in Business Competition*, Harvard Business School Press, U. S. A.
- Pascale, Richard T., Mark Millemann, and Linda Gioja (2000) *Surfing the Edge of Chaos. The Laws of Nature and The New Laws of Business*, Crown Business, New York.
- Pearl, Judea (2000) *Causality. Models, Reasoning and Inferences*, Cambridge University Press, Cambridge, UK.
- Pegden, Dennis C., Robert E. Shannon, and Randall P. Sadowski (1995) *Introduction to Simulation Using SIMAN*, McGraw-Hill, New York.
- Pettigrew, Andrew M., Richard W. Woodman, and Kim S. Cameron (2001) "Studying Organizational Change and Development: Challenges For Future Research," *Academy of Management Journal*, v. 44, n. 4, pp. 697-713.
- Pike, John, and Richard Barnes (1994) *TQM in Action: A Practical Approach to Continuous Performance Improvement*, Chapman and Hall, New York.
- Poister, Theodore H., and Gregory D. Streib (1999) "Strategic Management in the Public Sector. Concepts, Models, and Processes," *Public Productivity & Management Review*, v. 22 n. 3, March, pp. 308-325.
- Poole, Peter P. (1998) "Words and Deeds of Organizational Change" *Journal of Managerial Issues*, v. 10 n. 1, Spring, pp.45-59.
- Porter, Michael E. (1998) *Competitive Advantage: Creating and Sustaining Superior Performance*, The Free Press, U. S. A.
- Powell, Sarah (2002) "Spotlight on Renée Mauborgne," *Emerald Now Spotlight*, April 2002 (on <http://www.emeraldinsight.com/now/archive/apr2002/spotlight.htm>)

- Presley Adrien, Joseph Sarkis, and Donald H. Liles (2000), "A Soft-System Methodology Approach for Product and Process Innovation," *IEEE Transactions on Engineering Management*, Vol 47, No. 3, pp. 379-392.
- Quattrone, Paolo, and Trevor Hopper (2001) "What Does Organizational Change Mean? Speculations on a Taken for Granted Category," *Management Accounting Review*, v. 12, n. 4 pp. 403-435.
- Raczkowsky, J. and W. Reithofer (1998) "Design of Consistent Enterprise Models," *Cybernetics and Systems: An International Journal*, v. 29, pp. 525-552.
- Rasmussen, Dan Renè, and Erik Mosekilde (1988) "Bifurcations and Chaos in a Generic Management Model," *European Journal of Operational Research*, v. 35, pp. 80-88.
- Rathi, Krishnakant R., (1999) *A Strategic and Diagnostic Business Process Evaluation Methodology*, University of Missouri – Columbia, Master's Thesis.
- Remenyi, Dan, Briam Williams, Arthur Money, and Ethné Swartz (1998), *Doing Research in Business and Management*, Sage Publications, U. S. A.
- Richardson, G. P. (1999) "Reflections for the Future of Systems Dynamics," *Journal of the Operational Society*, v. 50, n. 4, pp. 440 – 449.
- Rogers, Robert W., and William C. Byham (1994) "Diagnosing Organization Cultures for Realignment," in Ann Howard and Associates (Eds.), *Diagnosis for Organizational Change*, The Guilford Press, New York.
- Rouse, Anne, and David Watson (1994) "Some Classic Theories of Organizational Change, and Their Implications for Business Process Renovation and Re-engineering," in B. C. Glasson, et al., (Ed.), *Business Process Re-Engineering: Information Systems Opportunities and Challenges*, Elsevier Science B. V., U. K.
- Russell, Gregory D., and Robert J. Waste (1998) "The Limits of Reinventing Government," *American Review of Public Administration*, v. 28 n. 4, December, pp. 325-346.
- Samuelson, Robert J. (2002) "The Erosion of Confidence," *Newsweek*, June 17, p. 45.

- Sastry, M. Anjali (1997) "Problems and Paradoxes in a Model of Punctuated Organizational Change," *Administrative Science Quarterly*, v. 42, pp. 237-275.
- Scherer, Anderas Georg, and Marc Smid (2000) "The Downward Spiral and the US Model Business Principles – Why MNEs Should Take Responsibility for the Improvement of World-Wide Social and Environmental Conditions," *Management International Review*, v. 40, n. 4 pp. 351-371.
- Scherr, A. L. (1993) "A New Approach to Business Processes," *IBM Systems Journal*, v. 32, n. 1, pp. 81 - 99.
- Scofield, Michael (1996) *Enterprise Models. Anticipating Complexity*, Enterprise Reengineering, [www.reengineering.com](http://www.reengineering.com).
- Senge, Peter M., and John D. Sterman (1992) "Systems Thinking and Organizational Learning: Acting Locally and Thinking Globally in the Organization of the Future," *European Journal of Operational Research*, v. 59, pp. 137-150.
- Shachter, Ross D. (1986) "Evaluating Influence Diagrams," *Operations Research*, v. 34, n. 6, November – December, pp. 871-882.
- Shareef, Reginald (1997) "A Popperian View of Change in Innovative Organizations," *Human Relations*, v. 50 n. 6, pp. 655-670.
- Shaughnessy, John J., and Eugene B. Zechmeister (1994) *Research Methods in Psychology*, McGraw Hill, U. S. A.
- Skarke, Gary, Dutch Holland, Bill Rogers, and Diane Landon (1995) *The Change Management Toolkit*, Holland and Davis, U. S. A.
- Spector, Bert A. (1989) "From Bugged Down to Fired Up: Inspiring Organizational Change," *Sloan Management Review*, v. 10, n. 4, Summer, pp.29 – 34.
- Staw, Barry M., and Lisa D. Epstein (2000) "What Bandwagons Bring. Effects of Popular Management Techniques on Corporate Performance, Reputation and CEO Pay," *Administrative Science Quarterly*, v. 45, n. 3, September, pp. 523-556.
- Sterman, John D. (2000) *Business Dynamics. Systems Thinking and Modeling for a Complex World*, McGraw-Hill, New York.
- Sterman, John D. (2001) "System Dynamics Modeling: Tools for Learning in a Complex World," *California Management Review*, v. 43, n. 5, Summer, pp. 8 – 25.

- Stevens, James (1996) *Applied Multivariate Statistics for the Social Sciences*, Lawrence Erlbaum Associates, Publishers, New Jersey.
- Strauss, Anselm, and Juliet Corbin (1990) *Basic Qualitative Research. Grounded Theory, Procedures and Techniques*, Sage Publications, California.
- Sørensen, Jasper B., and Toby E. Stuart (2000) "Aging, Obsolescence, and Organizational Innovation," *Administrative Science Quarterly*, v. 45, n. 1, March, pp. 81-112.
- Talwar, Rohit (1993) "Business Re-engineering – a Strategy-Driven Approach," *Long Range Planning*, v. 26, n. 6, pp. 22-40.
- Taylor, Howard M., and Samuel Karlin (1994) *An Introduction to Stochastic Modeling*, Academic Press, New York.
- Thompson, Steven K., and George A. F. Seber (1996) *Adaptive Sampling*, John Wiley & Sons, New York.
- Thong, James Y. L., Chee-Sing Yap, and Kin-Lee Seah (2000) "Business Process Reengineering in the Public Sector: The Case of the Housing Developing Board in Singapore," *Journal of Management Information Systems*, v. 17, n. 1, summer, pp. 245-270.
- Toffler, Alvin (1970) *Future Shock*, Random House, New York.
- Toffler, Alvin (1972) *The Futurist*, Random House, New York.
- Turban, Efraim, Ephraim Mclean, and James Wetherbe (1999) *Information Technology for Management. Making Connection for Strategic Advantage*, John Wiley & Sons, Inc., New York.
- Umble, Elizabeth J., and M. Michael Umble (2002) "Avoiding ERP Implementation Failure," *Industrial Management*, v. 44, n. 1, January-February, pp. 25 – 33.
- U. S. General Accounting Office (1995) *Business Process Reengineering Assessment Guide*.
- U. S. General Services Administration (1997) *Government Business Process Reengineering Readiness Assessment*.
- Vacha-Haase, Tammi (2001) "Statistical Significance Should Not Be Considered One of Life's Guarantees: Effect Sizes are Needed," *Educational and Psychological Measurement*, v. 61, n. 2, April, pp. 219-224.

- Van Dijkum, Cor (2001) "A Methodology for Conducting Interdisciplinary Social Research," *European Journal of Operational Research*, v. 128, n. 2, pp. 290-299.
- Van de Ven, Andrew H., and Diane L. Ferry (1980) *Measuring and Assessing Organization*, John Wiley and Sons, New York.
- Vansina Leopold S., and Tharsi Taillieu (1996) "Business Process Reengineering or Socio-Technical System Design in New Clothes?," *Research in Organizational Change and Development*, v. 9, pp. 81-100.
- Veasey, Phillip W. (1994) "Managing a Programme of Business Re-engineering Projects in a Diversified Business," *Long Range Planning*, v. 27, n. 5, October, pp. 124-135.
- Vennix, Jac A. M. (1996) *Group Model Building. Facilitating Team Learning Using System Dynamics*, John Wiley Sons, New York.
- Ventana Systems, Inc. (1999) *Vensim® PLE User's Guide – Version 4*. Included with the software.
- Vernadat, F. B., (1996) *Enterprise Modeling and Integration: Principles and Applications*, Chapman & Hall, New York.
- Waggoner, Daniel B., Andy D. Neely, and Mike P Kennerley (1999) "The Forces that Shape Organizational Performance Measurement Systems: An Interdisciplinary Review," *International Journal of Production Economics*, v. 60-61, pp. 53 – 60.
- Walston, Stephen L., Richard J. Bogue and Michael Schwarts (1999) "The Effects of Reengineering: Fad or Competitive Factor? Practitioner Application," *Journal of Healthcare Management*, v. 44, n. 6, November – December, pp. 46-476.
- Wechsler, Barton, and Bruce Clary (2000) "Implementing Performance Government," *Public Productivity & Management Review*, v. 23, n. 3, March, pp. 264-266.
- Whitman, Larry, and Brian Huff (2001) "On the Use of Enterprise Models," *The International Journal of Flexible Manufacturing Systems*, v. 13, n. 2, pp. 195-208.
- Wiley, Jack W. (1996) "Linking Survey Results to Customer Satisfaction and Business Performance", in Krautt, Allen I. (Ed.), *Organizational Surveys: Tools for Assessment and Change*, Jossey-Bass Publishers, San Francisco.
- Winch, G. (1998) "Dynamic visioning for Dynamic Environments," *Journal of the Operational Research Society*, v. 49, n. 4, pp. 354-361.
- Wittenberg, Jason (1992) "On the Very Idea of a System Dynamic Model of Kuhnian Science," *System Dynamics Review*, v. 8, n. 1, winter, pp. 21-33.

- Worren, Nicolay A. M., Keith Ruddle, and Karl Moore (1999) "From Organizational Development to Change Management: The Emergence of a New Profession," *The Journal of Applied Behavioral Sciences*, v. 35, n. 3, September, pp. 273-286.
- Wortman, J. C., H. M. H. Hegge, and S. Rolefes (2000) "Embedding enterprise software in extended enterprise models," *Computers in Industry*, v. 42, n. 2-3, pp. 231-243.
- Wu, Bin (1994) *Manufacturing Systems Design and Analysis. Context and Techniques*, Chapman & Hall, New York.
- Wu, B., J. M. Kay, V. Looks, and M. Bennett (2000) "The design of Business Process within Manufacturing Systems Management," *International Journal of Production Research*, v. 38, n. 17, pp. 4097 - 4111.
- Yin Robert K. (1994) *Case Study Research: Design and Methods*, Sage Publications, U. S. A.
- Yuki, Gary, and David D. Van Fleet (1992) "Theory and Research on Leadership in Organizations," in Dunnette, Marvi D., and Leaetta M. Hough (Eds.), *Handbook of Industrial and Organizational Psychology*, Consulting Psychologists Press, Inc., California.
- Zayas-Castro, José L., Thomas J. Crowe, and Humberto Alvarez (2002) "Organizational Change: A Case for More Systematic and Dynamic Modeling," *Proceedings of the 2002 Annual Industrial Engineering Research Conference*, Institute of Industrial Engineers, Orlando, Florida, May 18-22, 10 pages, CR-ROM published.
- Zeithaml, Valerie A., Leonard L. Berry, and A. Parasuraman (1988) "Communication and Control Processes in the Delivery of Service Quality," *Journal of Marketing*, pp. 35-48.
- Zhou, MengChu, and Kurapati Venkatesh (1999) *Modeling, Simulation, and Control of Flexible Manufacturing Systems: A Petri Net Approach*, World Scientific, River Edge, NJ.

APPENDIX 1

DIAGNOSTIC INSTRUMENT



## Consent Letter

Dear <name>

Humberto Alvarez is a doctoral student from the Department of Industrial and Manufacturing Systems Engineering at the University of Missouri – Columbia. As part of his doctoral dissertation entitled **A Diagnostic Investigation and a Corrective Model for Implementing Change in Response to Innovation**, he is performing a follow up study on the different change efforts attempted at the Missouri Lottery.

Included in his study is the application of a series of surveys and interviews to some of the employees at different levels in this organization in order to gather information pertaining to the readiness of the Missouri Lottery to successfully implement large scale change within the organization. The information obtained from this study will be used to corroborate or reject a series of change hypotheses and models proposed as integral elements of this project.

You have been randomly selected to participate in this research. Your participation is voluntary and will not take more than one hour of your time. If you consider that the information asked in the surveys or the interviews conflicts with your personal considerations, you can withdraw from the study at any time. The project will be conducted under strict research guidelines. All the information obtained from this research will be kept confidential and only group data and conclusions will be reported. There are no potential risks associated with this project for you as a participant, since anonymity and confidentiality are guaranteed.

Please, indicate your participation consent by signing this form and returning it in the envelope provided. If you have questions regarding this project or the specific methodologies that are being used, please feel to contact Mr. Alvarez at the address shown below. In addition, should you have questions about your rights as a participant in human subject research, please feel free to contact the Campus Institutional Review Board of the University of Missouri – Columbia at the following telephone number (573)-882-9585.

We appreciate your cooperation in this research initiative. Your participation is important for the success of this research and for the Missouri Lottery to improve the likelihood of success of future change efforts.

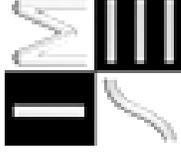
Sincerely yours,

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**University of Missouri-Columbia**  
**College of Engineering**  
**Department of Industrial and Manufacturing Systems Engineering**



**Diagnosis Questionnaire**

**Designed by:**

**Humberto R. Alvarez A.**

**Instructions for returning the materials are at the end of this document.  
Please return this questionnaire by January 25, 2002.**

**Your participation is highly appreciated. Thank you**

### **Section I. General Information**

The purpose of this section of the Survey is to gather important information about yourself, your role at the Missouri Lottery and the different projects concerning organizational change that have been attempted in this organization since 1994. This information will be used to corroborate certain propositions regarding organizational change that are an important component of this research effort.

The information provided in this questionnaire will be kept strictly confidential. You are encouraged to answer each question according to your own experiences and opinions.

#### **1. Your Division**

- Administration
- Communications
- Executive Office
- Marketing
- Security

#### **2. Your work location:**

- Headquarters
- Kansas City
- Midstate:
  - Jefferson City
  - Springfield
  - Saint Louis

Yes

No

3. Do you have more than one supervisor?

3.a If Yes, how many supervisors do you have?

4. How many people do you supervise?

5. How many people work with you in your working unit?

6. Years working for the state

7. Years working for the Missouri Lottery

8. Years at your current position

9. Do you have previous experience working with other state lotteries? If so please indicate for how long

10. Following are a series of processes that are currently executed at the Lottery. On a scale of 1 to 5, where 1 is not at all and 5 is very much, to what extent do your daily job responsibilities involve you in each these work processes.

Accounting	<input type="text"/>	Promotions and Events	<input type="text"/>
Administration	<input type="text"/>	Public Relations	<input type="text"/>
Communication	<input type="text"/>	Purchasing	<input type="text"/>
Customer Care	<input type="text"/>	Recruitment	<input type="text"/>
Human Resources	<input type="text"/>	Research and Development	<input type="text"/>
Information Technology	<input type="text"/>	Sales	<input type="text"/>
Licensing	<input type="text"/>	Security	<input type="text"/>
Marketing	<input type="text"/>	Telemarketing	<input type="text"/>
Product Development	<input type="text"/>	Warehouse and Distribution	<input type="text"/>

11. Following there is a list of different projects that have been executed in the Lottery since 1994. Please, on a scale from 1 to 5, where 1 is not at all and 5 is very much, indicate how much each has changed your daily work or activities.

1. 4C's (Billing component)	<input type="text"/>	8. Customer Care	<input type="text"/>
2. 4C's (Courier component)	<input type="text"/>	9. Promotions and Events	<input type="text"/>
3. 4C's (Cross redemption)	<input type="text"/>	10. Procurement	<input type="text"/>
4. 4C's (Cashing)	<input type="text"/>	11. Prize Structure Modification (ongoing)	<input type="text"/>
5. Strategic Plan	<input type="text"/>	12. 4C's <u>Revisited</u> - Technology development (ongoing)	<input type="text"/>
6. New Advertising Campaign (Lucky Town)	<input type="text"/>	13. 4C's <u>Revisited</u> - Distribution analysis (ongoing)	<input type="text"/>
7. ReOp	<input type="text"/>	14. <u>Other</u>	

12. The following questions ask for specific information about each of the individual projects. Please complete the information ONLY for the projects with which you are familiar.

## 1. 4'C (Billing Component)

Are you familiar with this specific project  YES  NO

If you answered **NO** to the above question, please skip this page and complete the information for the next project.

Otherwise, please answer this questionnaire to the best of your recollections.

Please describe in a few words the objectives of this project

a. On a scale from 1 to 5, where 1 is not at all and 5 is very much, to what extent was your role on this project defined?

- 1. Project Leader
- 2. Steering committee member
- 3. Direct participant
- 4. Support personnel
- 5. Other:

b. Please, using the following scales describe this project to the best of your recollections.

b.1 Project Level



b.2 Project Goal



b.3 Results obtained



c. On a scale from 1 to 5, where 1 is not at all and 5 is very much, to what extent can you define your involvement in the different stages of the project?

- 1. Project Definition
- 2. Project Planning and Development
- 3. Project Implementation
- 4. Project Execution (Final user)
- 5. Other:

d. On a scale from 1 to 5, where 1 is not at all and 5 is very much, to what extent are the following characteristics of the project?

- 1. Adoption of new working procedures
- 2. Adoption of new working systems
- 3. Adoption of new technology
- 4. Adoption of new functions and responsibilities
- 5. Adoption of a new way of doing business

## 2. 4°C (Courier Component)

Are you familiar with this specific project  YES  NO

YES  NO

If you answered **NO** to the above question, please skip this page and complete the information for the next project.

Otherwise, please answer this questionnaire to the best of your recollections.

Please describe in a few words the objectives of this project

a. On a scale from 1 to 5, where 1 is not at all and 5 is very much, to what extent was your role on this project defined?

- 1. Project Leader
- 2. Steering committee member
- 3. Direct participant
- 4. Support personnel
- 5. Other:

b. Please, using the following scales describe this project to the best of your recollections.

b.1 Project Level



b.2 Project Goal



b.3 Results obtained



c. On a scale from 1 to 5, where 1 is not at all and 5 is very much, to what extent can you define your involvement in the different stages of the project?

- 1. Project Definition
- 2. Project Planning and Development
- 3. Project Implementation
- 4. Project Execution (Final user)
- 5. Other:

d. On a scale from 1 to 5, where 1 is not at all and 5 is very much, to what extent are the following characteristics of the project?

- 1. Adoption of new working procedures
- 2. Adoption of new working systems
- 3. Adoption of new technology
- 4. Adoption of new functions and responsibilities
- 5. Adoption of a new way of doing business

### 3. 4'C (Cross Redemption Component)

Are you familiar with this specific project  YES  NO

If you answered **NO** to the above question, please skip this page and complete the information for the next project.

Otherwise, please answer this questionnaire to the best of your recollections.

Please describe in a few words the objectives of this project

a. On a scale from 1 to 5, where 1 is not at all and 5 is very much, to what extent was your role on this project defined?

- 1. Project Leader
- 2. Steering committee member
- 3. Direct participant
- 4. Support personnel
- 5. Other:

b. Please, using the following scales describe this project to the best of your recollections.



b.2 Project Goal



b.3 Results obtained



c. On a scale from 1 to 5, where 1 is not at all and 5 is very much, to what extent can you define your involvement in the different stages of the project?

- 1. Project Definition
- 2. Project Planning and Development
- 3. Project Implementation
- 4. Project Execution (Final user)
- 5. Other:

d. On a scale from 1 to 5, where 1 is not at all and 5 is very much, to what extent are the following characteristics of the project?

- 1. Adoption of new working procedures
- 2. Adoption of new working systems
- 3. Adoption of new technology
- 4. Adoption of new functions and responsibilities
- 5. Adoption of a new way of doing business

#### 4. 4'C (Cashing)

Are you familiar with this specific project

YES

NO

If you answered **NO** to the above question, please skip this page and complete the information for the next project.

Otherwise, please answer this questionnaire to the best of your recollections.

Please describe in a few words the objectives of this project

a. On a scale from 1 to 5, where 1 is not at all and 5 is very much, to what extent was your role on this project defined?

1. Project Leader

2. Steering committee member

3. Direct participant

4. Support personnel

5. Other:

b. Please, using the following scales describe this project to the best of your recollections.

b.1 Project Level



b.2 Project Goal



b.3 Results obtained



c. On a scale from 1 to 5, where 1 is not at all and 5 is very much, to what extent can you define your involvement in the different stages of the project?

1. Project Definition

2. Project Planning and Development

3. Project Implementation

4. Project Execution (Final user)

5. Other:

d. On a scale from 1 to 5, where 1 is not at all and 5 is very much, to what extent are the following characteristics of the project?

1. Adoption of new working procedures

2. Adoption of new working systems

3. Adoption of new technology

4. Adoption of new functions and responsibilities

5. Adoption of a new way of doing business

## 5. Strategic Planning

Are you familiar with this specific project  YES  NO

If you answered NO to the above question, please skip this page and complete the information for the next project.

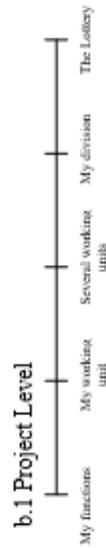
Otherwise, please answer this questionnaire to the best of your recollections.

Please describe in a few words the objectives of this project

a. On a scale from 1 to 5, where 1 is not at all and 5 is very much, to what extent was your role on this project defined?

- 1. Project Leader
- 2. Steering committee member
- 3. Direct participant
- 4. Support personnel
- 5. Other:

b. Please, using the following scales describe this project to the best of your recollections.



b.2 Project Goal



b.3 Results obtained



c. On a scale from 1 to 5, where 1 is not at all and 5 is very much, to what extent can you define your involvement in the different stages of the project?

- 1. Project Definition
- 2. Project Planning and Development
- 3. Project Implementation
- 4. Project Execution (Final user)
- 5. Other:

d. On a scale from 1 to 5, where 1 is not at all and 5 is very much, to what extent are the following characteristics of the project?

- 1. Adoption of new working procedures
- 2. Adoption of new working systems
- 3. Adoption of new technology
- 4. Adoption of new functions and responsibilities
- 5. Adoption of a new way of doing business

## 6. Lucky Town Advertising Campaign

Are you familiar with this specific project  YES  NO

YES  NO

If you answered **NO** to the above question, please skip this page and complete the information for the next project.

Otherwise, please answer this questionnaire to the best of your recollections.

Please describe in a few words the objectives of this project

a. On a scale from 1 to 5, where 1 is not at all and 5 is very much, to what extent was your role on this project defined?

- 1. Project Leader
- 2. Steering committee member
- 3. Direct participant
- 4. Support personnel
- 5. Other:

b. Please, using the following scales describe this project to the best of your recollections.

b.1 Project Level



b.2 Project Goal



b.3 Results obtained



c. On a scale from 1 to 5, where 1 is not at all and 5 is very much, to what extent can you define your involvement in the different stages of the project?

- 1. Project Definition
- 2. Project Planning and Development
- 3. Project Implementation
- 4. Project Execution (Final user)
- 5. Other:

d. On a scale from 1 to 5, where 1 is not at all and 5 is very much, to what extent are the following characteristics of the project?

- 1. Adoption of new working procedures
- 2. Adoption of new working systems
- 3. Adoption of new technology
- 4. Adoption of new functions and responsibilities
- 5. Adoption of a new way of doing business

## 7. Retail and Operations (ReOp)

Are you familiar with this specific project  YES  NO

If you answered **NO** to the above question, please skip this page and complete the information for the next project.

Otherwise, please answer this questionnaire to the best of your recollections.

Please describe in a few words the objectives of this project

a. On a scale from 1 to 5, where 1 is not at all and 5 is very much, to what extent was your role on this project defined?

1. Project Leader
2. Steering committee member
3. Direct participant
4. Support personnel
5. Other:

b. Please, using the following scales describe this project to the best of your recollections.

### b.1 Project Level



### b.2 Project Goal



### b.3 Results obtained



c. On a scale from 1 to 5, where 1 is not at all and 5 is very much, to what extent can you define your involvement in the different stages of the project?

1. Project Definition
2. Project Planning and Development
3. Project Implementation
4. Project Execution (Final user)
5. Other:

d. On a scale from 1 to 5, where 1 is not at all and 5 is very much, to what extent are the following characteristics of the project?

1. Adoption of new working procedures
2. Adoption of new working systems
3. Adoption of new technology
4. Adoption of new functions and responsibilities
5. Adoption of a new way of doing business

## 8. Customer Care Unit

Are you familiar with this specific project  YES  NO

If you answered **NO** to the above question, please skip this page and complete the information for the next project.

Otherwise, please answer this questionnaire to the best of your recollections.

Please describe in a few words the objectives of this project

a. On a scale from 1 to 5, where 1 is not at all and 5 is very much, to what extent was your role on this project defined?

1. Project Leader
2. Steering committee member
3. Direct participant
4. Support personnel
5. Other:

b. Please, using the following scales describe this project to the best of your recollections.



b.2 Project Goal



b.3 Results obtained



c. On a scale from 1 to 5, where 1 is not at all and 5 is very much, to what extent can you define your involvement in the different stages of the project?

1. Project Definition
2. Project Planning and Development
3. Project Implementation
4. Project Execution (Final user)
5. Other: \_\_\_\_\_

d. On a scale from 1 to 5, where 1 is not at all and 5 is very much, to what extent are the following characteristics of the project?

1. Adoption of new working procedures
2. Adoption of new working systems
3. Adoption of new technology
4. Adoption of new functions and responsibilities
5. Adoption of a new way of doing business

## 9. Promotions and Events

Are you familiar with this specific project  YES  NO

If you answered **NO** to the above question, please skip this page and complete the information for the next project.

Otherwise, please answer this questionnaire to the best of your recollections.

Please describe in a few words the objectives of this project

a. On a scale from 1 to 5, where 1 is not at all and 5 is very much, to what extent was your role on this project defined?

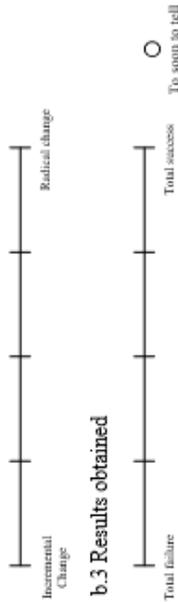
1. Project Leader
2. Steering committee member
3. Direct participant
4. Support personnel
5. Other:

b. Please, using the following scales describe this project to the best of your recollections.

### b.1 Project Level



### b.2 Project Goal



### b.3 Results obtained

c. On a scale from 1 to 5, where 1 is not at all and 5 is very much, to what extent can you define your involvement in the different stages of the project?

1. Project Definition
2. Project Planning and Development
3. Project Implementation
4. Project Execution (Final user)
5. Other:

d. On a scale from 1 to 5, where 1 is not at all and 5 is very much, to what extent are the following characteristics of the project?

1. Adoption of new working procedures
2. Adoption of new working systems
3. Adoption of new technology
4. Adoption of new functions and responsibilities
5. Adoption of a new way of doing business

10. Other: \_\_\_\_\_

Are you familiar with this specific project  YES  NO

If you answered NO to the above question, please skip this page and complete the information for the next project.

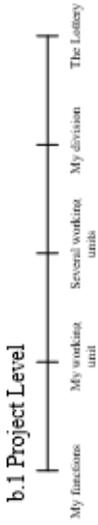
Otherwise, please answer this questionnaire to the best of your recollections.

Please describe in a few words the objectives of this project

a. On a scale from 1 to 5, where 1 is not at all and 5 is very much, to what extent was your role on this project defined?

- 1. Project Leader
- 2. Steering committee member
- 3. Direct participant
- 4. Support personnel
- 5. Other:

a. Please, using the following scales describe this project to the best of your recollections.



b.1 Project Level

b.2 Project Goal



b.3 Results obtained



b. On a scale from 1 to 5, where 1 is not at all and 5 is very much, to what extent can you define your involvement in the different stages of the project?

- 1. Project Definition
- 2. Project Planning and Development
- 3. Project Implementation
- 4. Project Execution (Final user)
- 5. Other: \_\_\_\_\_

c. On a scale from 1 to 5, where 1 is not at all and 5 is very much, to what extent are the following characteristics of the project?

- 1. Adoption of new working procedures
- 2. Adoption of new working systems
- 3. Adoption of new technology
- 4. Adoption of new functions and responsibilities
- 5. Adoption of a new way of doing business

## Section II. Diagnostic Survey

The purpose of this section of the survey is to provide an assessment of important areas such as mission and strategy, leadership, managerial behavior, work group climate, employee satisfaction and organizational culture, and their impact on your daily performance.

Please answer each question according to your own experience and opinions. Each answer should reflect your perceptions.

Please, select the best answer by circling or crossing the corresponding mark for each of the situations presented to the best of your recollections. Each question is based on the following scale:

- To a very small extent
- To a small extent
- To some extent
- To a great extent
- To a very great extent

In addition, you can select in your answer:

**No or I don't know** : You are not familiar with the information asked.

**N/A or Not Applicable** : If you consider that the question or information asked is not applicable to your specific situation.

In this section, you have to answer different questions concerning your perceptions about critical aspects in the Missouri Lottery for three different situations:

**Today** : Your perception of the situation presented as of today.

**A year ago** : Your perception of the situation one year ago.

**Preferred** : The situation as you would prefer it to be ideally.

Your answers will be treated with confidentiality by the researcher and your individual responses will not be released to anyone. You are therefore encouraged to express your true feelings as honestly as possible.

Thank you for taking your time in answering this section of the survey.

: To no extent or to a very small extent   
 : To a small extent   
 : To some extent   
 : To a great extent   
 : To a very great extent   
 N/A: Not applicable   
 No: I don't know

No.	Item	Today	A year ago	Preferred
1	To what extent do the following elements influence the Lottery's decisions to attempt new change initiatives?			
a	- Competitors	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No
b	- Government	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No
c	- Other lotteries	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No
d	- Lottery's management	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No
e	- Lottery's employees	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No
f	- Players	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No
g	- Retailers	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No
2	To what extent are you familiar with the stated vision and mission of The Lottery?	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No
3	To what extent are your coworkers familiar with the stated vision and mission of The Lottery?	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No
4	To what extent are you familiar with the strategies decided upon for achieving the proposed vision and mission?	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No
5	To what extent are your coworkers familiar with the strategies decided upon for achieving the proposed vision and mission?	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No
6	To what extent are the mission and strategies relevant?	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No
7	To what extent are the mission and strategies meaningful?	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No
8	To what extent are the mission and strategies achievable?	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No
9	To what extent are you clear about what the Lottery is trying to achieve with the different change projects attempted in your organization?	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No

: To no extent or to a very small extent   
 : To a small extent   
 : To some extent   
 : To a great extent   
 : To a very great extent   
 N/A: Not applicable   
 No: I don't know

No.	Item	Today	A year ago	Preferred
10	To what extent are you clear about how you are supposed to achieve the different change projects attempted in your organization?	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No
11	To what extent are your coworkers clear about what the Lottery is trying to achieve with the changes proposed?	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No
12	To what extent are your coworkers clear about how they are supposed to achieve different change projects attempted in your organization?	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No
13	To what extent do you perceive that the different change attempts at the Lottery are limiting your daily performance?	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No
14	To what extent do your coworkers perceive that the different change attempts at the Lottery are hampering their daily performance?	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No
15	To what extent are managers supporting the new direction and change processes?	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No
16	To what extent are managers acting as a cohesive and coherent team when attempting change?	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No
17	To what extent are managers being trustworthy and ethical in the treatment of your coworkers?	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No
18	To what extent do managers communicate about changes that affect your coworkers and their jobs?	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No
19	To what extent are you attempting new approaches to doing your work?	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No
20	To what extent are you solving unexpected situations rather than anticipating problems?	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No
21	To what extent are you soliciting diverse opinions and perspective before any decisions are made?	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No

No.	Item	Today	A year ago	Preferred
22	To what extent are <b>your coworkers</b> attempting new approaches to doing their work?	□□□□□ N/A No	□□□□□ N/A No	□□□□□ N/A No
23	To what extent are <b>your coworkers</b> solving unexpected situations rather than anticipating problems?	□□□□□ N/A No	□□□□□ N/A No	□□□□□ N/A No
24	To what extent are <b>your coworkers</b> soliciting diverse opinions and perspective before any decisions are made?	□□□□□ N/A No	□□□□□ N/A No	□□□□□ N/A No
25	To what extent are <b>your coworkers</b> treating one another with trust and respect?	□□□□□ N/A No	□□□□□ N/A No	□□□□□ N/A No
26	To what extent is information freely shared across units – both the good news and the bad?	□□□□□ N/A No	□□□□□ N/A No	□□□□□ N/A No
27	To what extent does the Lottery's structure limit <b>you</b> performing your work?	□□□□□ N/A No	□□□□□ N/A No	□□□□□ N/A No
28	To what extent does the Lottery's structure limit <b>your coworkers</b> performing your work?	□□□□□ N/A No	□□□□□ N/A No	□□□□□ N/A No
29	To what extent do <b>you</b> understand the rationale behind the change projects attempted at the Lottery?	□□□□□ N/A No	□□□□□ N/A No	□□□□□ N/A No
30	To what extent do <b>your coworkers</b> understand the rationale behind the changes attempted at the Lottery?	□□□□□ N/A No	□□□□□ N/A No	□□□□□ N/A No
31	To what extent are changes managed effectively?	□□□□□ N/A No	□□□□□ N/A No	□□□□□ N/A No
32	To what extent do managers inspire <b>you</b> to act?	□□□□□ N/A No	□□□□□ N/A No	□□□□□ N/A No
33	To what extent do managers involve <b>you</b> in decisions that affect your work?	□□□□□ N/A No	□□□□□ N/A No	□□□□□ N/A No
34	To what extent do managers inspire <b>your coworkers</b> to act?	□□□□□ N/A No	□□□□□ N/A No	□□□□□ N/A No

: To no extent or to a very small extent   
 : To a small extent   
 : To some extent   
 : To a great extent   
 : To a very great extent   
 N/A: Not applicable   
 No: I don't know

No.	Item	Today	A year ago	Preferred
35	To what extent do managers involve <b>your coworkers</b> in decisions that affect their work?	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No
36	To what extent do managers encourage openness and candid communication?	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No
37	To what extent do managers help in the growth of your coworkers in both formal and informal ways?	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No
38	To what extent do managers help in the development of your coworkers in both formal and informal ways?	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No
39	To what extent does management foster innovation among people in your working unit?	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No
40	To what extent does management act with integrity toward others?	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No
41	To what extent do the following elements help you accomplish work in your working unit?			
a	- Formal procedures	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No
b	- Technology	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No
c	- Communication channels	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No
d	- Compensation	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No
e	- Benefits	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No
f	- Career development initiatives	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No
42	To what extent do you perceive the following elements exist in your working unit?			
a	- Teamwork	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No
b	- Trust	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No
c	- Recognition	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No
d	- Openness	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No

		<input type="checkbox"/> : To no extent or to a very small extent	<input type="checkbox"/> : To a small extent	<input type="checkbox"/> : To some extent	<input type="checkbox"/> : To a great extent	<input type="checkbox"/> : To a very great extent	N/A: Not applicable	No: I don't know
No.	Item	Today		A year ago		Preferred		
e	- Diversity of opinions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f	- Willingness to change	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
43	To what extent are you clear about what the resources you need to be successful in your job?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
44	To what extent are you clear about what the actions you need to be successful in your job?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
45	To what extent are your coworkers clear about the resources they need to be successful in their jobs?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
46	To what extent are your coworkers clear about the actions they need to be successful in their jobs?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
47	To what extent are job descriptions clear enough to understand your objectives and tasks?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
48	To what extent do your skills match your job requirements?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
49	To what extent do your workers' skills match their job requirements?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
50	To what extent are you empowered when making decisions and executing your tasks?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
51	To what extent are your coworkers empowered when making decisions and executing their tasks?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
52	To what extent can you affirm that your morale is high?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
53	To what extent can you affirm that your satisfaction of the work performed is high?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

No.	Item	Likert Scale			Preferred
		To no extent or to a very small extent	To some extent	To a great extent	
		<input type="checkbox"/> : To no extent or to a very small extent	<input type="checkbox"/> : To some extent	<input type="checkbox"/> : To a great extent	No: I don't know
		N/A: Not applicable			
		Today	A year ago		
54	To what extent are your needs for balance in your work and personal life met?	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No
55	To what extent do you feel a sense of pride in your organization?	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No
56	To what extent do you feel that your job might be at risk?	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No
57	To what extent do your coworkers feel a sense of pride in the organization?	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No
58	To what extent do your coworkers feel unsafe about their job?	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No
59	To what extent do you consider retailers feel satisfied about Lottery's services?	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No
60	To what extent does the Lottery have performance measures that efficiently measure the performance and achievement of employees?	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No
61	To what extent does the Lottery use performance measures that efficiently measure the performance and achievement of employees?	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No
62	To what extent does the Lottery have performance measures that efficiently measure the performance of the Lottery as an organization?	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No
63	To what extent does the Lottery use performance measures that efficiently measure the performance of the Lottery as an organization?	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No
64	To what extent do you achieve the performance level of which you are capable?	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No
65	To what extent do your coworkers achieve the performance level of which they are capable?	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No
66	To what extent does the Lottery achieve the performance level of which it is capable?	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N/A No

The following are open-ended questions. Please briefly answer each one to the best of your recollection either here or on a separate sheet of paper. The researcher will treat the information provided confidentially and your responses will not be released to anyone. Please respond based on your own experiences and opinions of current conditions at the Missouri Lottery.

1. Do you know if the Missouri Lottery has competitors to its business?
2. If so, can you define who are the Lottery's competitors? Please give us some examples.
3. Do you think a change is necessary at the Missouri Lottery?
4. What type of change, if any, would you recommend to be implemented at the Missouri Lottery?
5. What do you think will be the results of these changes?
6. Please add any comment that you think might be helpful for this research effort.

APPENDIX II  
INTERVIEW PROTOCOL

Good (morning, afternoon) my name is Humberto Alvarez and I will like to ask you some questions about organizational change at the Missouri Lottery. The objective of this interview is to confirm the compiled final results of the questionnaire that was distributed in January. In addition, this interview will help to fill some gaps that have been found after the final compilation.

As mentioned in the email, this interview should not take more than 30 minutes of your valuable time, and again, if you feel that the questions that I will ask to violate in any way your confidence, you need not answer it. Further, you may withdraw from the study at any time. All the information provided here is confidential and only group results will be used to verify the previous results.

First I would like to ask some questions about you:

How long have you been working at MoLo?	
How long have you been in your current position?	
In which division do you work?	
Can you briefly describe your current responsibilities?	
Can you tell me your <b>perceptions</b> about the current performance of MoLo?  In terms of <b>efficiency and effectiveness</b> of the mission of MoLo	
In terms of your <b>expectations</b> of what the lottery currently does and attains.	

1. Do you think MoLo needs <b>to change</b> ? Why?	
No – Why?	
Yes – Why?	
<b>What type of change is needed? (please give some examples)</b>	
Something that makes your daily work easier?	
Something that will modify your activities and responsibilities?	
Something that will change your area, department or division?	
Something that will change the way the Lottery conducts business?	
Other?	

2. How do you know that change is necessary?

I will mention some elements or factors that might motivate change at MoLo. Which of them you think are the main **motivators** of change right now:

a. Environment (new markets, opportunities, players, retailers)

b. Government

c. Management's perception

d. Competition

Do you think these motivators have change in the last year?

Which ones do you think must be the main motivators? Why?

3. Here is a list of some of the most important projects that have been executed or attempted in the last 8 years at MoLo. Please briefly comment about the objectives, success, radicalness and significance at MoLo.				
4C's Billing	Success	Radicalness	Significance	
			Perceived	Desired
4C's Courier				
4C's Cross Redemption				
4C's Cashing				
Strategic Planning				
Lucky Town Campaign				
Retail and Operations (ReOp)				
Customer Care Unit				
Promotions and Events				
Procurement				
Prize structure				
4C's Revisited (Info-Technology)				
4C's Revisited (Distribution)				
Other_____				
Please indicate for each one: - Its degree of success: Total failure, some success, total success, etc.[or how would you classify the degree of success [extraordinary, high, average, fair, no success] - Radicalness: Something completely new in the lottery business (totally radical) Something completely new to MoLo but already existing somewhere else Something that modifies somewhat what your department actually do A change in your daily activities and routines - Significance to the business, your tasks and the lottery High, Low, Some [use a similar scale]				

<p>4. Following are a series of questions regarding the process of organizational change at MoLo. Please answer each to best of your recollections.</p>
<p>Which do you think are the main obstacles to determine if there is a need of change?</p>
<p>What are the main obstacles to develop a <b>change initiative</b>?</p>
<p>What are the main obstacles when implementing a <b>change initiative</b>?</p>
<p>How do you perceive the willingness for change from the people at MoLo? Your coworkers?</p>
<p>Is there any way to determine this willingness?  a. If so, how do you measure it?</p>
<p>Is there any measure to determine whether a change attempt has been successful?  b. If so, which are they? How do you use them?</p>
<p>Do you think that to increase the opportunity of success of new change or innovation initiatives it is necessary to generate a more profound change in the culture, perceptions or expectations of all of you as members of this organization?</p>
<p>Anything else you would like to add as part of this interview?</p>

Thanks again for your participations and for making possible the success of this project.

